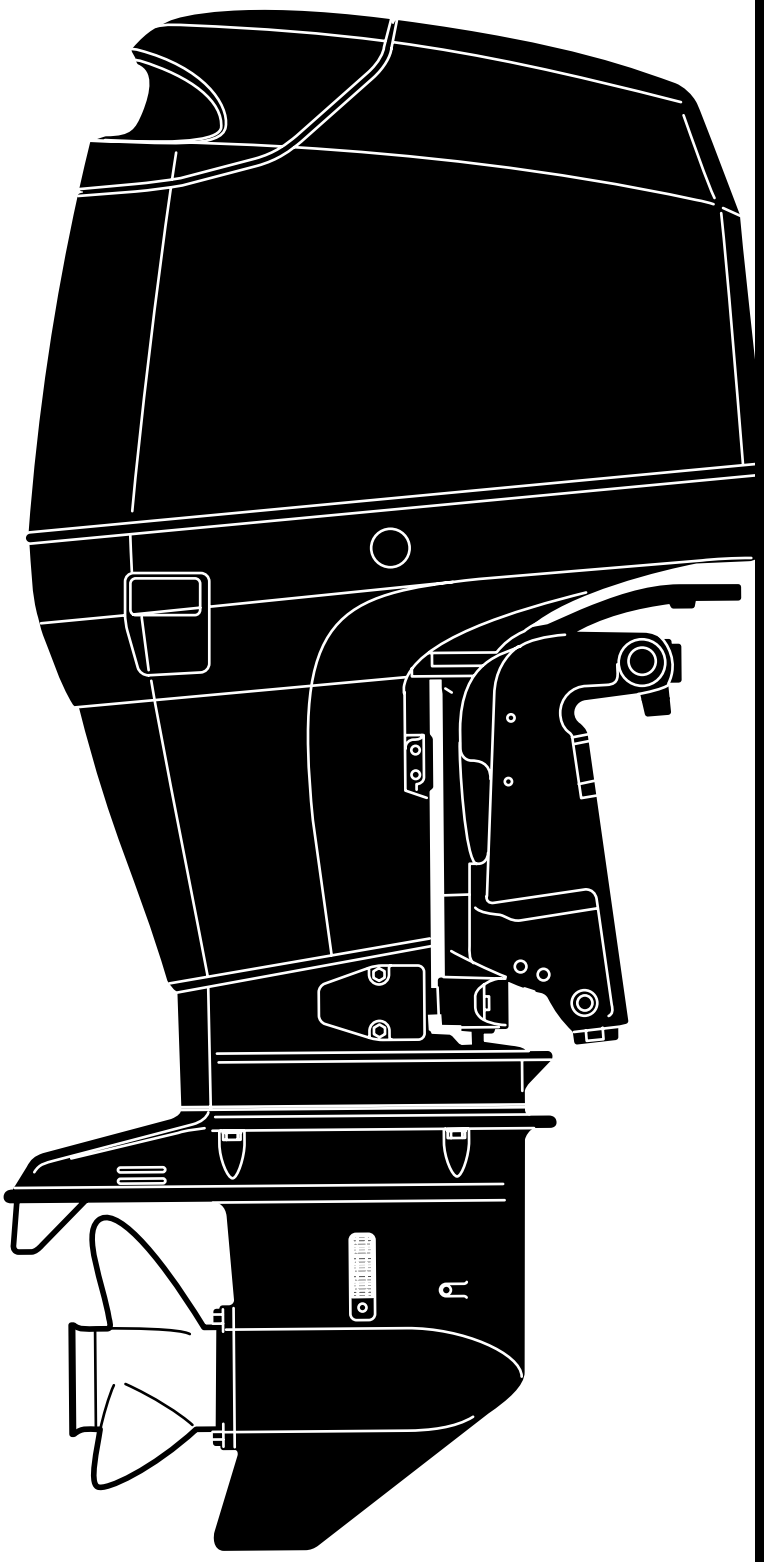
SERVICE MANUAL

TOHATSU
Outboards



TLDI

MD 115A Models

OB No.003-21060-0
07-05 NB-2600

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.

Information for securing of safety

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:

⚠ WARNING

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.



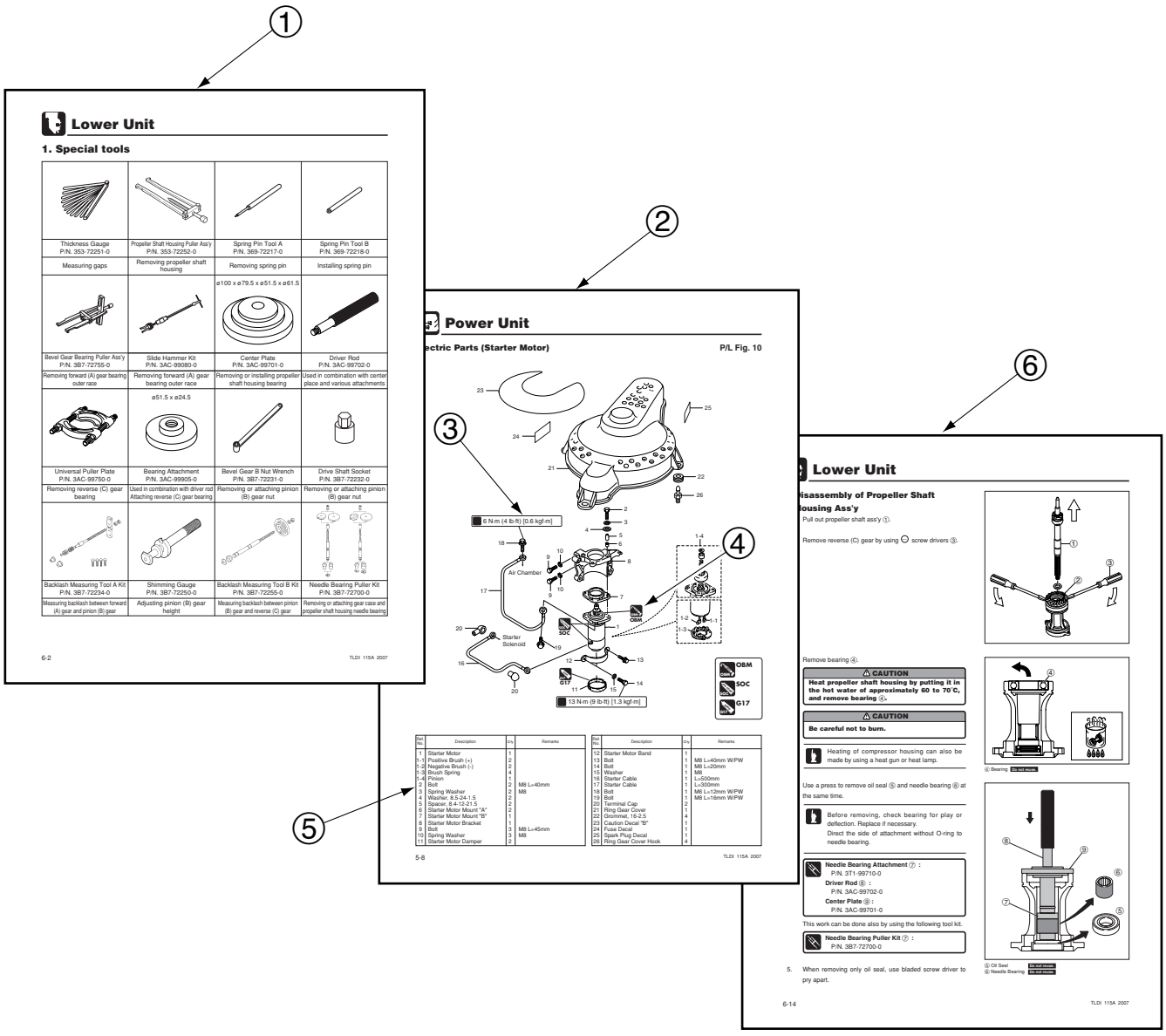
Provides an important one-point advice.

About this manual

Composition and use of this manual

This service manual is designed so that service persons are able to perform their work correctly.
Understand the following matters well for efficient works.

① Each chapter begins with the introduction of special tools that are used for the work described in the chapter so that the service persons are able to figure out the tools needed.
② Parts that are serviced in each chapter and their details are presented by using a component composition diagram.
③ Driving torques are described in the component composition diagram and in the body text are critical points of the applicable work.
④ Pictograms indicate that there is an important work instruction for the relevant parts. It also shows the type of lubricant and its application point(s).
⑤ The component composition diagrams describe the names of the parts, the number of pieces of the parts used, size of fasteners and special notes.
⑥ Specific works are described in detail by using illustrations and adding advice on the work.



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^2]

- [9.0 kgf/cm^2] — Conventional system (kilo-gram meter unit)
- (128 psi) — Conventional system (US pound inch unit)
- 0.90 MPa — SI unit (1 kgf/cm2 = 0.0980665 MPa)

* 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^3（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 "Systéme 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 	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 	Screw Lock Agent [Three Bond®] • 1373B 

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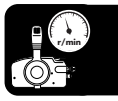
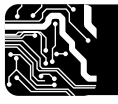
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Service Information

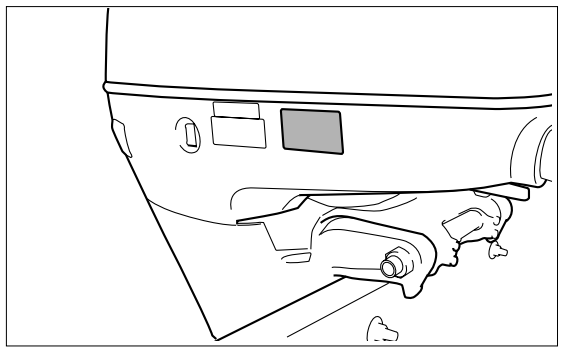


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1. Identification (Engine Serial Number)

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

① Model Name
② Model Type
③ Serial Number

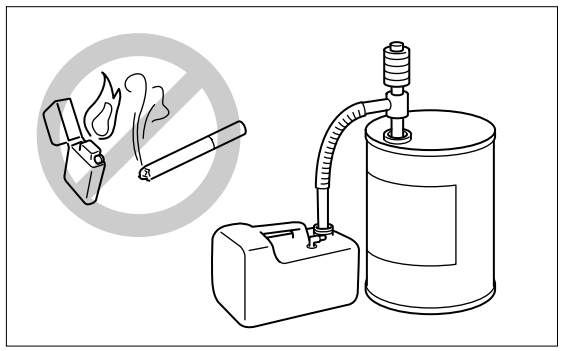


Tokyo, Made in Japan
2006 Model 115A ① 3T1 ②
SERIAL No. XXXXXXXX ③
RATED POWER 84.6 kW
FULL THROTTLE RANGE
5150 5850 r / min
MASS 178 181 kg

2. Securing of work safety

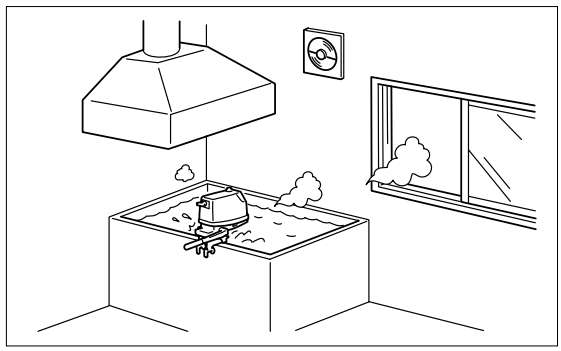
1) Fire Prevention

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



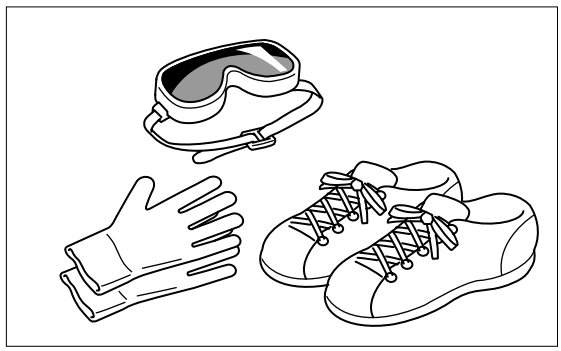
2) Ventilation

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



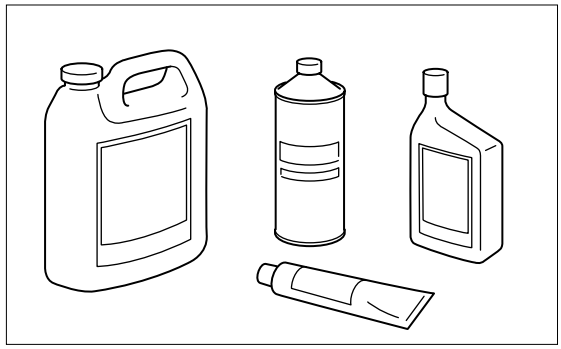
3) Protection

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.



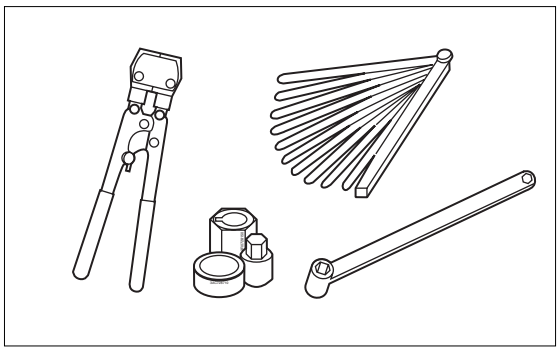
4) Genuine Parts

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



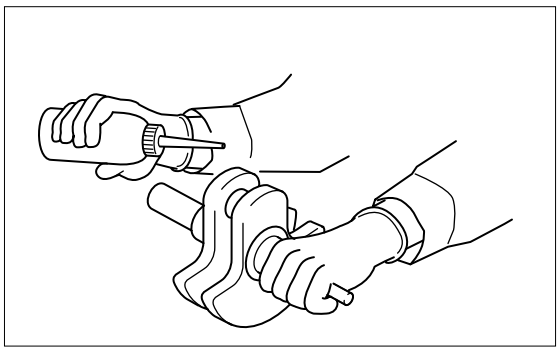
5) Tools

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.



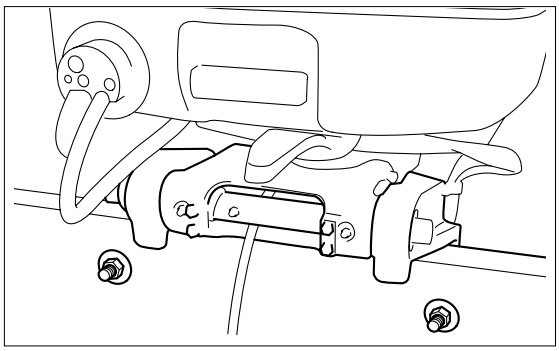
6) Recommendations on service

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.



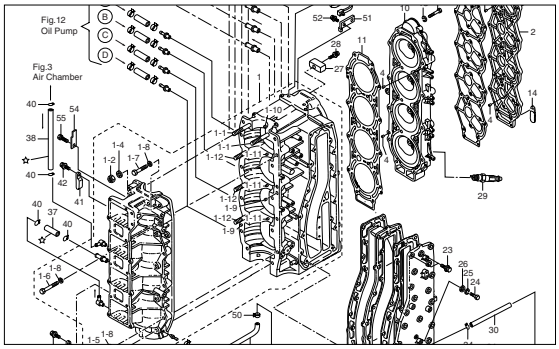
7) Cautions in disassembling and assembling components

(1) Secure outboard motor to dedicated stand firmly.



(2) Take special care not to scratch painted surfaces or mating surfaces of cylinder and crankcase.

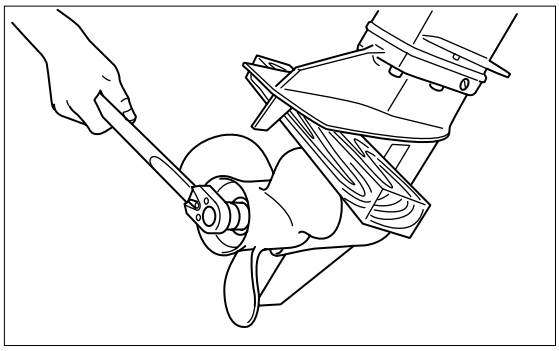
(3) Replace parts such as packings, gaskets, O rings, oil seals, spring pins or split pins with new ones after they are removed . Replace deformed snap rings with new ones.



(4) When replacing parts, be sure to use genuine parts. For fluids such as gear oil, use genuine product.

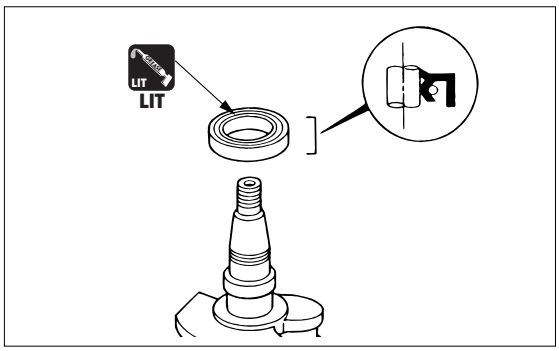
(5) Be sure to use special tools that are specified, and perform the work properly.

(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 fastners in diagonal or clockwise order from inner ones to outer ones evenly to specified torque. In either case, tighten the fastners to the specified torque in two or three steps. (Reverse the order when disassembling.)

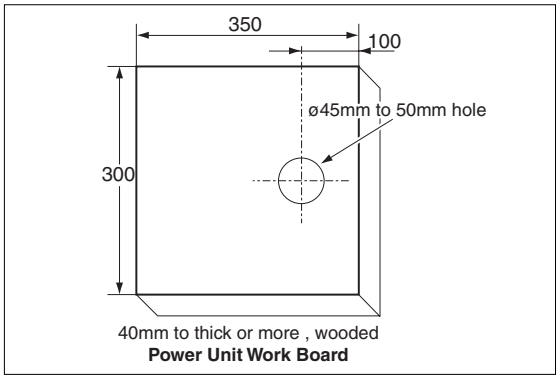


(9) When installing bearings, face the flat (numbered) side to the special assembling tool.

(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.

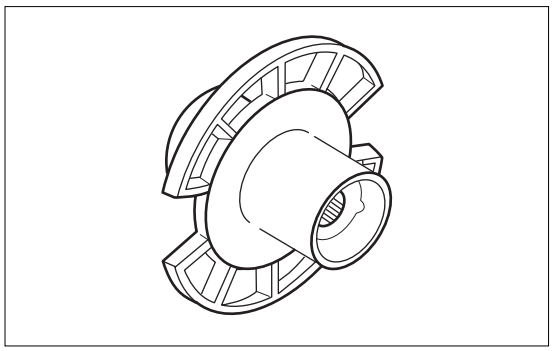
(12) When servicing power unit, use of wooden work board makes the work easier.



Power Unit Work Board

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)
115A	approximately 5,500

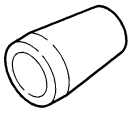
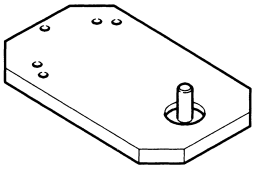
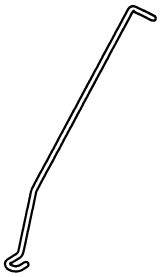
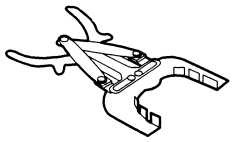
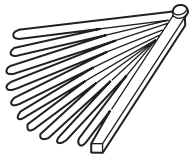
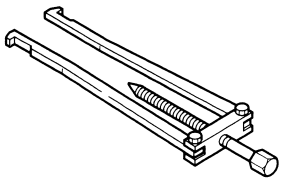
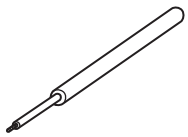
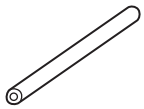
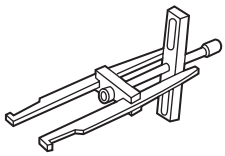
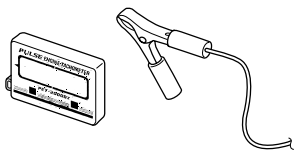
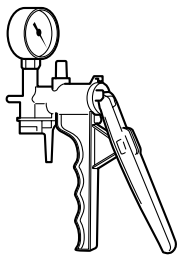
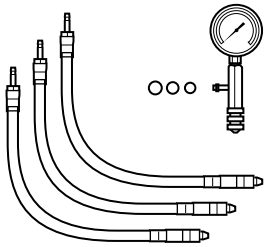
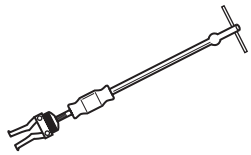
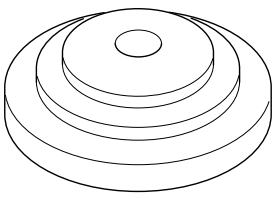
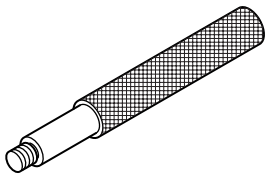
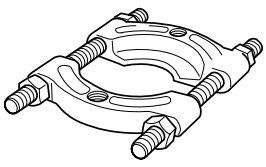
2) Measuring instruments

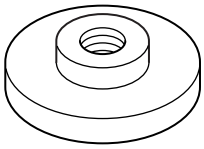
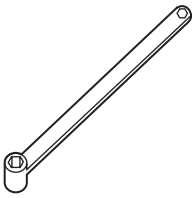
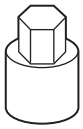
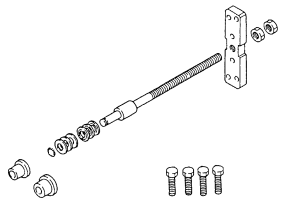
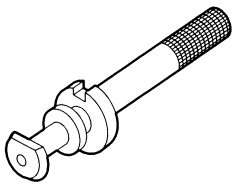
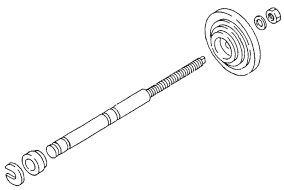
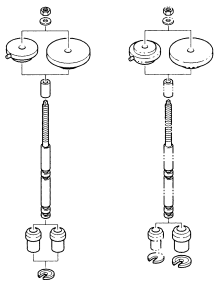
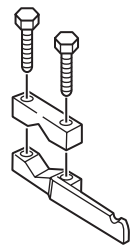
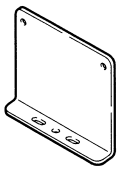
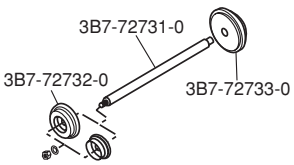
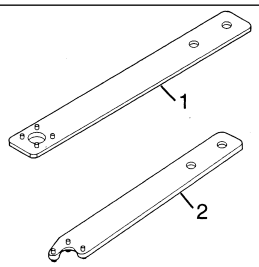
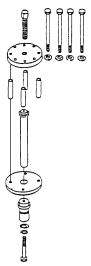
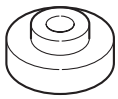
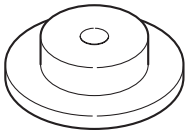
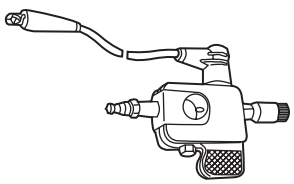
For the following measuring instruments, use commercially available ones.

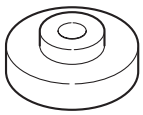
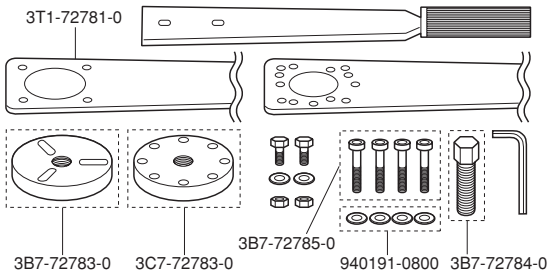
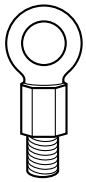
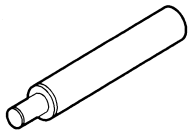
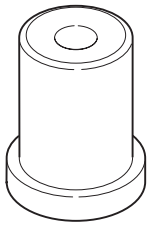
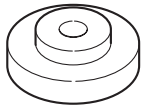
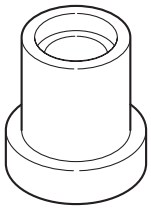
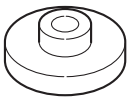
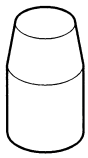
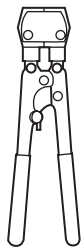
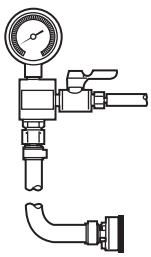
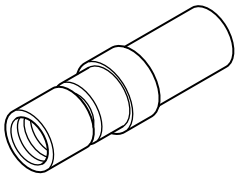
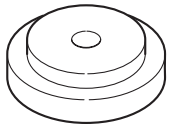
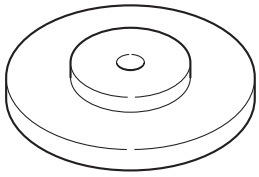
Circuit tester	(Resistance : 1Ω, 10Ω, 10 kΩ, AC voltage : 30 to 300V, DC voltage : 30V)
Vernier calipers	(M1 type, 300 mm)
Micrometer	(minimum graduation of 0.01, outer, 0 to 25 mm, 25 to 50 mm, 50 to 75 mm)
Cylinder gauge	(4 to 6 mm, 10 to 25 mm, 25 to 30 mm, 50 to 75 mm)
Ring gauge	(ø23, ø88)
Dial 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

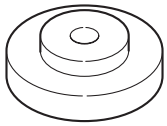
3) List of Special Tool

			
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 P/N. 369-72217-0	Spring Pin Tool B 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 place and various attachments	Removing reverse (C) gear bearing

ø51.5 x ø24.5 			
Bearing Attachment P/N. 3AC-99905-0	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 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 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 2 : Trim Rod Guide Wrench P/N. 3C8-72791
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

ø 41.5 x ø21.5 			
Oil Seal Attachment P/N. 3J6-99820-0	Flywheel Puller Kit P/N. 3T1-72211-0		Eye Bolt P/N. 3T1-72212-0
Attaching pump case (lower) oil seal	Removing or attaching flywheel		Used to hook power unit when hanging
		ø31.5 x ø25.0 	ø44.5 x ø24.5 
Piston Pin Tool P/N. 3T1-72215-0	Piston Slider P/N. 3T1-72871-0	Needle Bearing Attachment P/N. 3T1-99710-0	Oil Seal Attachment P/N. 3T1-99820-0
Removing or attaching piston pin	Assembling piston for air compressor	Used to press-fit forward (A) gear needle bearing	Attaching air compressor oil seal
ø79.5 x ø39.5 	ø51.5 x ø39.5 		
Bearing install Tool P/N. 3T1-99900-0	Bearing Attachment P/N. 3T1-99905-0	O Ring Set Tool (ø24) P/N. 3T5-72863-0	Clamp Pliers P/N. 3T5-72864-0
Attaching drive shaft bearing	Attaching air compressor bearing	Assembling O ring into fuel injector	Caulking clamps made by OETIKER
	ø31.5 x ø25 x H32 	ø51.5 x ø39.5 	ø79.5 x ø39.5 
Pressure Gauge Ass'y P/N. 3T5-72880-0	Needle Bearing Attachment P/N. 3U1-99710-0	Oil Seal Attachment P/N. 3U1-99820-0	Bearing Attachment P/N. 3U1-99905-0
Measuring air rail fuel pressure and air pressure	Used in combination with driver rod and center plate Attaching propeller shaft housing needle bearing	Used to press-fit coil bracket oil seal	Attaching propeller shaft housing bearing

ø49.5 x ø29.5



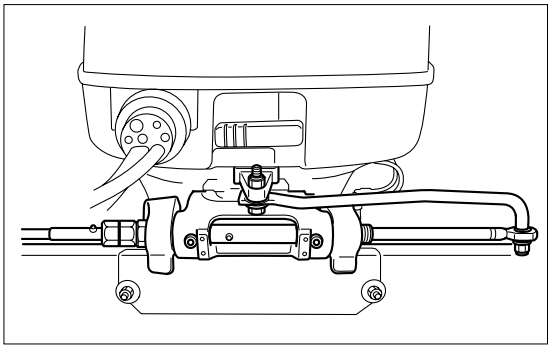
Oil Seal Attachment
P/N. 3Y9-99820-0

Used in combination with driver rod
Attaching propeller shaft housing oil seal

4. Pre-delivery Inspection

1) Steering Handle

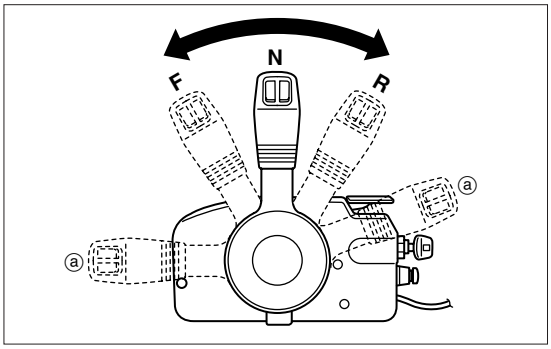
Check installation of drag link.



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 ⓐ to check that the throttle operations are smooth.

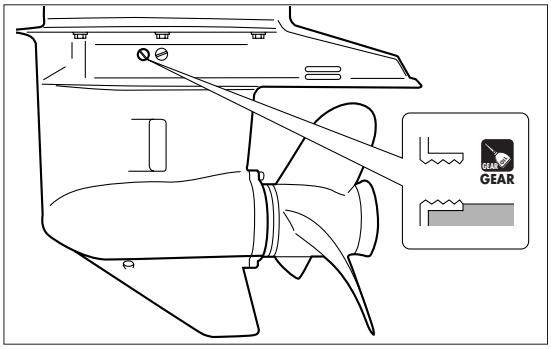


3) Gear Oil

Check quantity of gear oil.

Gear Oil :
900 cm³ (30.4 fl.oz)

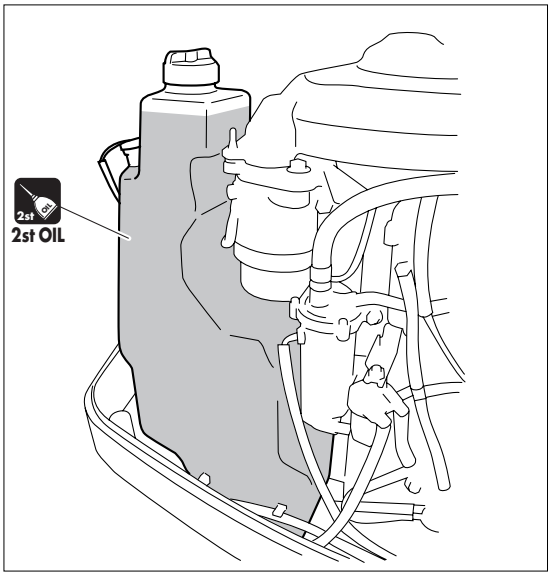
Leaking of some oil from plug hole as plug is removed indicates that gear case is filled with specified quantity of gear oil.



4) Engine Oil

Supply engine oil.

Engine Oil :
Genuine MD Platinum 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.

5) Check quantity of engine oil.

1. Set outboard motor to vertical position.

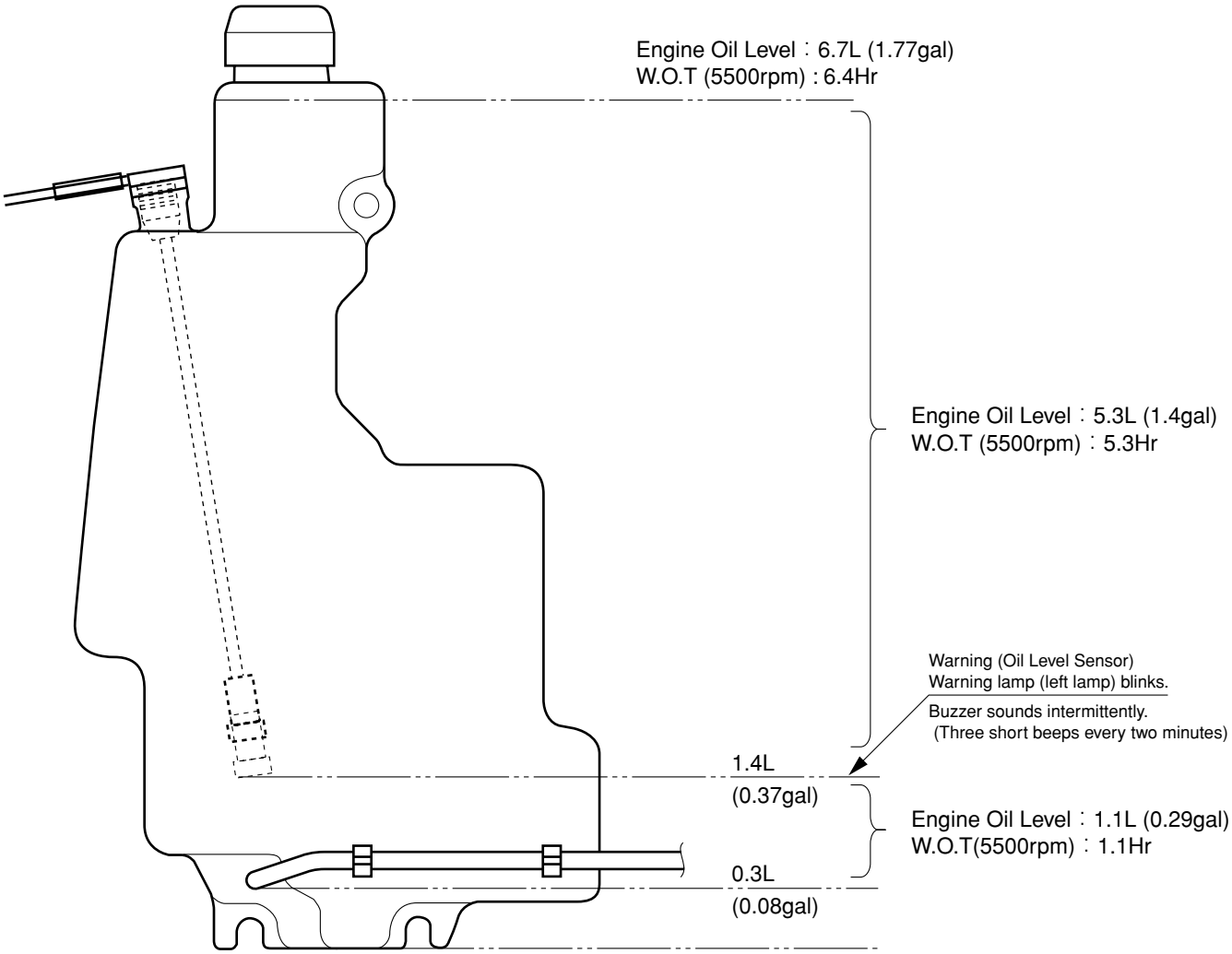
2. Check engine oil level.

Oil Tank Capacity :
6.7 ℓ (1.77 gal)

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

⚠ CAUTION

When quantity of faills below 1.4L (0.37gal), oil warning lamp blinks and the buzzer sounds three times successively every two minutes.



6) Fuel Line

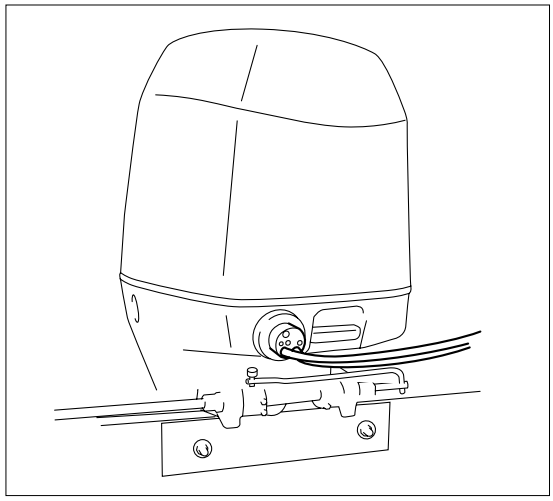
Check that fuel tank contains sufficient amount of gasoline, fuel line is connected and does not leak.

⚠ 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.

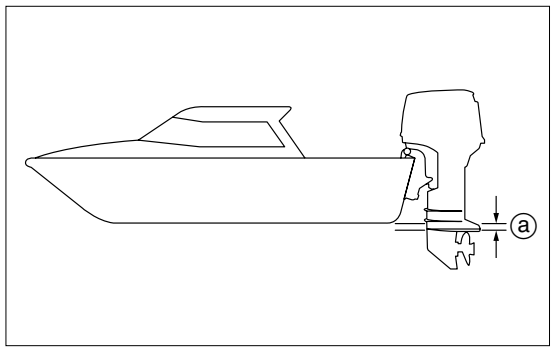
7) Installation of Outboard Motor (Rigging)

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.

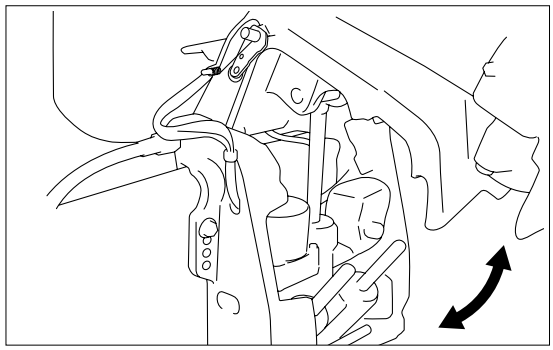
Anti-ventilation plate standard position ⓐ :
5～25 mm (0.2～1.0in) below boat bottom



ⓐ 5 - 25 mm (0.2 - 1.0 in)

8) Inspection of PTT Unit

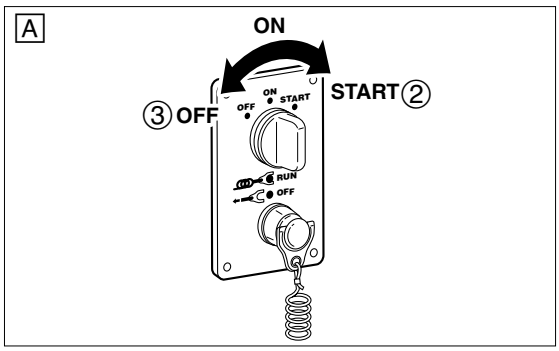
1. Operate PTT switch to check that outboard motor tilts up/down smoothly.
2. Operate PTT switch to check that tilting up/down outboard makes no abnormal noise.
3. Tilt up outboard motor and steer fully to the right and left to check that cables and hoses do not interfere with each other and with any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

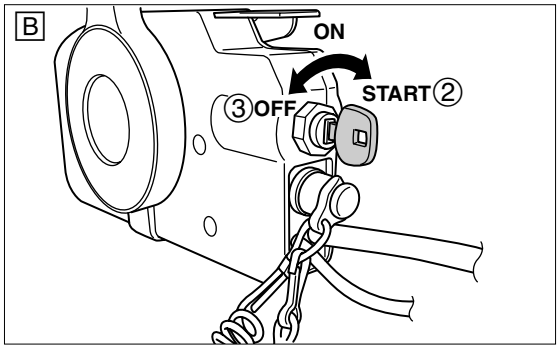


9) Inspection of Start Switch and Stop switch

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

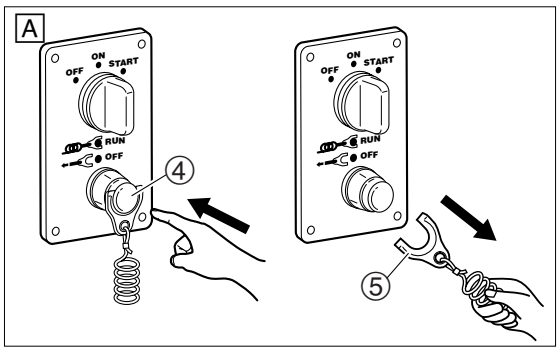
2. Turn main switch to OFF ③ to check that engine stops.
   - A Switch Panel Model
   - B Remote Control Model

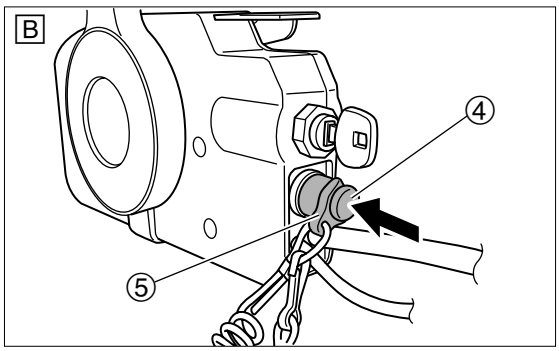




3. Press stop switch ④ hard or pull out lock plate ⑤ from stop switch ④ to check that engine stops.

   - A Switch Panel Model
   - B Remote Control Model





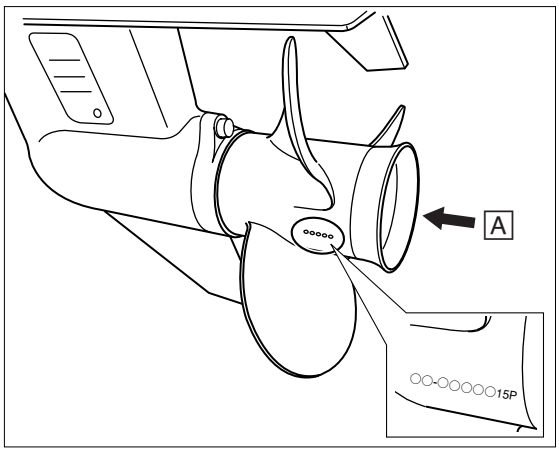
10) Propeller Selection

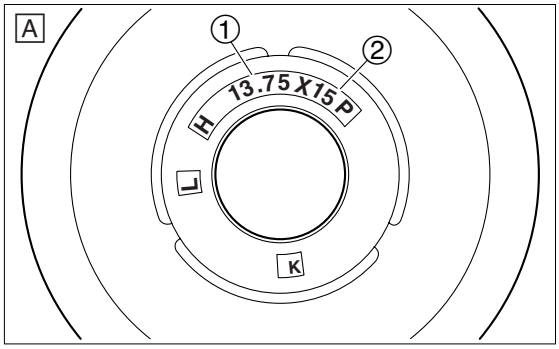
Select a propeller that is best-suited to type of boat and application.

Range of operating engine revolution at WOT :
5,150～5,850 r/min

⚠ CAUTION

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



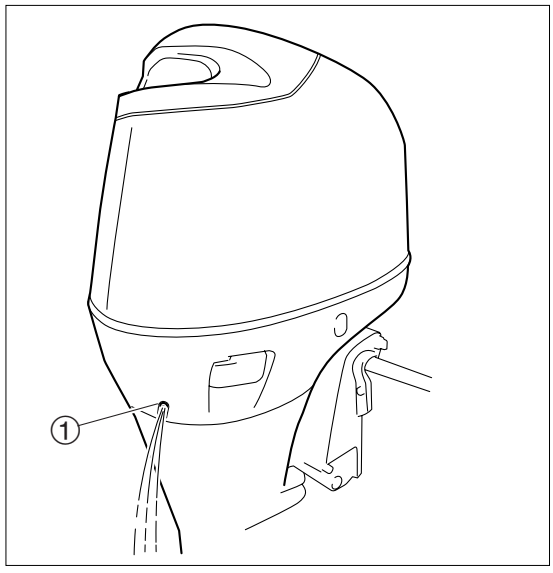


① Diameter ② Pitch

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]

11) Cooling Water Check Port

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

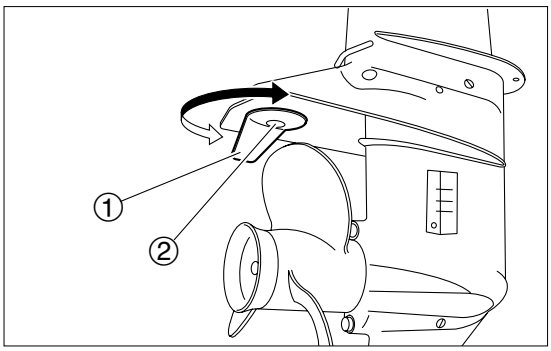


12) Trim Tab

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]



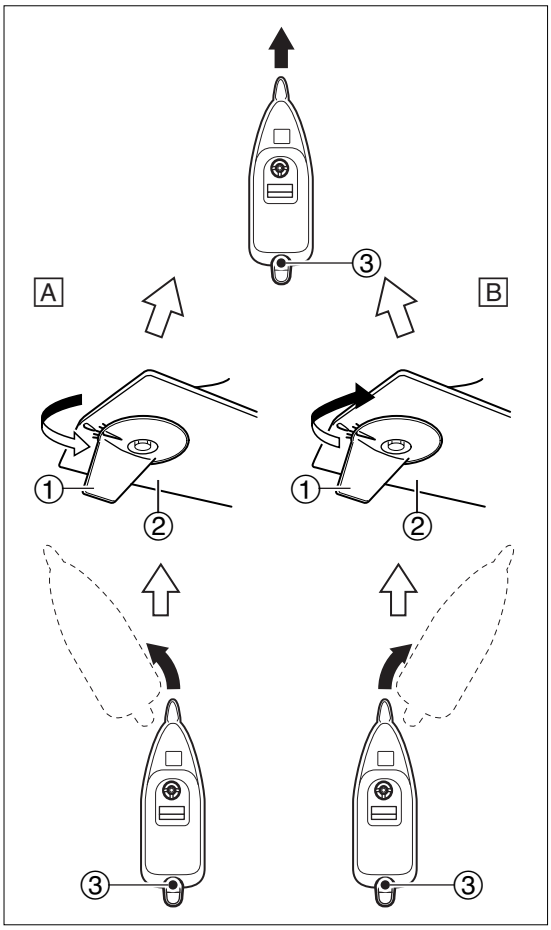
② Trim Tab **Do not reuse.**

Example of Adjustment

A If it is necessary to steer to port 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 rpm	Throttle Opening: 3/4 of WOT at approximately 4,000 rpm	Throttle Opening: 3/4 of WOT at approximately 4,000 rpm	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

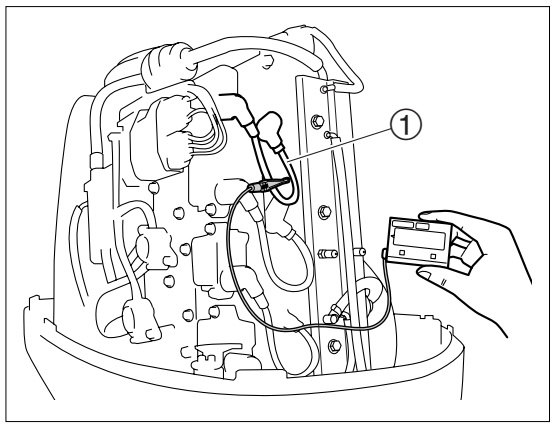
3. Shift gear into forward (F) and at idle slow for approximately 10 minutes.

Trolling Engine Speeds :
700 · 800 · 900 ±50 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 at engine.

2. Check that no fuel leaks in the cowl.

3. Check that no oil or water leaks at the engine.

4. After test run, use flushing kit and fresh water to wash cooling water path by idling engine.

2

Service Data

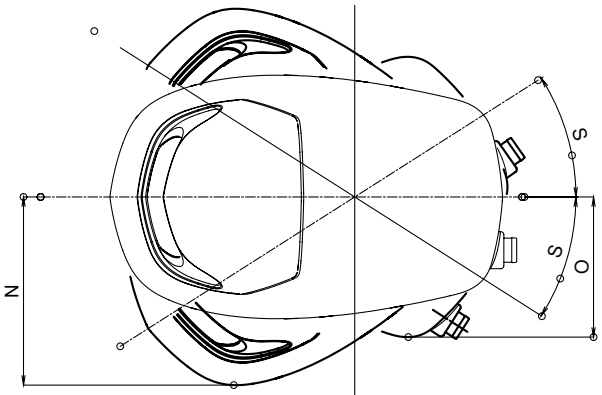


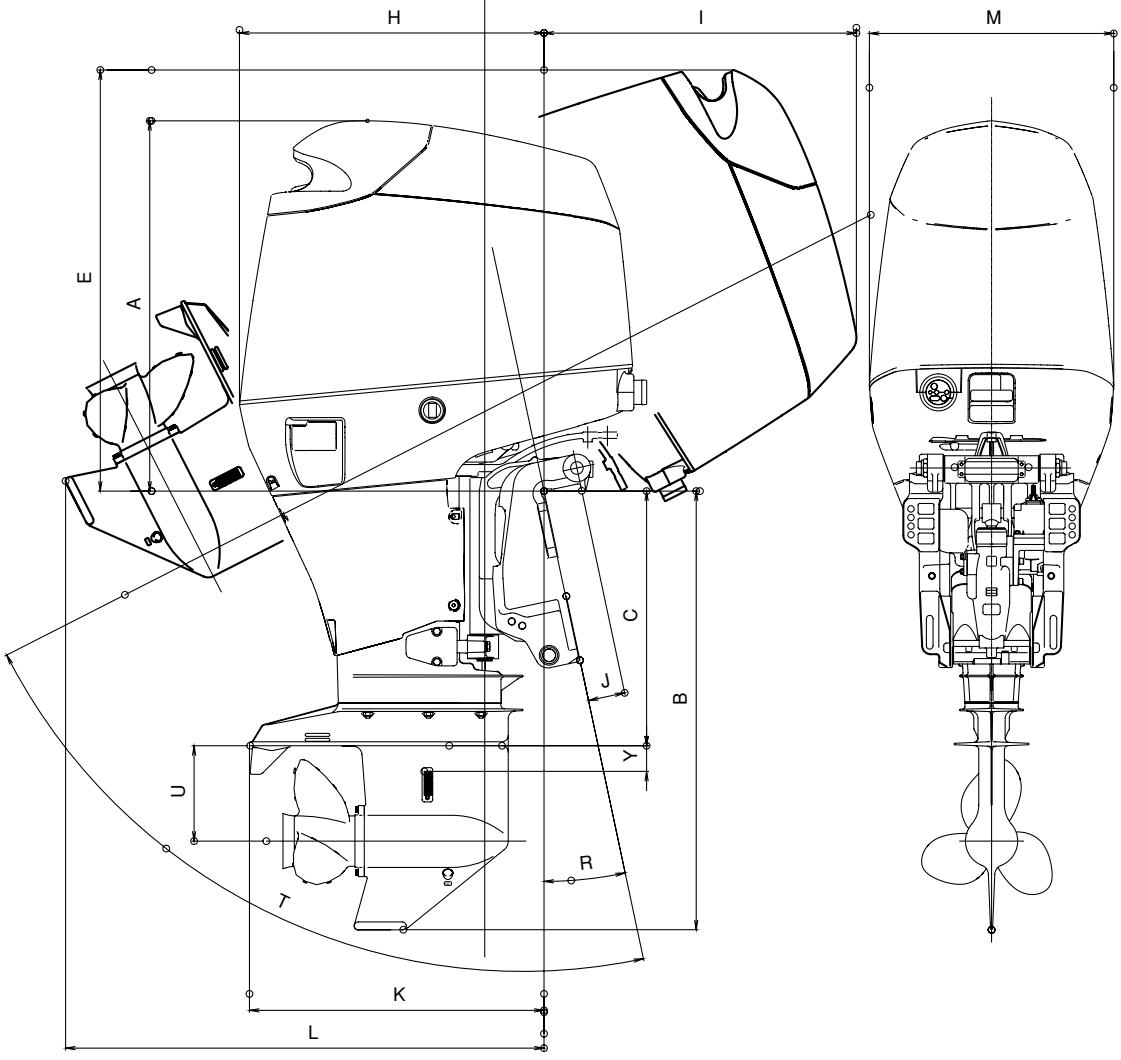
1. Outboard Dimensions ····· 2-2
1) Body dimensions ····· 2-2
2)Clamp Dimensions ····· 2-3
2. Cooling Water System Diagram ··· 2-4
3. Specifications ····· 2-6
4. Warning Indication List • • •
Display for abnormalities during operation ··· 2-8
5. Torque Specifications ····· 2-10
6. Maintenance Data ····· 2-12
7. Sealant And Lubricant ····· 2-18

1. Outboard Dimensions

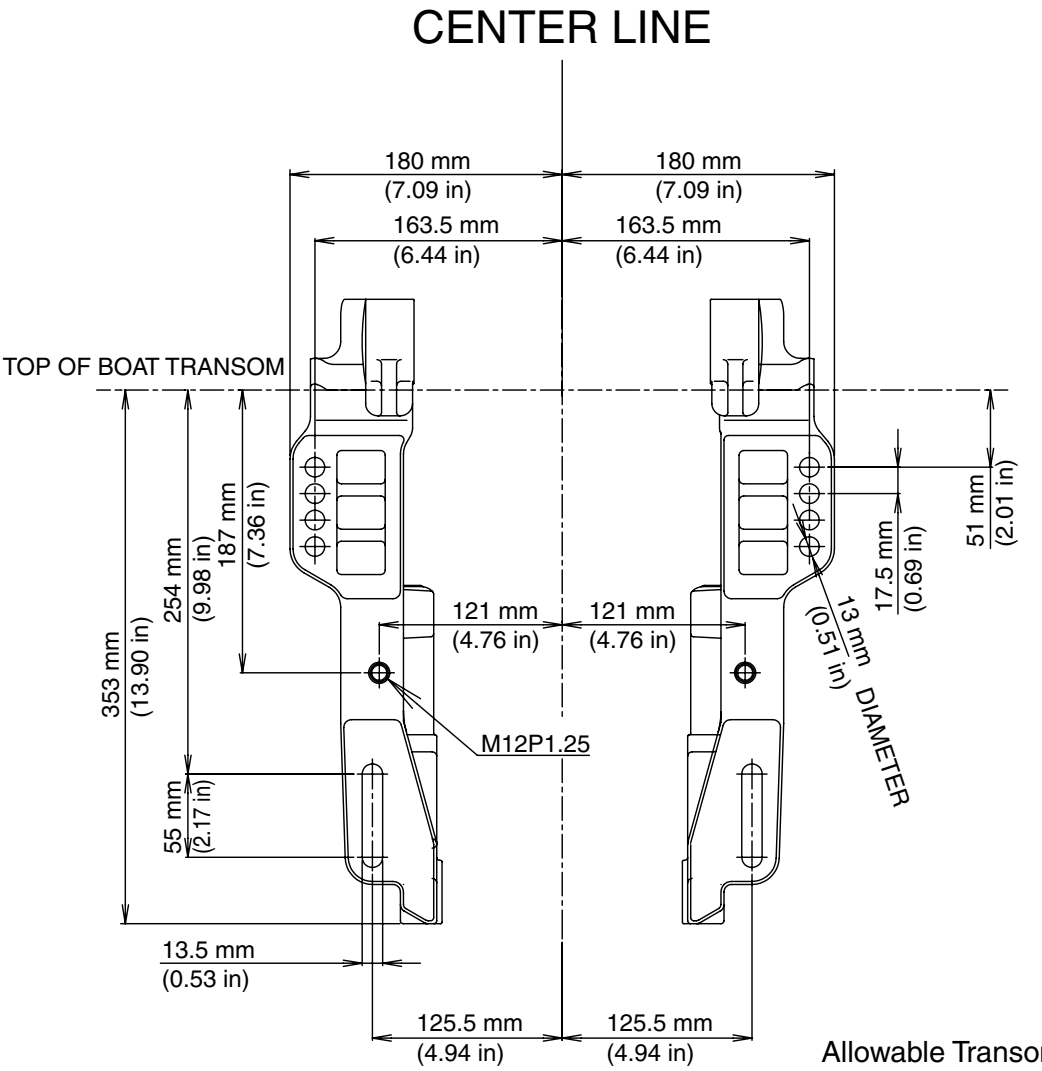
1) Body dimensions

Item	Type	Unit	115A	
			mm	in
A		mm/in	750	29.53
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	854	33.62
H		mm/in	618	24.33
I		mm/in	634	24.96
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	495	19.49
N		mm/in	382	15.04
O		mm/in	284	11.18
R		deg.	12	
S		deg.	33	
T		deg.	75	
U		mm/in	194	7.64
Y		mm/in	52	2.05



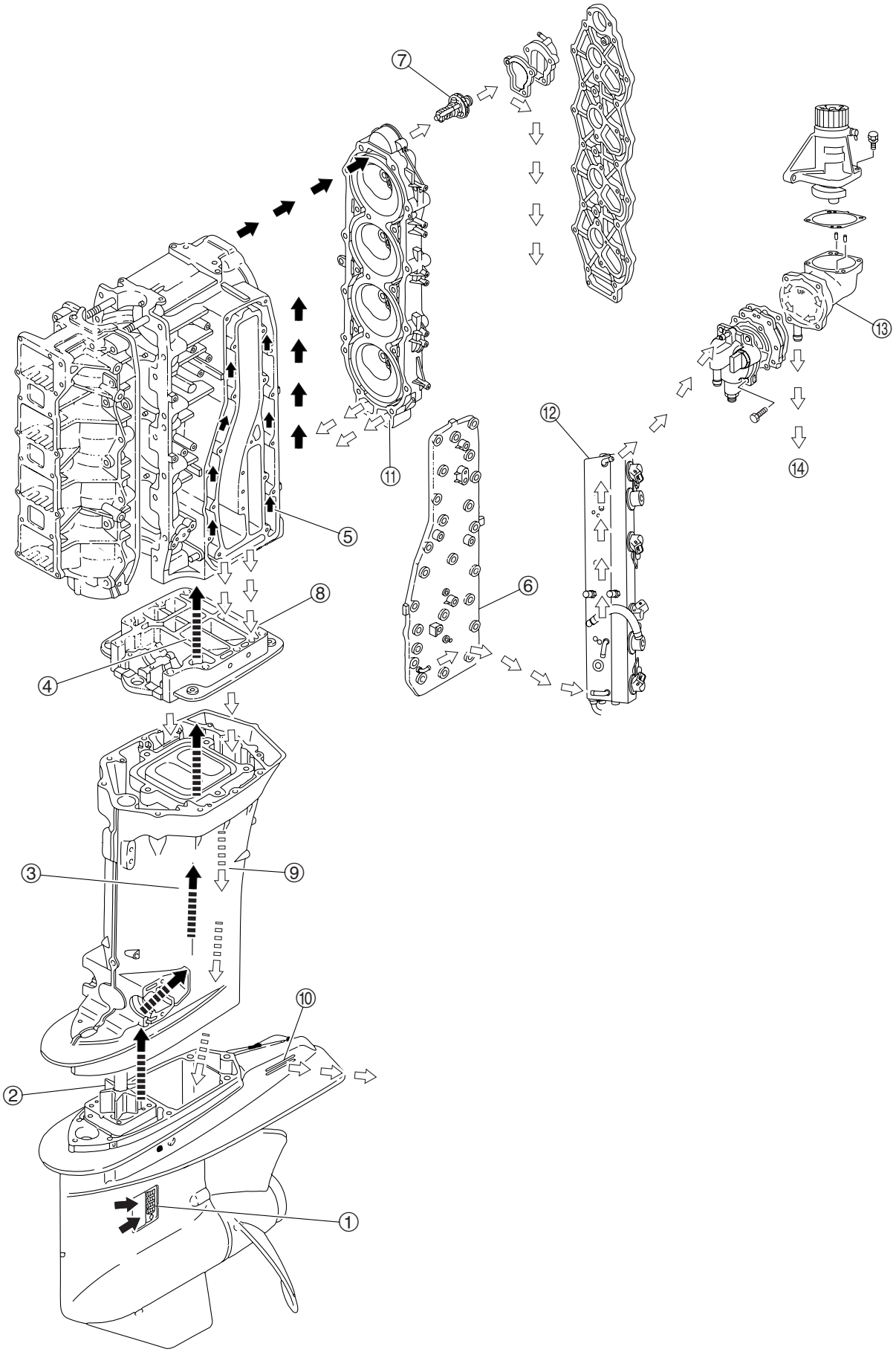


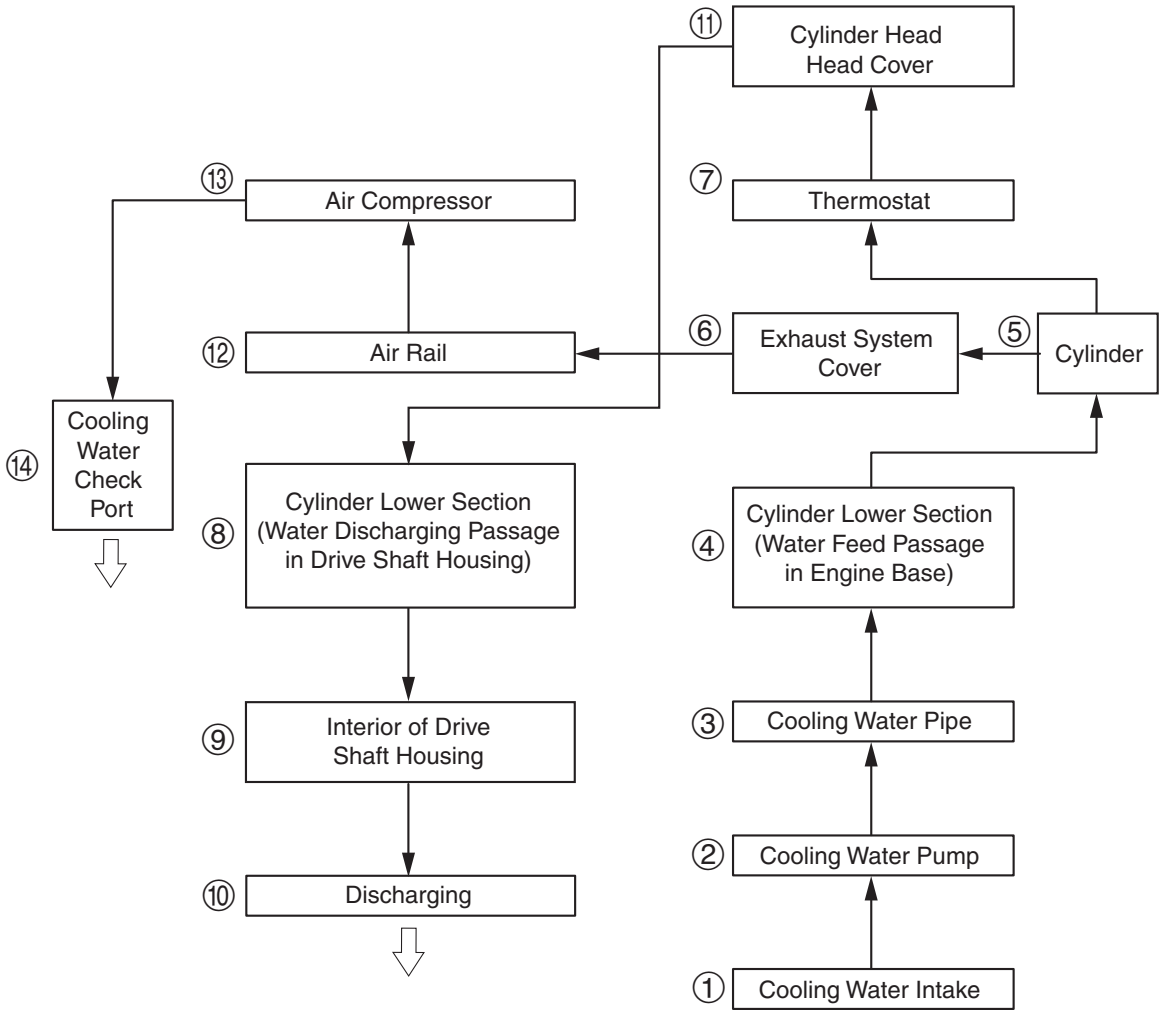
2) Clamp Dimensions



Allowable Transom Thickness
31 - 70mm (1.22 - 2.76 in)

2. Cooling Water System Diagram




⑪
Cylinder Head
Head Cover
⑦
Thermostat
⑬
Air Compressor
⑥
Exhaust System
Cover
⑤
Cylinder
⑫
Air Rail
⑭
Cooling
Water
Check
Port
⑧
Cylinder Lower Section
(Water Discharging Passage
in Drive Shaft Housing)
④
Cylinder Lower Section
(Water Feed Passage
in Engine Base)
⑨
Interior of Drive
Shaft Housing
③
Cooling Water Pipe
⑩
Discharging
②
Cooling Water Pump
①
Cooling Water Intake

3. Specifications

Item		Unit	Model
			EPT0
Dimensions (Approximate)			
Overall Length		mm (in)	800 (31.50)
Overall Width		mm (in)	495 (19.49)
Overall Height	L	mm (in)	1,640 (64.57)
	UL	mm (in)	1,767 (69.57)
Transom Height	L	mm (in)	517 (20.35)
	UL	mm (in)	644 (25.35)
Weight (Approximate)			
	L	kg (lb)	178 (392)
	UL	kg (lb)	181 (399)
Performance			
Max. Output		kW (ps)	84.6 (115)
Revolution range at WOT		r/min	5,150 - 5,850
Max. Fuel Consumption		L (gal.) /hr	44 (11.6)
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			4
Total Displacement		cm³ (cu in)	1,768 (107.9)
Bore × Stroke		mm (in)	88 x 72.7 (3.46 x 2.86)
Compression Ratio			6.9
Compression			Refer : 0.9 MPa (128 psi) [9.0 kgf/cm²)
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—3—2—4
Spark Plug			IZFR5J [NGK]
Alternator Output			12V—490W
Battery			12V 100 - 120AH (800 - 1,000 C.C.A)

Item		Unit	Model
			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 MD Oil (Oil for two stroke direct injection engine recommended by the outboard manufacturer)
	Quantity			6.7 L (1.77 gal)
Gear oil	Type			Hypoid Gear Oil
	Grade	*1	API	GL-5
		*1	SAE	#90
	Quantity		cm^3	900 (30.4 fl.oz)

Lower Unit

Gear Shift			F - N - R
Gear Ratio			1:2 (13:26)
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	67
Steering Angle	*4	Degrees	33+33
Allowable Transom Board Thickness		mm (in)	31 - 70 (1.22 - 2.75)

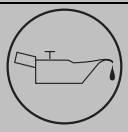
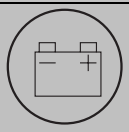
*1 To fill both API and SAE requirements.

*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. Warning Indication List • • • Display for abnormalities during operation

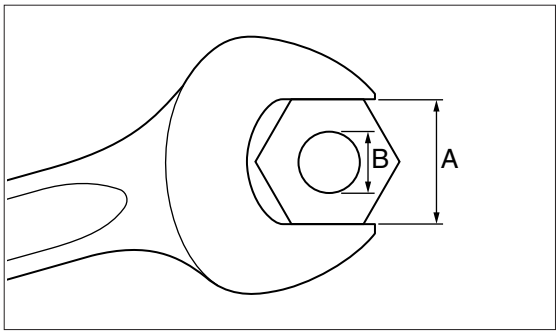
Warning Indicators				ESG Speed Control (*1)
Buzzer Sounding	 Indicator A	 Indicator B	 Indicator C	
Continuous	x	x	x	High speed ESG
Intermittent (3 beeps for every 2 minutes)	Flashing	x	x	-
Continuous	x	Flashing	x	Low speed ESG
Continuous	x	Flashing	x	Forced idling
Continuous	x	Flashing	x	-
Continuous	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	-
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. 1.4 L (0.37 gal) or less	Replenish engine oil in tank.
Cooling water temp. high	85℃ (185˚ F)	Refer to troubleshooting.
Engine cooling water temp. abnormally high	90℃ (194˚ F)	
Air compressor cooling water temp. high	90℃ (194˚ F)	
Air compressor cooling water temp. abnormally high	100℃ (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		

5. Torque Specifications

	Tightening Location	Wrench A	Screw B x Pitch	Type of Fastner	Temporary Driving Torque			Driving Torque			Remarks
					N·m	lb·ft	kg·m	N·m	lb·ft	kg·m	
Engine	Cylinder Head Cover	10	M6 x 1.0	Bolt	①2.0	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	②12	9	1.2	③32	23	3.2	
	Crankcase	13	M8 x 1.25	Bolt	13	9	1.3	25	18	2.5	
		17	M10 x 1.25	Bolt	①20	14	2.0	②40	29	4.0	
		17	M10 x 1.25	Nut	①20	14	2.0	②40	29	4.0	
	Exhaust Cover	13	M8 x 1.25	Bolt	①12	9	1.2	②20	14	2.0	
	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	13	M8 x 1.25	Bolt	-	-	-	15	11	1.5	
	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	M20 x 1.25	Nut	-	-	-	260	190	26.0	
	Hose Joint Adapter (Air Compressor)	17	-	-	-	-	-	15	11	1.5	
	Hose Joint Nut (Air Compressor)	17	-	-	-	-	-	15	11	1.5	
	Spark Plug	16	M12 x 1.25	-	-	-	-	25	18	2.5	
	MAP Sensor	10	M6 x 1.0	Screw	-	-	-	2	1.4	0.2	
	Rectifier	10	M6 x 1.0	Bolt	-	-	-	9	7	0.9	
Lower Unit	Engine Mount Bolt (Engine Base & Drive Shaft Housing)	14	M10 x 1.25	Bolt	①20	14	2.0	②40	29	4.0	
	Exhaust Housing Mount Bolt	13	M8 x 1.25	Bolt	-	-	-	15	11	1.5	
	Exhaust Pipe Installation Bolt	13	M8 x 1.25	Bolt	-	-	-	20	14	2.0	
	Propeller Shaft	21	M16 x 1.5	Nut	-	-	-	12	9	1.2	
	Shift Lever Shaft Holder	13	M8 x 1.25	Bolt	-	-	-	7	5	0.7	
	Mount Rubber (Upper)	17	7/16	Bolt/nut	-	-	-	45	33	4.5	
	Mount Rubber (Lower)	19	M12 x 1.5	Bolt/Nut	-	-	-	32	23	3.2	
	Stern Bracket	-	7/8	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	

	Tightening Location	Wrench A	Screw B x Pitch	Type of Fastner	Temporary Driving Torque			Driving Torque			Remarks
					N·m	lb·ft	kg·m	N·m	lb·ft	kg·m	
Power Trim & Tilt	Oil Reserve Tank Installation Bolt	-	-	-	-	-	-	5	4	0.5	
	Oil Reserve Cap	-	-	-	-	-	-	7	5	0.7	
	Manual Valve	-	-	-	-	-	-	3	2	0.3	
	Tilt Motor Ass'y Bolt	-	-	-	-	-	-	4	3	0.4	
	Gear Pump Bolt	-	-	-	-	-	-	9	7	0.9	
	Trim Rod Guide	-	-	-	-	-	-	80	58	8.0	
	Tilt Rod Guide	-	-	-	-	-	-	130	94	13.0	
Standard Torque	M4	7	M4 x 0.7	-	-	-	-	1.5	1.1	0.15	
	M5	8	M5 x 0.8	-	-	-	-	4	3	0.4	
	M6	10	M6 x 1.0	-	-	-	-	6	4	0.6	
	M8	13	M8 x 1.25	-	-	-	-	13	9	1.3	
	M10	17	M10 x 1.25	-	-	-	-	27	20	2.7	



6. Maintenance Data

	Description	Item	Standard Values
Engine Parts	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	ϕ88.02 mm <0.5 mm oversaize : ϕ88.52 mm> ϕ3.4654 in <0.0197 in oversize : ϕ3.4850 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.>	ϕ87.86 mm <0.5 mm oversize : ϕ88.36 mm> ϕ3.4590 in <0.0197 in oversize : ϕ3.4787 in> *Value with piston coating
		Piston clearance <The gap between cylinder and piston.>	0.15 - 0.21 mm (0.0059 - 0.0083 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) Third: 0.04 - 0.08 mm (0.0016 - 0.0032 in)
		Measure piston pin hole diameter	ϕ23.02 mm (ϕ0.9063 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 (0.00098 - 0.0157 in) Second: 0.25 - 0.40 mm (0.00098 - 0.0157 in) Third: 0.25 - 0.40 mm (0.00098 - 0.0157 in)
	Piston Pin	Outer diameter	ϕ23.00 mm (0.9060 in)
	Crank Shaft	Deflection <Measure with both ends supported.>	0.05 mm (0.0020 in) or less
		Bearing external diameter	Upper area of #1: ϕ40.0 mm (1.574 in) Lower area of #4: ϕ40.0 mm (1.574 in)
		Oil seal scratches	
	Connecting Rod	Loose rod	
		Small end inner diameter	ϕ28.00 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 four spark plugs and measure after warming with the throttle fully open.	0.9 Mpa (128 psi) [9.0 kg/㎠]

Functional Limit	Action To Be Taken
	Clean and remove build up.
Scratches or deflection of 0.10 mm (0.004 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 0.10 mm (0.004 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.
ϕ88.08 mm (3.4677 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.
ϕ87.78 mm (ϕ3.4559 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.
ϕ23.03 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.
ϕ22.97 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/㎠] 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 dameter. Check ports and grind if necessary. (Use 0.5 oversize pistons and piston rings.)

	Description	Item	Standard Values
Engine Parts	Air Rail	Wear and damage on O-rings	
	Air Regulator	Air pressure	0.55 Mpa (79.6 psi) [5.6 kg/㎠] ±7%
	Fuel Regulator	Fuel pressure	Measured air pressure + 0.07 Mpa (10.1 psi) [0.71kg/㎠] ±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 - 230N (Tension measuring instrument by Yunitta)
Electrical Parts	Ignition Coil	Primary coil resistance (between L - B/R, B/W, B/G, B/L lines) Secondary coil resistance (between high tension cord and B line)	0.4 - 0.6 Ω 20℃ (68˚ F) 6.8 - 10.2 kΩ 20℃ (68˚ F) *10.8 - 16.2 kΩ (With spark plug cap)
	Spark Plug Cap	Resistance	3.75 - 6.25 kΩ 20℃ (68˚ F)
	Engine Control Unit (ECU)	Low-speed ESG trigger High-speed ESG trigger	App. 3,000 r/min App. 6,000 r/min
	Magneto (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℃ (68˚ F)
	Spark Plug	Standard plug	IZFR5J [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℃ (68˚ F)
		Operating condition	
	Fuel Injector	Resistance between terminals	1.7 - 1.9 Ω 20℃ (68˚ F)
	Fuel Feed Pump (FFP)	Wear and damage on seals and grommets	
		Operating condition	
	Crank-position Sensor	Gap with encoder ring <flywheel>	0.5 - 0.9 mm (0.020 - 0.036 in)
		Pickup coil resistance value <L/B wire to G/R wire>	400 - 600 Ω 20℃ (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(kΩ)
	Water Temperature Sensor	Resistance between terminals	0.91 - 1.37 kΩ 20 ℃ (68˚ F) 0.13 - 0.19 kΩ 100 ℃ (212˚ F)
	Oil Level Sensor	Resistance between terminals	Sensor ON position : ∞ Sensor OFF position : 0 Ω
	MAT Sensor	Resistance between terminals	2.35 - 2.55 kΩ 20 ℃ (68˚ F) 0.30 - 0.35 kΩ 80 ℃ (176˚ F)
	Rectifiers	Resistance between terminals	Refer to tester checkpoint table
	Electric Oil Pump	Resistance between terminals	1.84 - 2.08 Ω 20 ℃ (68˚ F)
	Stater Motor	Output	12 V 1.0 kW
		Brush length	14 - 15 mm (0.55 - 0.59 in)
		Commutator undercut	0.5 - 0.8 mm (0.020 - 0.032 in)
		Commutator outer diameter	33 mm (1.30 in)
	Starter Solenoid	Rated voltage	12 V (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	Output	3.1 - 4.6 V @25℃ (77˚ F)

	Fully closed	Fully opened
TPS1	0.5 - 1	4 - 6
TPS2	0.5 - 1	4 - 6

*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) 2) When electrodes show excessive wear	Repair so that parts conform to standard values. 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 ∞Ω or 0Ω 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)	
32 mm (1.26 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.

	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 kg/㎠] Tilted down : 3.9 - 7.4 MPa (569 - 1,067 psi) [40 - 75kg/㎠]
		Spool check valve opening pressure	Upper chest: 0.24 MPa (34.1 psi) [2.4 kg/㎠] Lower chest: 0.12 MPa (17.1 psi) [1.2 kg/㎠]
		Oil capacity	682 ㎤ (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 (2,134 - 2,703 psi) [150 - 190 kg/㎠]
		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	4.7 - 5.7Ω
Cooling System	Thermostat	Opening and closing of thermostat valve	With wax type Pressure Relief Valve (PRV) Valve start temperature: 60 ℃ (140 ˚ F) Valve full-open temperature: 75 ℃ (167 ˚ F) or higher
	Pump Impeller	Wear and cracks	
	Pump Case Liner	Wear	
	Guide Plate	Wear	
Lower Unit	Anode	Corrosion	
	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	
	Propeller	Wear, warping, cracking, chipping	
Other	Oil Seales	Wear, damage	

Functional Limit	Action To Be Taken
When the valve opens even slightly at ambient temperature Check valve opening temperature by immersing the thermostat in water and gradually increasing water temperature	Replace with new part.
When the tips or upper and lower surface lip areas show wear, cracks or damage	Replace with new assembly.
	Replace when wear is excessive.
	Replace when wear is excessive.
When anode shows excessive corrosion	Replace with new part.
	Replace with new part.
	Adjust or replace with new parts.
	Replace if over specified limit.
0.4mm (0.016 in)	
When depth of wear is 0.1 mm (0.004 in)	
	Replace with new part.
When lip area shows deterioration, heat discoloration, or damage or when reduces interference to 0.5 mm (0.02 in) or less	Replace with new part.

7. Sealant And Lubricant

Applied to		Low-Strength Screw Lock AgentLock Agent	High Strength Screw Lock Agent	Gasket Seal Agent	Adhesive	Instantaneous Adhesive	Low Temperature Resistant Lithium Grease LIT	Waterproof Grease OBM	Silicone Grease SOC	Molybdenum Grease MOL	2st Engine Oil	Gear Oil	PTT Fluid	Remarks
		ThreeBond		Loctite	Konishi	Three Bond	Chuo Yuka		Shinetsu Silicones					
		1342	1373B	518	G17	1741	Centax L2	FM-531	KS-64				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 Bold	○												
	Cylinder-Crank Case Mating Surface			○										Be careful of application thickness.
	Exhaust Cover Gasket													Apply to both faces.
	Water Temp. Sensor							○						Apply to O Ring.
	High Tension Cord				a○	b○								a : Plug cap side, b : Ignition coil side
	Spark Plug Cap								○					Interior
	Advancer Arm						○							Sliding section
	Throttle Cam						○							Sliding section
	Shift Arm						○							Sliding section
	Ball Joint Cap						○							Sliding section
	Cable Joint (Shift Arm Section)							○						Sliding section
	Rectifier Bolt	○												
	Starter Motor							a○	b○					a : Pinion section, b : Terminal section
	Starter Motor Rubber					○								Bond to starter motor band.
	Protector (for Electric Bracket)				○									
	Solenoid Switches (Starter Motor, 2 locations)								○					Terminal section
	Solenoid Switches (PTT, 6 locations)								○					Terminal section
	ECU Mount Rubber								○					ECU mounting section (3 locations)

Applied to		Low-Strength Screw Lock AgentLock Agent	High Strength Screw Lock Agent	Gasket Seal Agent	Adhesive	Instantaneous Adhesive	Low Temperature Resistant Lithium Grease LIT	Waterproof Grease OBM	Silicone Grease SOC	Molybdenum Grease MOL	2st Engine Oil	Gear Oil	PTT Fluid	Remarks
		ThreeBond		Loctite	Konishi	Three Bond	Chuo Yuka		Shinetsu Silicones					
		1342	1373B	518	G17	1741	Centax L2	FM-531	KS-64				ATF (*1)	
Air Rail	Air Injector O Ring										○			Apply to two O Rings.
	Air Injector Terminal								○					Terminal section
	Fuel Injector O Ring										○			Apply to two O Rings.
	Fuel Injector Terminal								○					Terminal section
	Fuel Regulator O Ring										○			Apply to two O Rings.
	Air Regulator O Ring										○			Apply to two O Rings.
	Compression Seal										○			Apply to 6 locations in the air rail.
	Plug O Ring										○			Apply to 3 locations in the air rail.
	Air Hose L Nipple O Ring										○			Apply to two O Rings.
	Fuel Hose L Nipple O Ring										○			Apply to two O Rings.
	Valve Ass'y	○												Apply to tapered screw section.
Air Compressor	Piston										○			Apply to whole circumference.
	Cylinder										○			Apply to whole circumference.
	Piston Pin										○			Apply to whole circumference.
	Piston Ring										○			Apply to whole circumference.
	Big End Needle Bearing										○			Apply to rolling sections.
	Housing Oil Seal						○							Fill lip area.
	Crank Shaft B/G										○			Apply to rolling sections.
	Collar O Ring										○			Apply to rolling sections.
	Adapter Hose Joint	○												Apply to embededed sections (M10P1.0 sections).
FFP Ass'y	Adapter Hose Joint	○												Apply to embededed sections (M10P1.0 sections).
	Cable Terminal Grommet										○			Apply to both inner and outer faces.
	FFP Upper Grommet										○			Apply to both inner and outer faces.
	FFP Lower Grommet										○			Apply to both inner and outer faces.
	Pipe Grommet										○			Apply to both inner and outer faces.

	Applied to	Low-Strength Screw Lock AgentLock Agent	High Strength Screw Lock Agent	Gasket Seal Agent	Adhesive	Instantaneous Adhesive	Low Temperature Resistant Lithium Grease LIT	Waterproof Grease OBM	Silicone Grease SOC	Molybdenum Grease MOL	2st Engine Oil	Gear Oil	PTT Fluid	Remarks
		ThreeBond		Loctite	Konishi	Three Bond	Chuo Yuka		Shinetsu Silicones					
		1342	1373B	518	G17	1741	Centax L2	FM-531	KS-64				ATF (*1)	
Lower Unit	Pinion Gear (B Gear) Nut	○												After degreasing screw section completely
	Propeller Shaft Housing							○						Inside
	Propeller Shaft Housing O Ring							○						
	Propeller Shaft Oil Seal							○						Lip area
	Propeller Shaft							○						Spline section
	Forward Thrust Washer							○						Taper section
	Lower Pump Case							○						Inside
	Lower Pump Case O Ring							○						
	Lower Pump Case Oil Seal							○						Lip area
	Pump Case Bolt							○						Below neck
	Water Pipe Grommet							○						Upper face
	Water Pipe Grommet Upper Seal Rubber											○		Inner face
	Water Pipe Grommet Lower Seal Rubber				a○							b○		a : Case mounting section, b : Inner face
	Water Pipe Grommet Guide Rubber							○						Whole face
	Pump Case Liner							○						Thinly on the inner face
	Gear Case Plate Screw	○												Screw section
	Exhaust Housing Grommet					○								
	Trim Tab Mounting Bolt							○						Stub bolt thread section
	Drive Shaft							○						Engine side spline section
	Engine Base Gasket													
	Shift Lever Shaft Holder Mounting Bolt	○												Screw section
	Shift Lever Shaft Holder							○						Sliding section and interior (small amount)
	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
	Shift Assist Ass'y													a: Thread of cap, nut and joint, b: Interior (Sling)
	Gear Case Lubrication Oil											○		Oil q'ty : 900㎤ 30.4 fl.oz
	Gear Case Bolt							○						Below neck
	Extension Housing Bolt	○												Below neck
	Propeller Shaft Housing Bolt	○												Below neck
	Seal Rubber (for Apron)					○								

Applied to		Low-Strength Screw Lock AgentLock Agent	High Strength Screw Lock Agent	Gasket Seal Agent	Adhesive	Instantaneous Adhesive	Low Temperature Resistant Lithium Grease LIT	Waterproof Grease OBM	Silicone Grease SOC	Molybdenum Grease MOL	2st Engine Oil	Gear Oil	PTT Fluid	Remarks
		ThreeBond		Loctite	Konishi	Three Bond	Chuo Yuka		Shinetsu Silicones					
		1342	1373B	518	G17	1741	Centax L2	FM-531	KS-64				ATF (*1)	
Stern Bracket Components	Bracket Bolt							(○)						Fill with grease
	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
PT/T Components	PTT Trim Receiver							○						Head section
	PTT Upper Cylinder Pin							○						
	Tilt Rod Nut	○												Screw section
	PTT Assembly Bolt							○						Below neck
	Tilt Rod Nut	○												
	PTT Sensor Bolt	○												Screw section
	PTT Switch								○					Terminal section
	PTT Oil												○	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

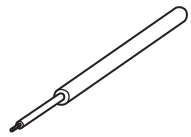
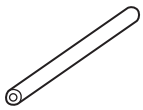
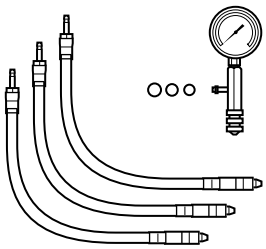
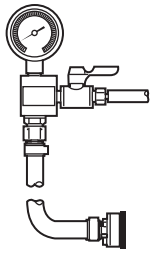
3

Inspections and Adjustments



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1. Special Tool

			
Spring Pin Tool A P/N. 369-72217-0	Spring Pin Tool B 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

2. Inspection Schedule

Section	Inspection Part	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	Inspection Item	Remarks
Fuel System and Compression System	Fuel Filter	○	○	○	○	○	Inspection and filter cleaning	
	High Pressure Fuel Filter		○	○	○	Replace	Inspection	Cartridge type
	Piping	○	○	○	○	Replace	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)
Stating System	Starter Motor			○	○	○	Adhesion of salt, and battery cables	
	Battery	○	○	○	○	○	Installation, electrolyte level, specific gravity	
Oil System	Oil Tank	○		○	○	○	Oil leak, damage Clip existence, location Filter cleaning	
	Oil Pipe	○		○	○	○		
	Oil Filter	○		○	○	○		
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 overhaul the machine every 300 hours of operation.

3. Top Cowl

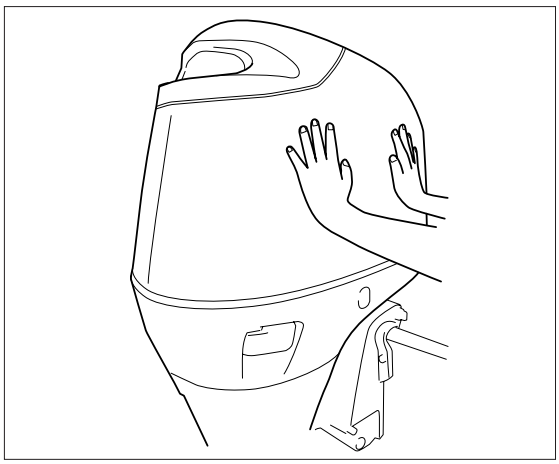
1) Adjustment of Cover Hook

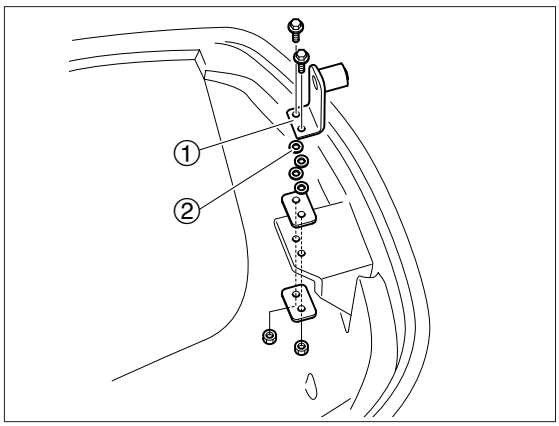
Push cover to check for play, and adjust if necessary.

Remove cover stay ① .
Add or remove washer(s) ② for adjustment.

⚠ CAUTION

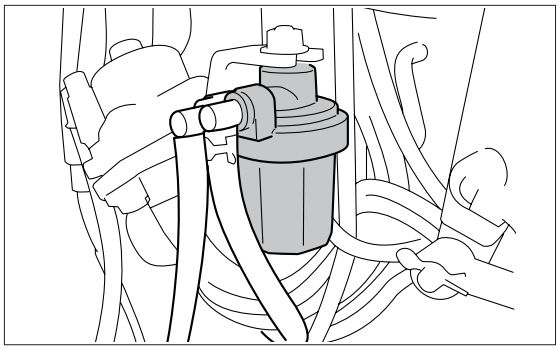
Remove washer(s) if too much play.
Add washer(s) if too much tightening is needed.



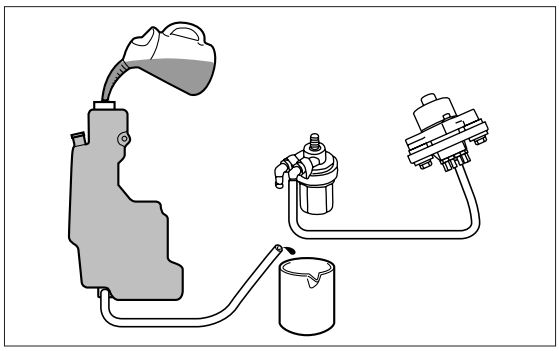


2) Oil Filter and Oil Tank

Only clean if debris, water, or contamination is present.
If cleaned then you must bleed the oil system.



3) Air Bleeding

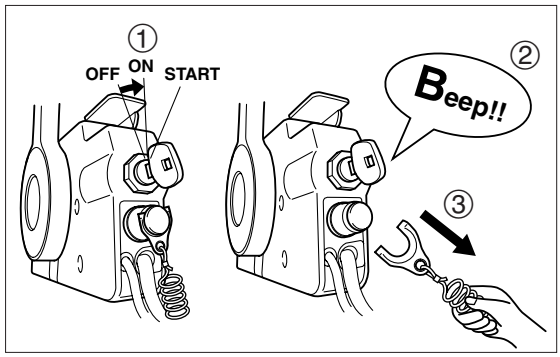


1. Visually check if any air is found in the oil line from oil tank to cylinder block, and if any air is found, bleed the air by using the following procedure.

2. Fill oil tank.

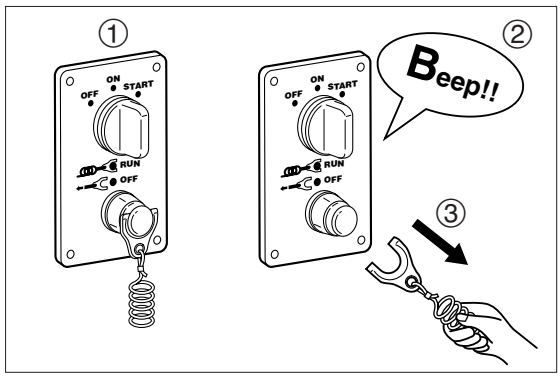
3. Disconnect oil filter inlet hose, and then reconnect the hose when oil containing no air bubbles flows out.

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



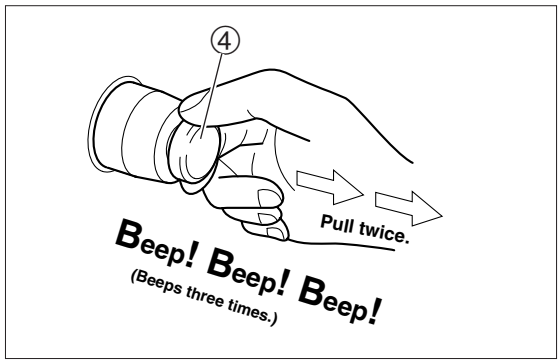
4. Set key switch ① a to "ON".

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.



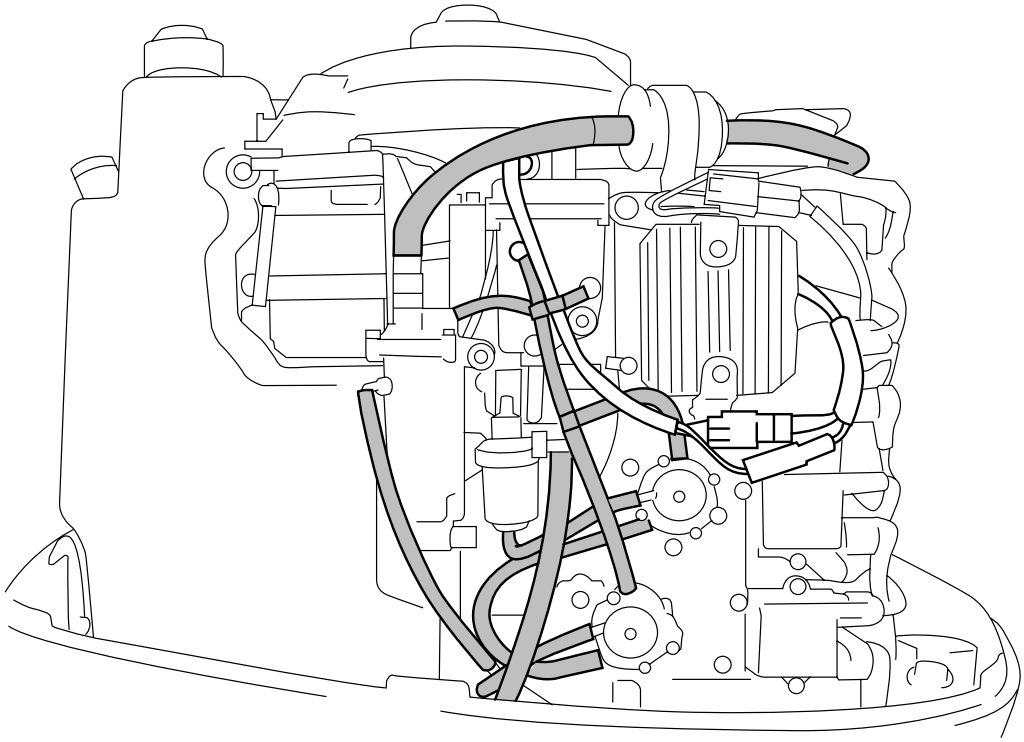
7. The oil pump continues to operate to feed oil. When air is bled from the oil, set the key switch to "OFF".

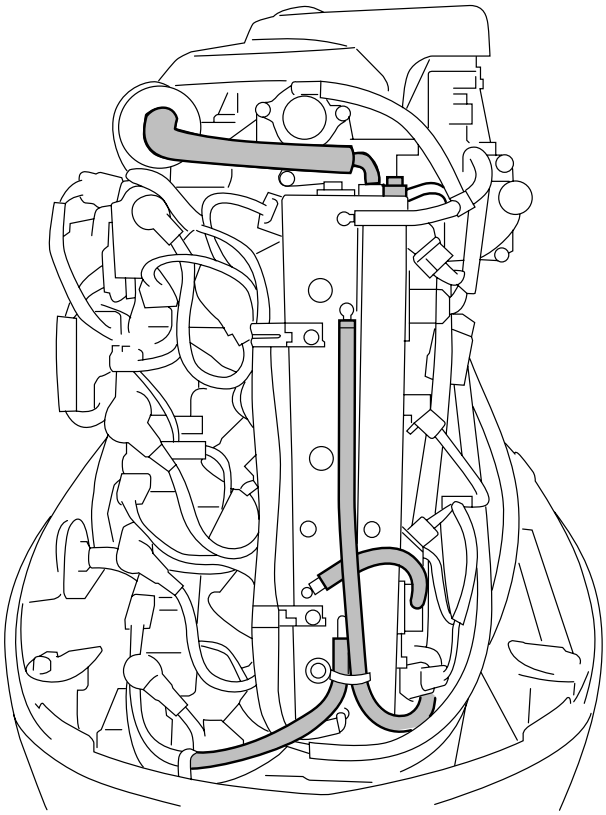
The oil pump stops automatically at approximately one minute.

4. Fuel System

1) Inspection of Fuel Pipes and Joints

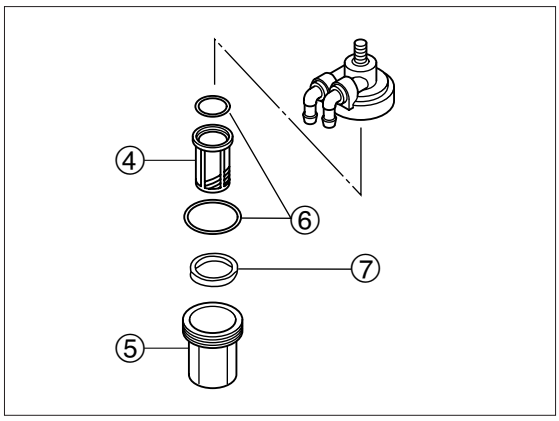
Check the fuel system piping for fuel leak, dirt, deterioration and damage, and replace or clean parts if necessary.





2) Inspection of Fuel Filter

Check fuel filter ④ for contamination, and fuel filter cup ⑤ for invasion of foreign matter and cracks. Clean fuel filter cup with gasoline, and replace fuel filter ④ if necessary.



⑥ O Ring **Do not reuse.**

Do not spill fuel when removing fuel filter cup.

⚠ CAUTION

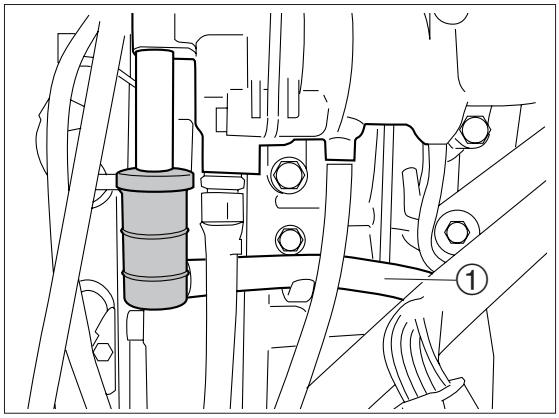
If red float ⑦ is floating in the filter, water is in the cup. Remove the cup and drain the water.

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

3) Inspection of Air Compressor Air Filter

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.



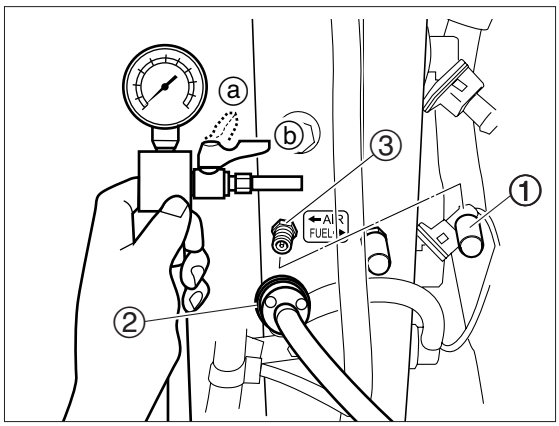
⚠ CAUTION

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

4) Inspection of Air Pressure

1. Remove cap ①.

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



⚠ CAUTION

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

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

3. Set the lever of pressure gauge ass'y to position ⓐ.

4. Measure air pressure while idling the engine or cranking for 15 seconds.

Air Pressure : Specified Value
0.52 - 0.58 MPa (75.25 - 83.95 psi) [5.2 - 5.8 kgf/cm²]

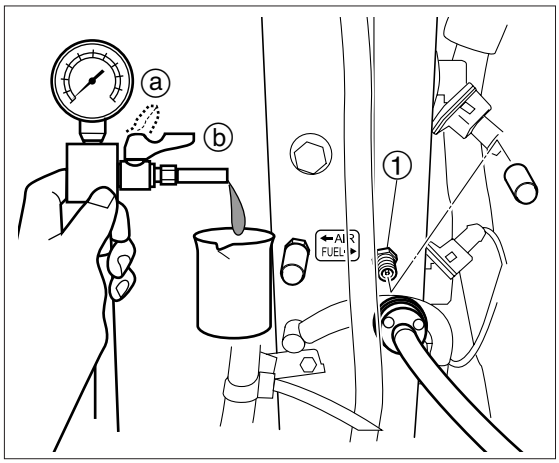
⚠ CAUTION

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

5. Set the lever of pressure gauge ass'y to position ⓑ to relief pressure.

6. Remove pressure gauge ass'y and attach cap.

5) Inspection of Fuel Pressure



1. Remove cap.

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

⚠ 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.

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

3. Set the lever of pressure gauge ass'y to position ⓐ.

4. Measure fuel pressure while idling the engine or cranking for 15 seconds.

Fuel Pressure : Specified Value
0.58 MPa - 0.66 MPa (83.95 - 95.55 psi) [5.8 - 6.6 kgf/cm²]

⚠ 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.

5. Set the lever of pressure gauge ass'y to postion ⓑ to relief pressure.

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

6. Remove gauge.

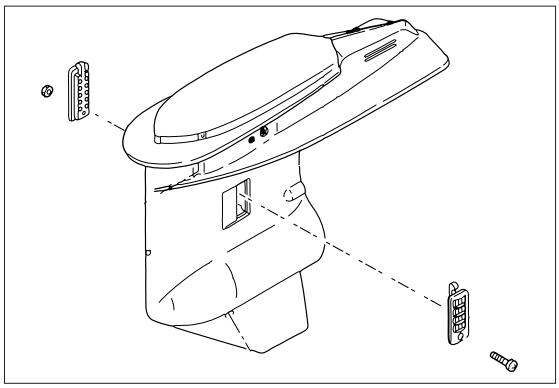
> **⚠ CAUTION**
>
> **Be careful not to let the fuel in the gauge leak when removing the gauge.**

7. Attach the cap.

5. Cooling System

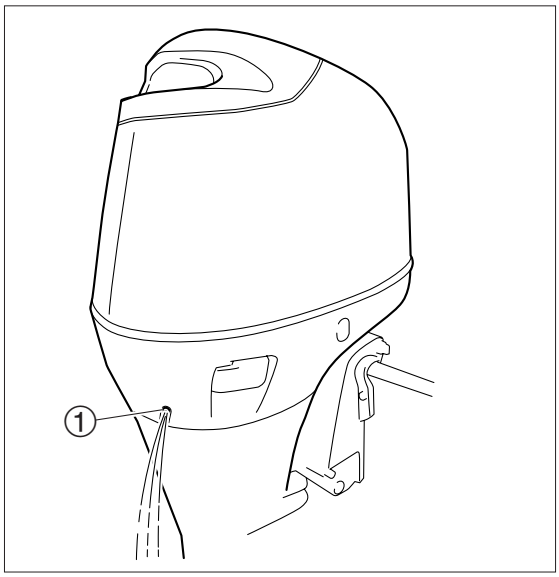
1) Inspection of Cooling Water Passage

1. Check that cooling water intake is clogged. Clean if necessary.



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

3. Check that cooling water check port ① ejects water.



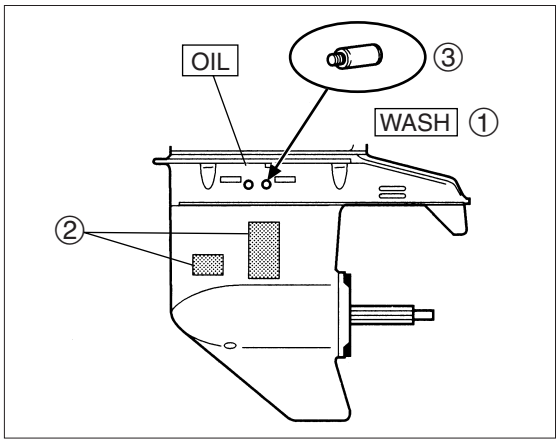
2) Flushing with Water

⚠ WARNING

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

⚠ 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.



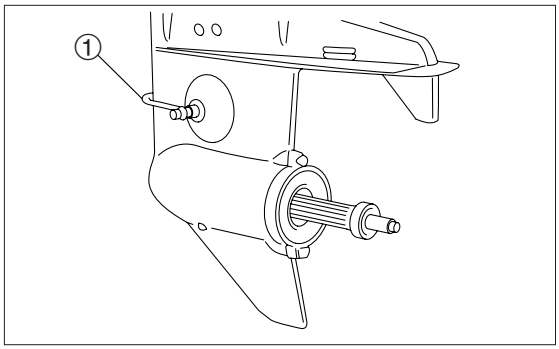
② Tape
③ Flushing Attachment

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.

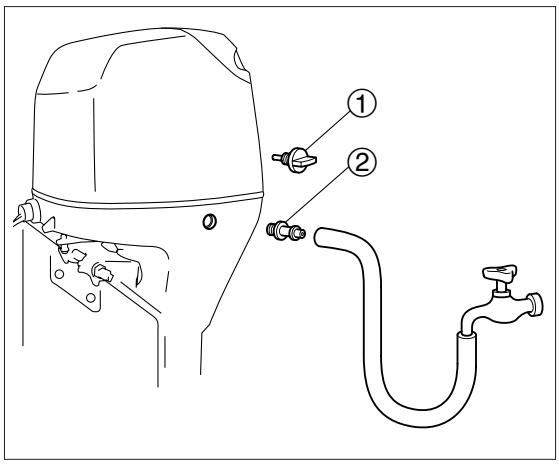
3. Set shift lever to neutral (N) and start engine.

4. Check that cooling water check port discharges water, and run engine for 3 to 5 minutes at idle speed.

Flushing using flushing device

1. Set outboard motor to vertical position.

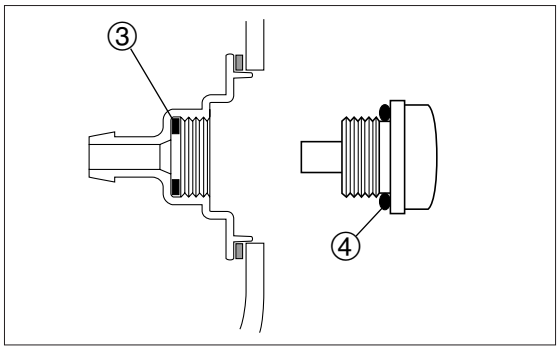
2. Take out flushing connector cap ① and attach flushing attachment ② to it.



3. Put water hose on the flushing attachment and run water for 3 to 5 minutes.

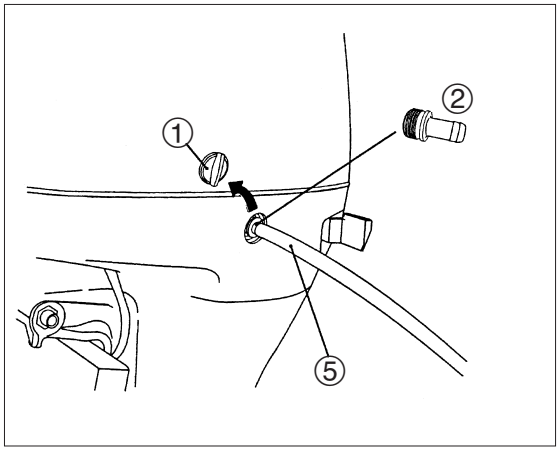
> **⚠ CAUTION**
>
> **The flushing can be made without running the engine.**
> **Water pressure:**
> **0.12 - 0.2MPa (1.74 - 29.0psi) [1.2 - 2.0kgf/cm²]**

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.**



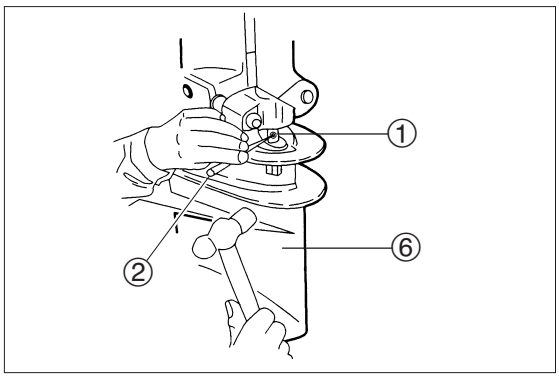
⑤ Hose

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:
   P/N. 369-72217-0

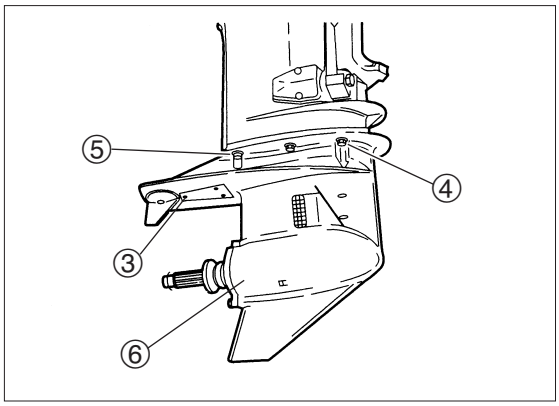
   ● Remove gear case ass'y from drive shaft housing.



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.)

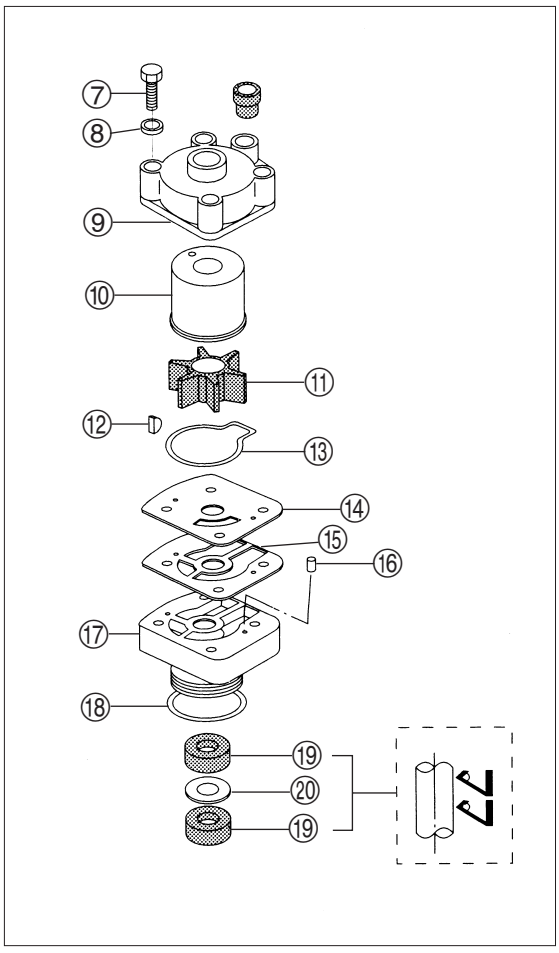
   Speed meter pipe is put on the nipple of gear case ass'y. After gear case has come down slightly, remove pipe from nipple.



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

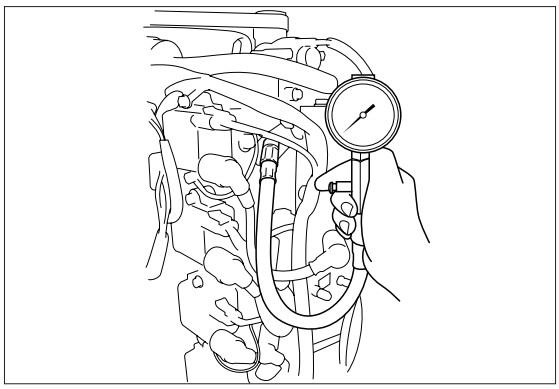
Inspection

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



⑪⑮⑱⑲ **Do not reuse.**

3) Inspection of Compression Pressure



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.

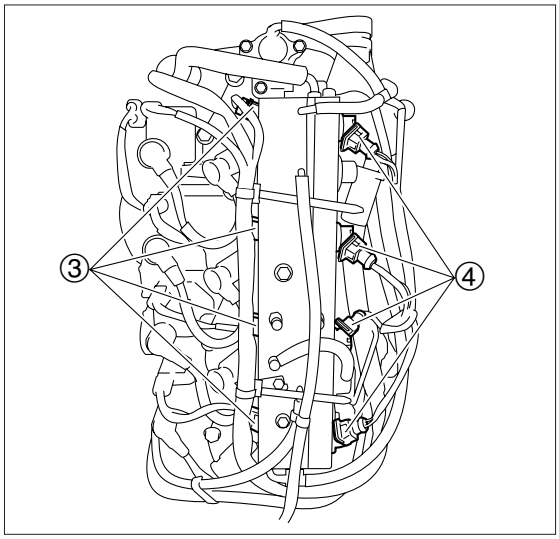
⚠ CAUTION

To prevent accidental start of the engine, remove lock plate (of stop switch lanyard) from stop switch before measuring compression pressure.

4. Remove all plug caps and then all spark plugs.

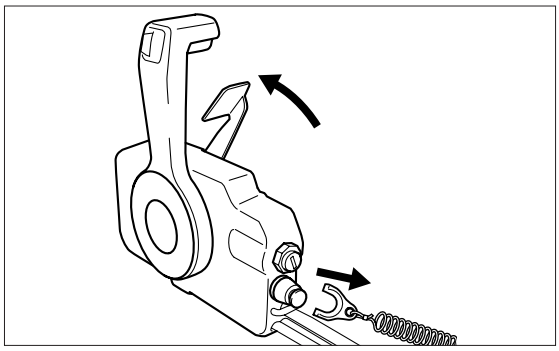
⚠ CAUTION

Clean areas around spark plugs on the cylinder before removing spark plugs to prevent dirt from entering cylinder.



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/cm²]

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.

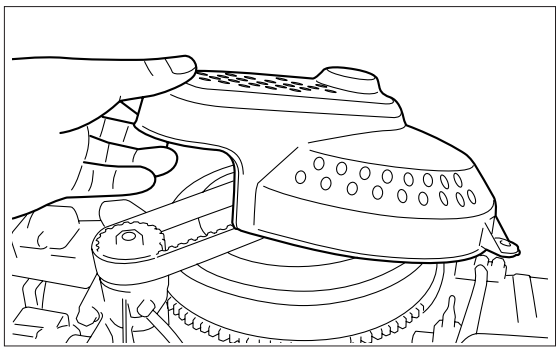
If any of the following results is obtained by the measurement, it is necessary to repair or replace relevant part(s).

- The measurement is lower than specified value,
- Different between compression pressure of the cylinders exceeds; 0.105 MPa (15 psi) [1.05 kgf/cm²], or
- The measurement is abnormally higher than specified value.

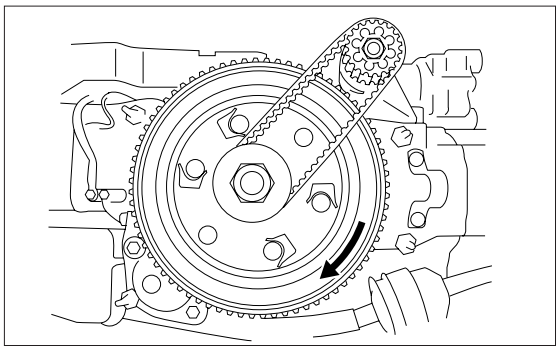
6. Power Unit

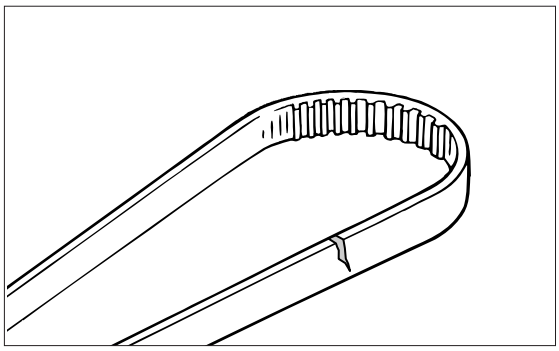
1) Inspection of Drive Belt

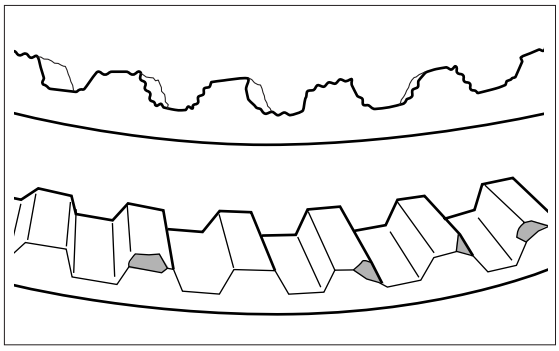
1. Remove ring gear cover.



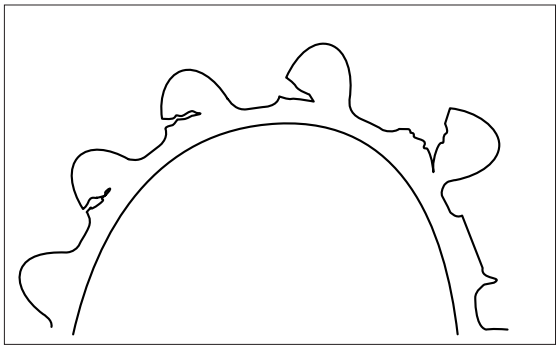
2. Check drive belt for wear and damage on the inner and outer faces while turning flywheel clockwise. Check if oil or dirt is adhered to the belt.
   Replace with new one if any of the problems exists.



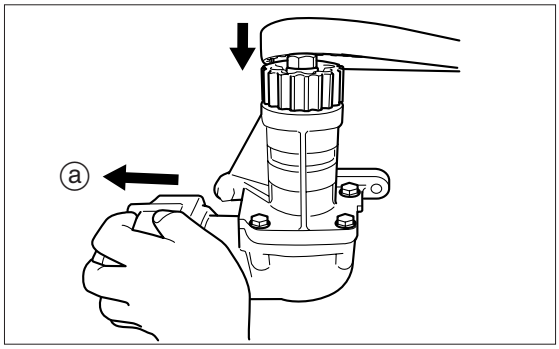




Crack or chip of the belt, if any, can be found easily by turning it over.



2) Adjustment of Drive Belt Tension



1. Loosen compressor securing bolts.

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

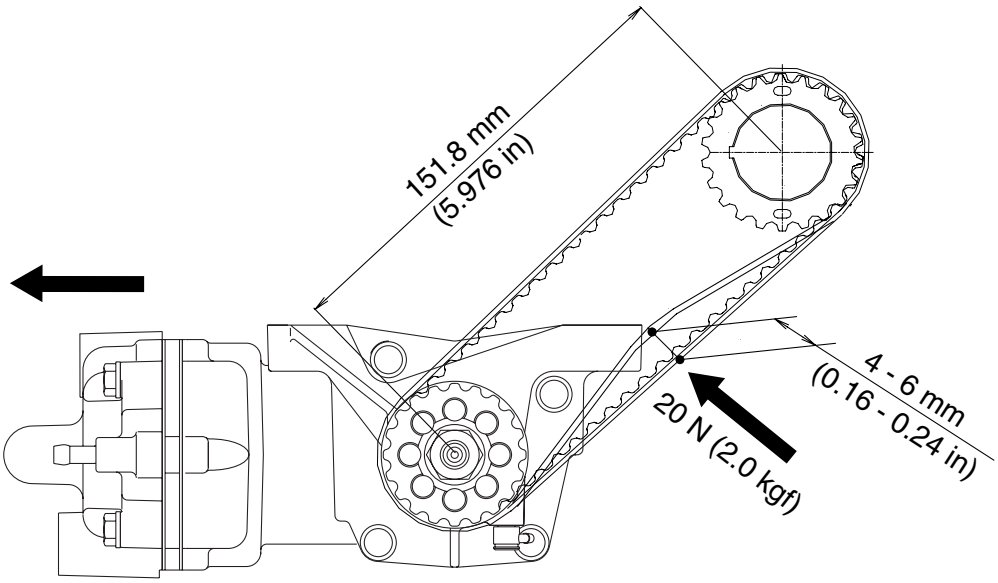
Deflection of Belt:
4 - 6 mm (0.16 - 0.24 in) when pushing the belt with 20 N (2.0 kg) .

⚠ CAUTION

Be careful that oil or grease does not adhere to the belt.

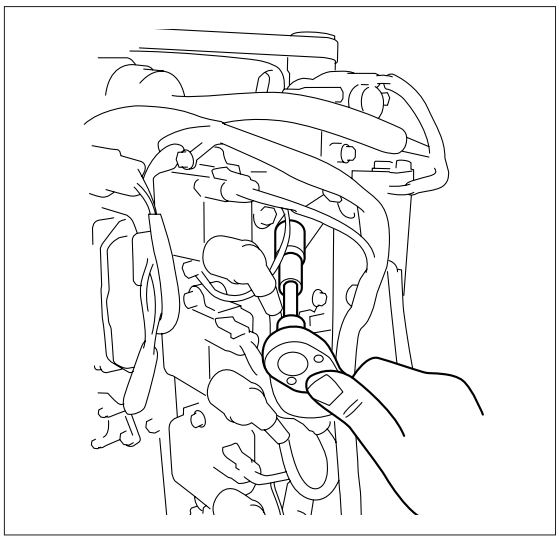
⚠ CAUTION

Perform belt tension adjustment when the engine is cold.



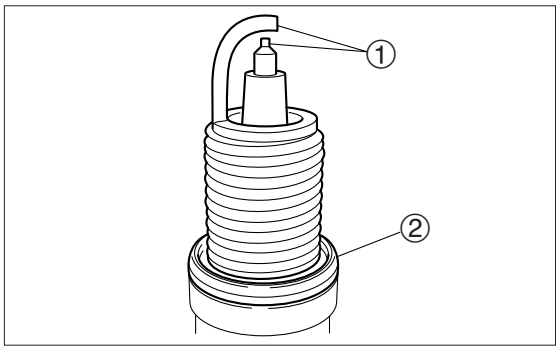
3) Inspection of Spark Plugs

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.

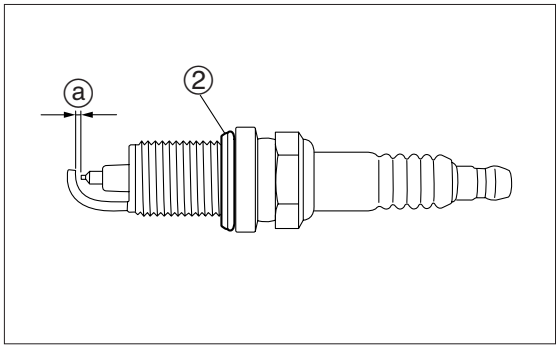


4. Check spark plug gap ⓐ. Replace if it is over specified value. Adjust gap if it is out of specified range.

Spark Plug Gap ⓐ:Standard Value
0.7 - 0.8 mm (0.029 - 0.032 in)

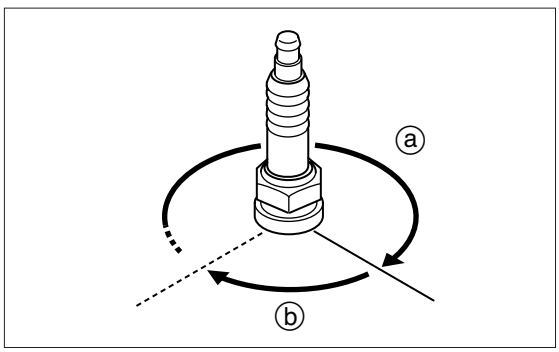
Functional Limit:
0.9 mm (0.036 in)

Specified Spark Plug:
IZFR5J [NGK]



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

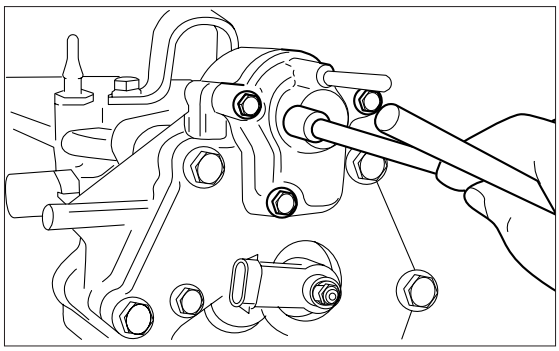
Spark Plug:
25 N · m (18 lb · ft) [2.5 kgf · m]

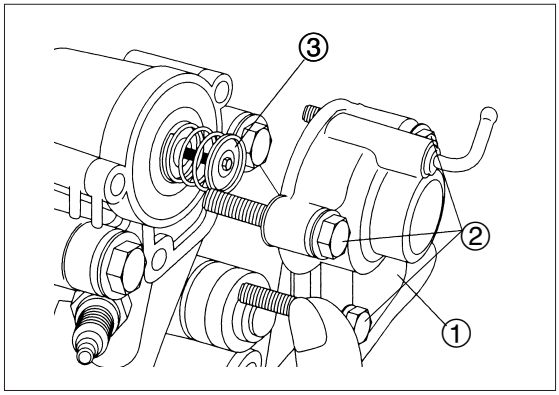


4) Inspection of Thermostat

1. Remove air rail.

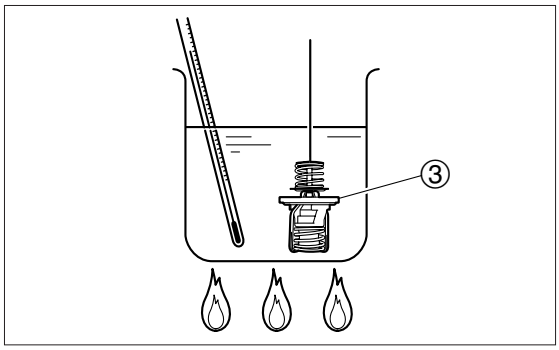
2. Loosen cover installation bolts ②, remove them, and then remove cover 1 and thermostat ③.





3. Hang thermostat ③ in the water contained in vessel.

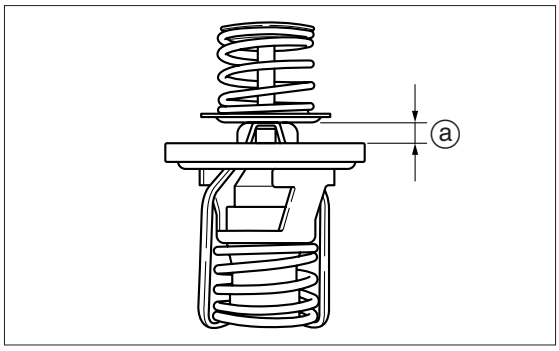
4. Put thermometer in the water, and warm up water to measure valve opening temperature.



> 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:
58.5 - 61.5˚C (137 - 143˚F)

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



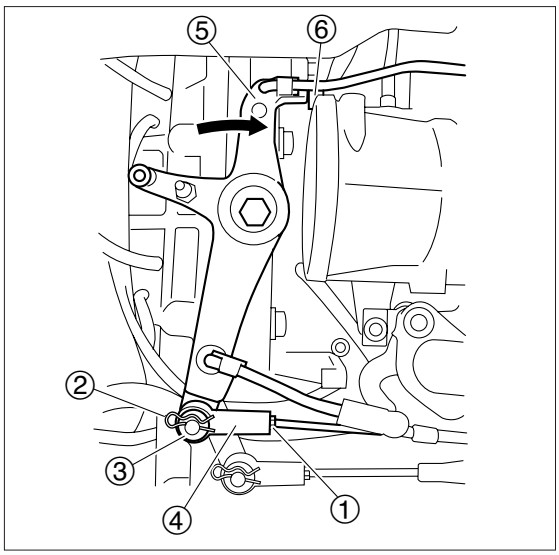
Water Temperature	Valve Lift ⓐ
75˚C (167˚F)	4.5 mm (0.177 in) or more

6. Install thermostat, new gasket and cover.

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

7. Operating System

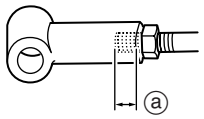
1) Adjustment of Throttle Cable



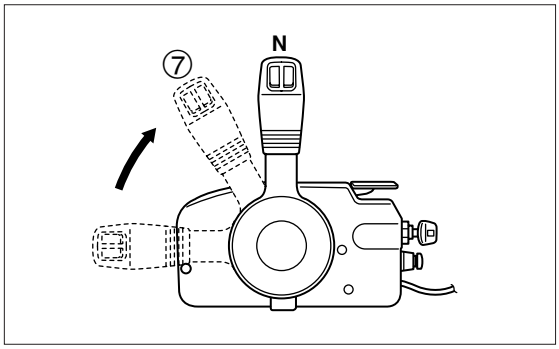
1. Loosen lock nut ①.
2. Remove "R" shaped pin ② and washer ③.
3. Remove cable joint ④ from advancer arm ⑤.
4. Bring advancer arm ⑤ to full close stopper ⑥.
5. Set remove control lever to throttle full close position ⑦.
6. Adjust cable joint screw-in length so that the pin of advancer arm is aligned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

⚠ CAUTION

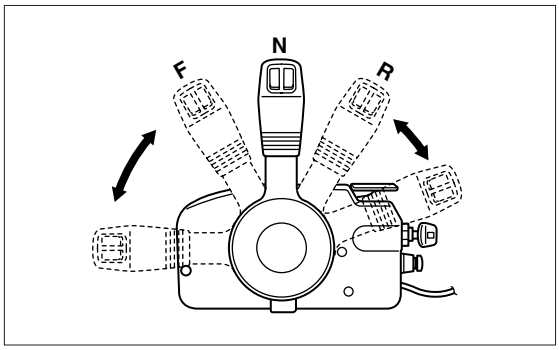
Adjust cable joint screw-in length ⓐ to 10mm (0.39in) or over.



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



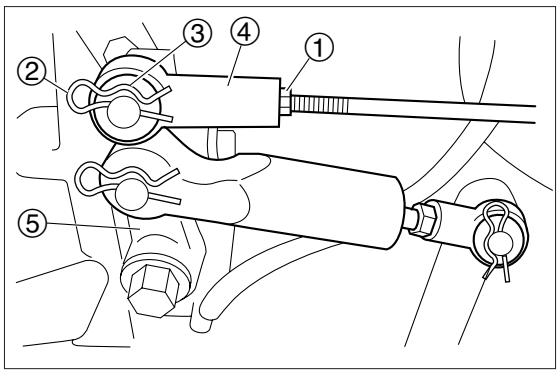
7. Attach cable joint, washer and "R" shaped pin to advancer arm.
8. Check if throttle control can be made smoothly. If necessary, readjust by following the steps 1 to 7.
   Make sure the cable pushes the throttle arm against the stop at WOT in forward against.



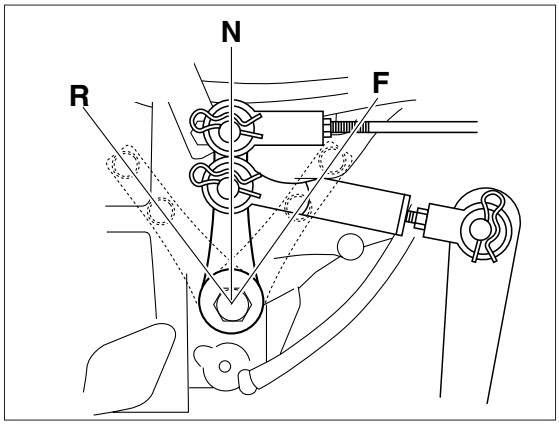
⚠ CAUTION

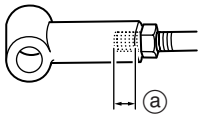
TPS error occurs if advancer arm touches the full close stopper when remote control lever is at throttle full close position.
Refer to Chapter "10" for resetting the error.

2) Adjustment of Shift Cable

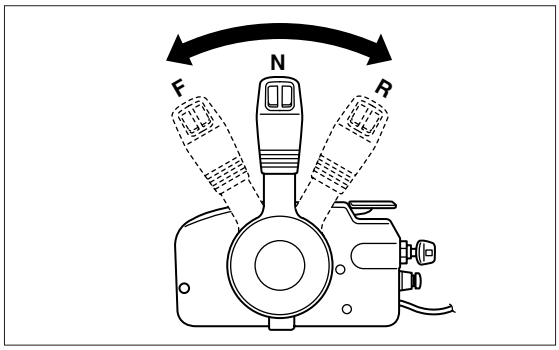


1. Loosen lock nut ①.
2. Remove "R" shaped pin ② and washer ③.
3. Remove cable joint ④ from shift lever ⑤.
4. Set shift lever to neutral position (N).
5. Set remote control lever to neutral position (N).
6. Adjust cable joint screw-in length so that the pin of shift lever is aligned with the hole of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

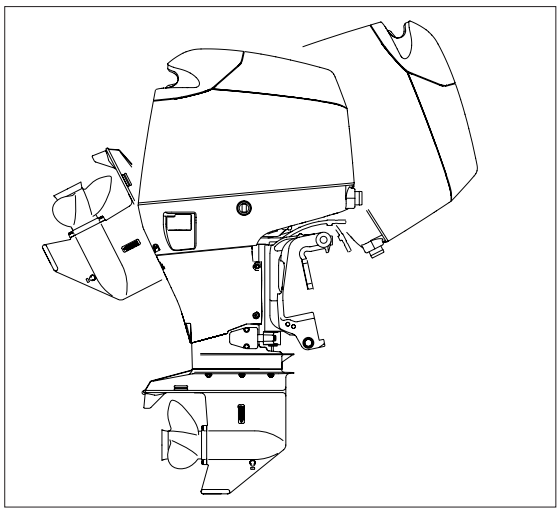


8. PTT System

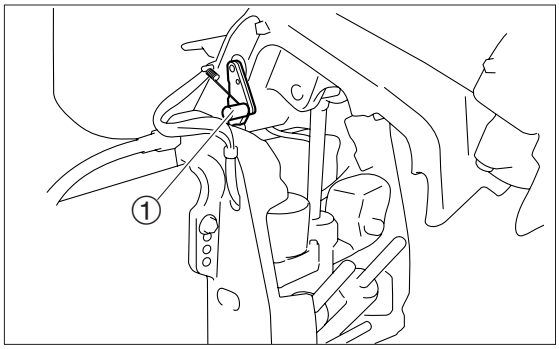
1) Inspection of PTT Unit Operation

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.

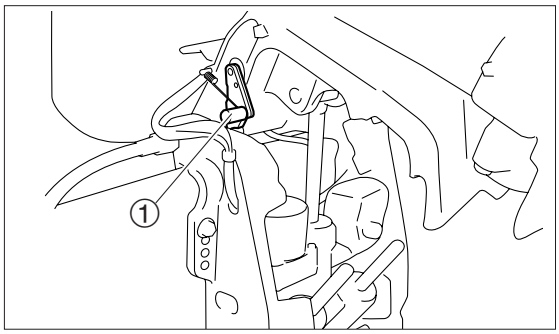


2) Inspection of PTT Fluid Quantity

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. Danger! Outboard motor may come down if hydraulic pressure of PTT unit reduces accidentally.

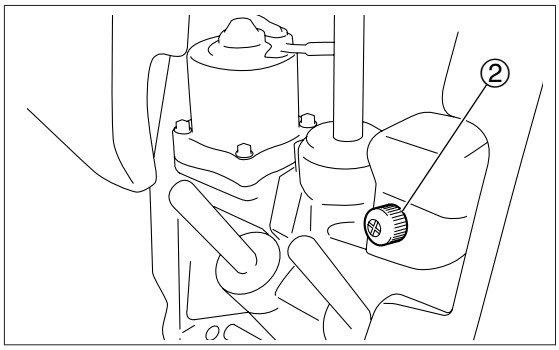


2. Remove cap ② and check PTT fluid quantity.

⚠ CAUTION

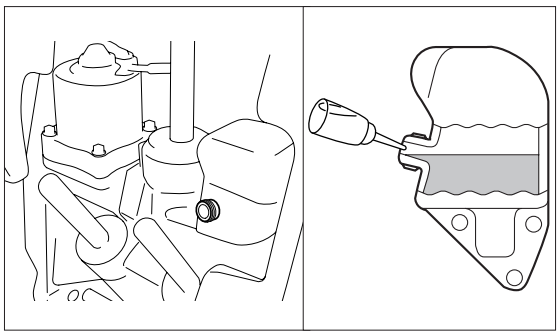
Be sure to remove the cap when outboard motor is in full tilt up position. Removal of the cap in other than full tilt up position may cause the fluid to blast out.

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^3 (23.1 fl.oz)



4. Attach the cap.

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

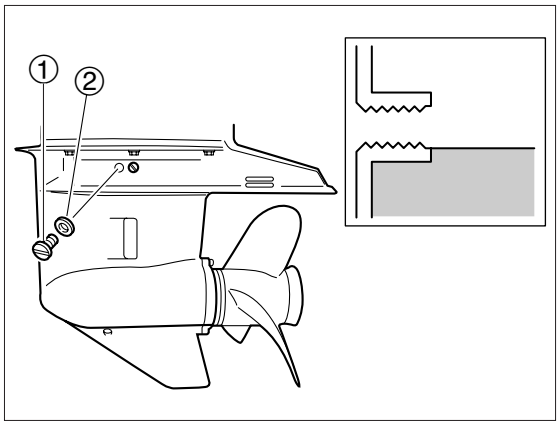
9. Lower Unit

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.



② Gasket **Do not reuse.**

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

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

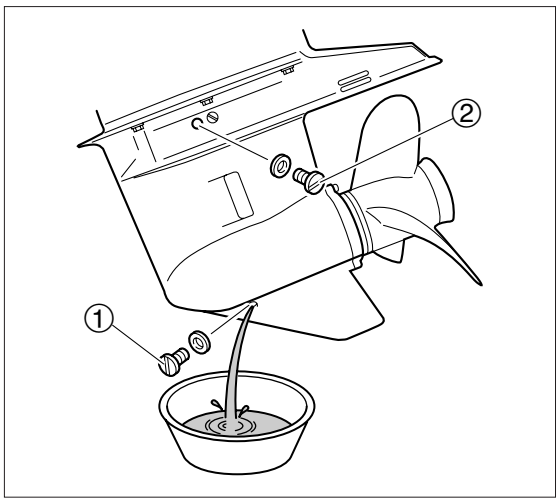
If the oil is low, add through lower oil plug hole.

4. Attach upper oil plug ① and gasket ②.

2) Replacement of Gear Oil

1. Tilt outboard motor a little as shown.

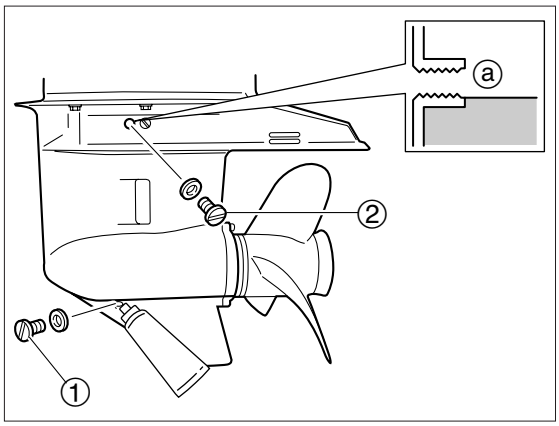
2. Place drain oil pan below oil plug ①, remove lower oil plug ① and then upper oil plug ② to drain oil.



> Remove lower oil plug first when draining.

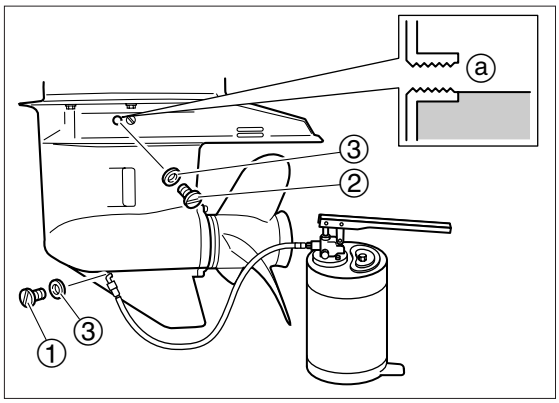
3. Check gear oil for presence of metal particles, change of color (abnormal if clouded), and viscosity. Check lower unit internal components if necessary.

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 ⓐ without air bubble.



> **Gear Oil:**
> Hypoid Gear Oil
> API:GL-5 SAE:#90
> **Gear Oil Quantity:**
> 900 cm³ (30.4 fl.oz)

> 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.



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.

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.

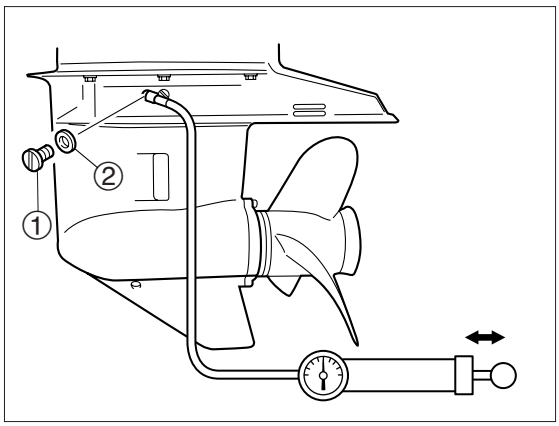
Specified Gear Case Maintained Pressure:
0.05 MPa (7 psi) [0.5 kgf/cm²]

- 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.

⚠ CAUTION

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

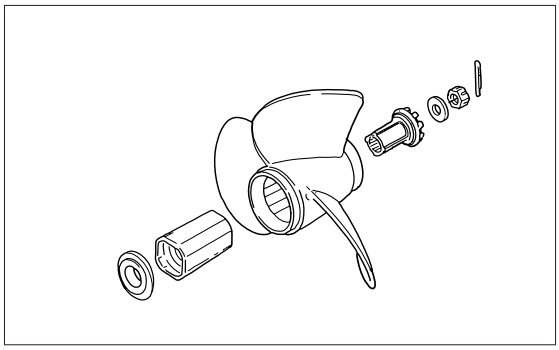
4. If the specified pressure cannot be maintained, check oil seals of drive shaft and propeller shaft and O ring of shift shaft, and propeller shaft housing and water pump case lower for damages.



② Gasket **Do not reuse.**

4) Inspection of Propeller

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

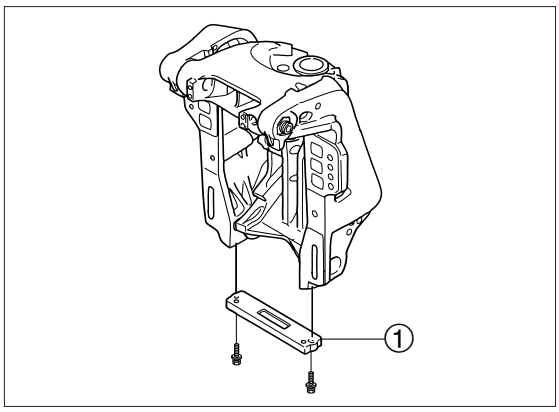


10. Others

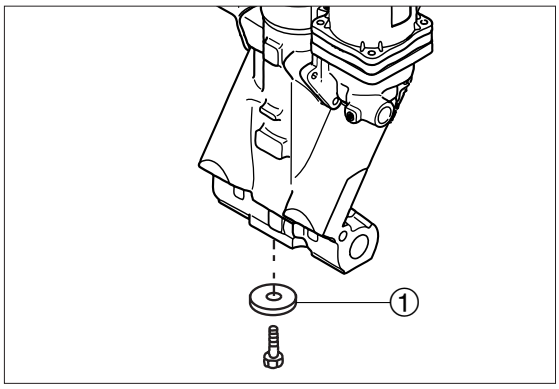
1) Replacement of Anode

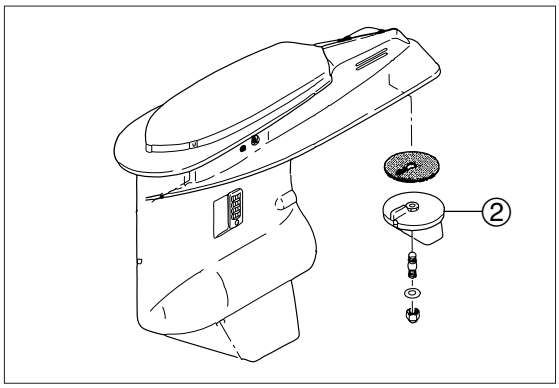
1. Dirt on Anode and Trim Tab
   Check if grease or oil is adhered to the components. Clean if necessary.

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



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.

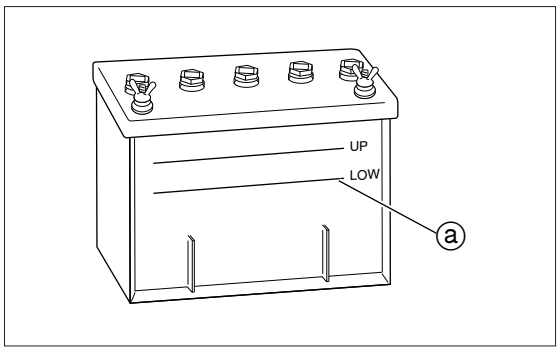


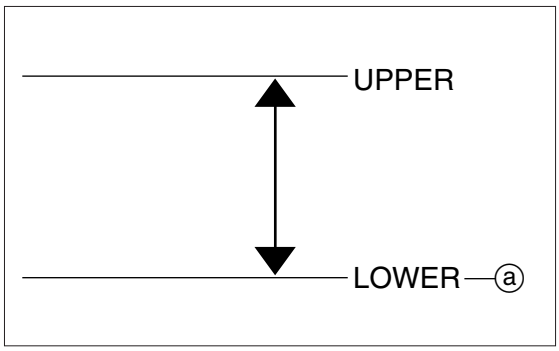


2) Inspection of Battery

1. Inspect battery liquid level. If lower than "LOWER" mark ⓐ , 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:

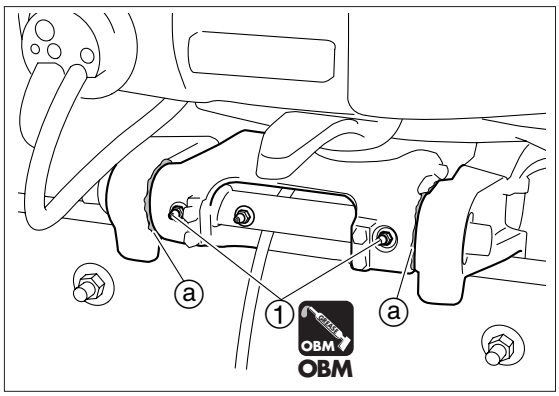
12V100 AH	12V120 AH (in cold regions)
CCA : 800	CCA : 1,000
MCA : 600	MCA : 850

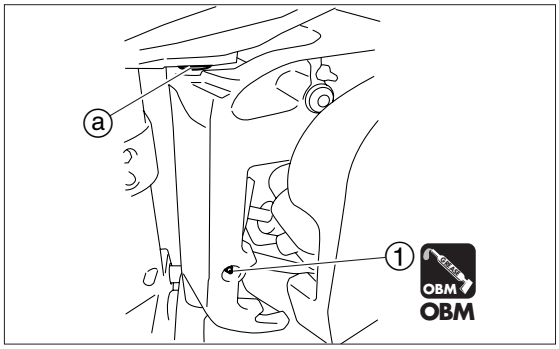
Specific Gravity of Battery Electrolyte:
1.280 (at 20˚C) (68˚F)

Charging data : Example 12V70AH Battery
Charging current : 70AH x 1/10 = 7A
Charging period : 70AH ÷ 7A = 10H

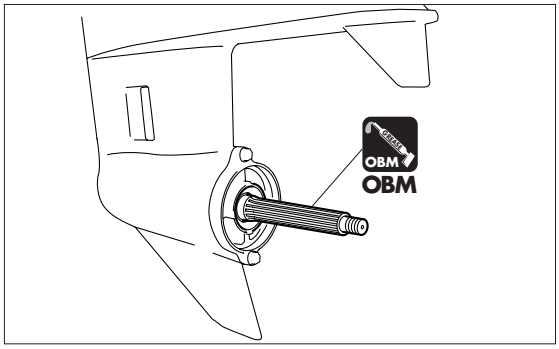
3) Greasing

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

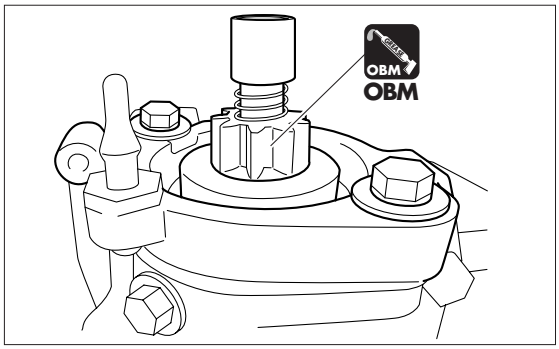




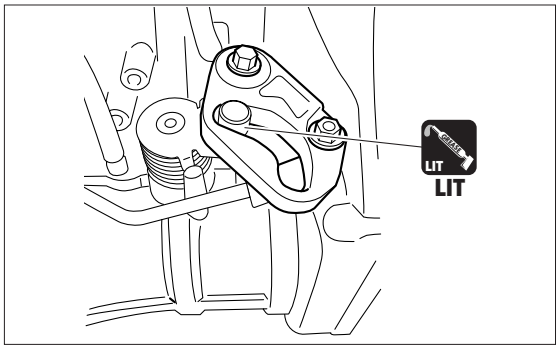
2. Apply grease to propeller shaft spline.



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



4. Apply grease to throttle cam sliding areas.



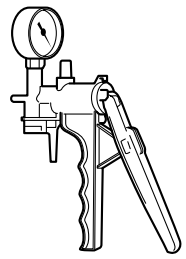
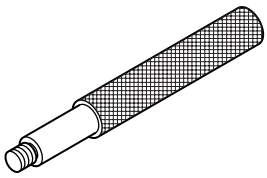
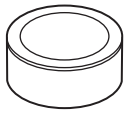
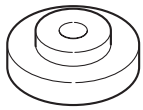
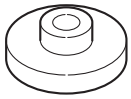
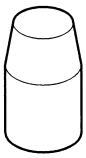
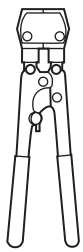
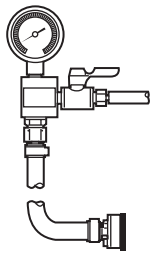
4

Fuel System (TLDI)



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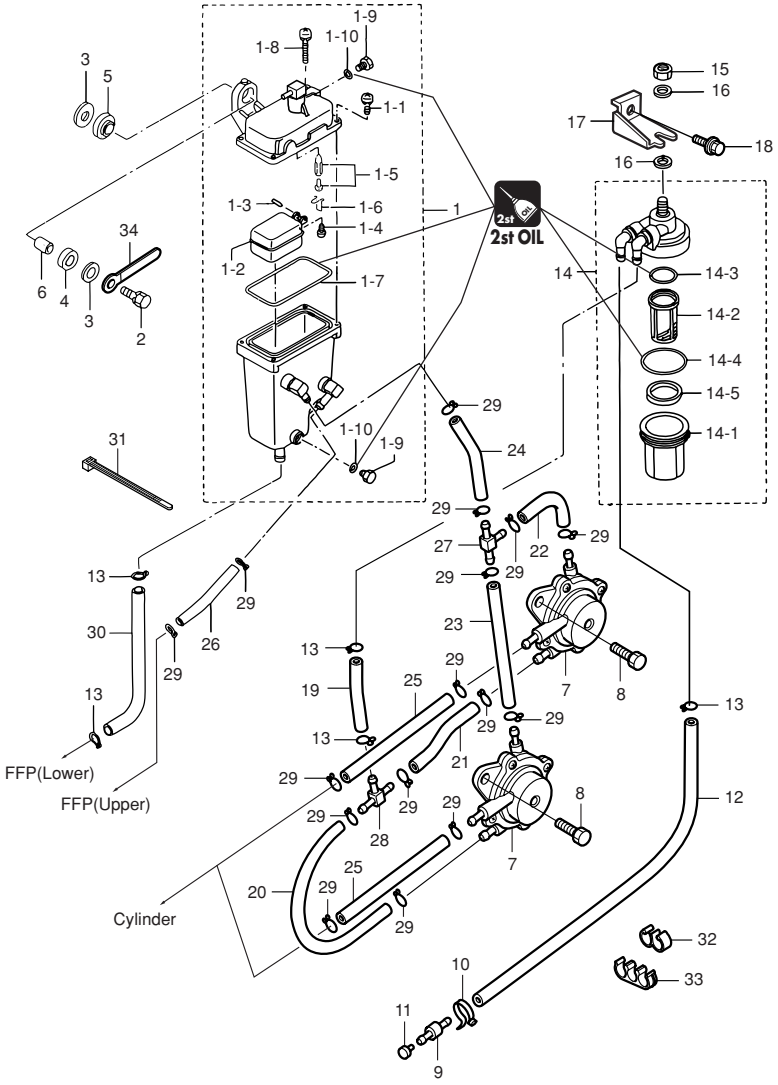
1. Special Tools

			
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. 6

Vapor Separator & Fuel Line



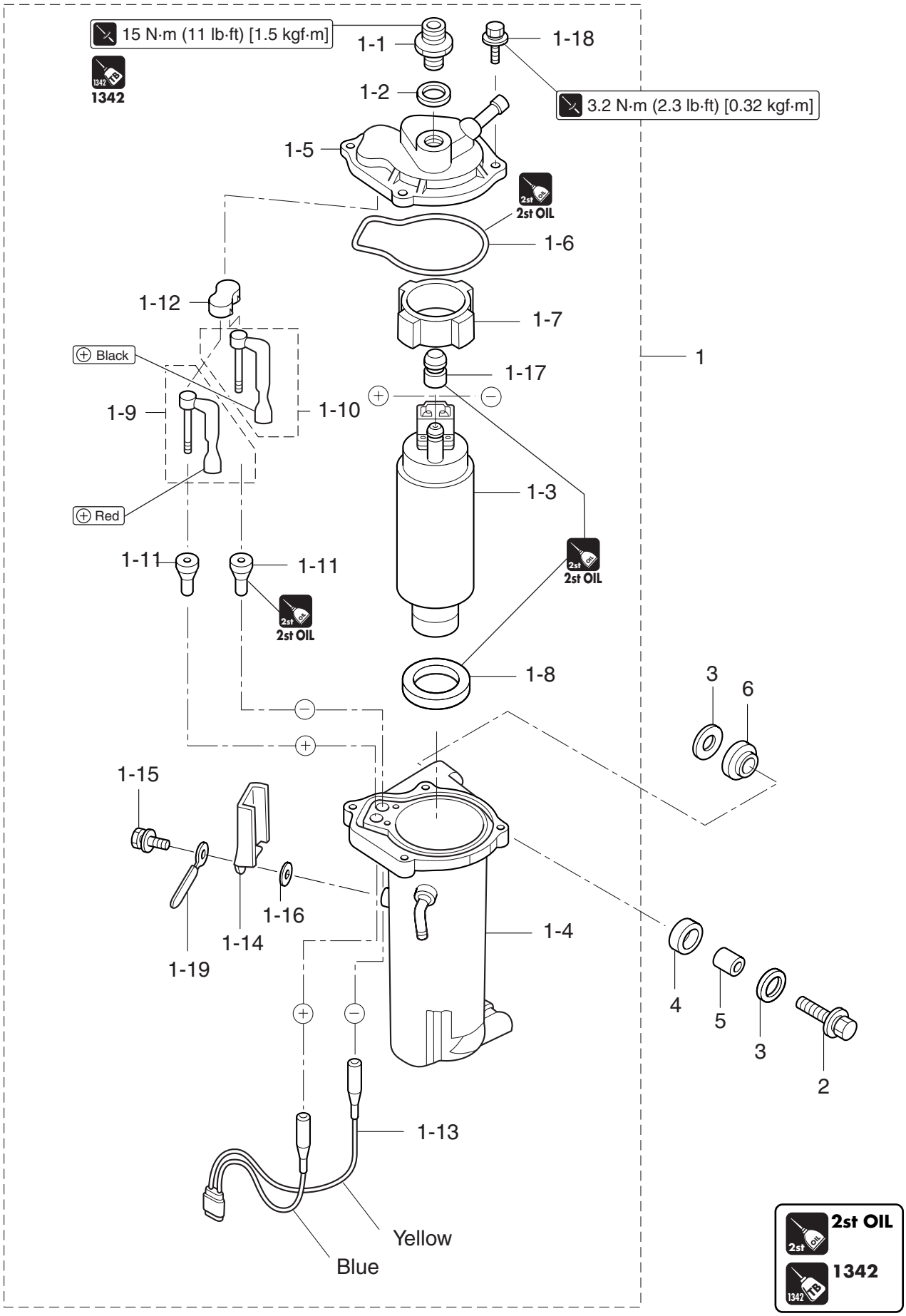
2st OIL

見出番号	部 品 名	個数	備 考
1	Vapor Separator	1	
1-1	Screw	3	M4 L=14mm W/SW
1-2	Float	1	
1-3	Float Arm Pin	1	
1-4	Screw	1	M4 L=8mm
1-5	Float Valve	1	with Valve Pin
1-6	Clip	1	
1-7	O-Ring	1	Do not reuse
1-8	Screw	1	M4 L=30mm W/SW
1-9	Drain Screw	2	
1-10	O-Ring	2	Do not reuse
2	Bolt	2	M6 L=30mm W/SW
3	Washer, 6.5-21-1	4	
4	Rubber Mount, 8.5-14-2.5	2	
5	Rubber Mount, 8.5-14-2.5	2	
6	Spacer, 6.2-9-15.7	2	
7	Fuel Pump	2	
8	Bolt	4	M6 L=20mm W/SW
9	Fuel Hose Nipple	1	
10	Lead Wire Band, 104	1	Do not reuse
11	Fuel Hose Nipple Plug	1	
12	Fuel Hose	1	I/D= ø7 Liter=1,200 Fuel hose nipple - Fuel filter
13	Clip, ø12	5	
14	Fuel Filter	1	
14-1	Cup	1	

見出番号	部 品 名	個数	備 考
14-2	Filter	1	
14-3	O-Ring B	1	Do not reuse
14-4	O-Ring A	1	Do not reuse
14-5	Float	1	
15	Nut	1	M8
16	Washer	2	M8
17	Filter Plate	1	
18	Bolt	1	M6 L=14mm W/SW
19	Rubber Hose	1	I/D=ø7 Liter=70 Fuel filter -T-nipple
20	Rubber Hose	1	I/D=ø5 Liter=180 T-nipple - Fuel pump
21	Rubber Hose	1	I/D=ø5 Liter=50 T-nipple - Fuel pump
22	Rubber Hose	1	I/D=ø5 Liter=90 Fuel pump - T-nipple
23	Rubber Hose	1	I/D=ø5 Liter=115 Fuel pump - T-nipple
24	Rubber Hose	1	I/D=ø5 Liter=105 T-nipple - V. S. T.
25	Rubber Hose	2	I/D=ø5 Liter=150 Fuel pump - Cylinder (Pulse)
26	Rubber Hose	1	I/D=ø5 Liter=90 FFP case (upper) - V. S. T.
27	Pipe Joint "T" type, 4-4	1	V. S. T. - Fuel pump
28	Pipe Joint, 7-5	1	Fuel filter - Fuel pump
29	Clip, ø10	16	
30	Rubber Hose	1	V. S. T. - FFP case
31	Lead Wire Band, 104	3	Do not reuse
32	Hose Clamp	3	
33	Hose Clamp	2	
34	Clamp, 6.5-47.5P	1	

FFP Ass'y

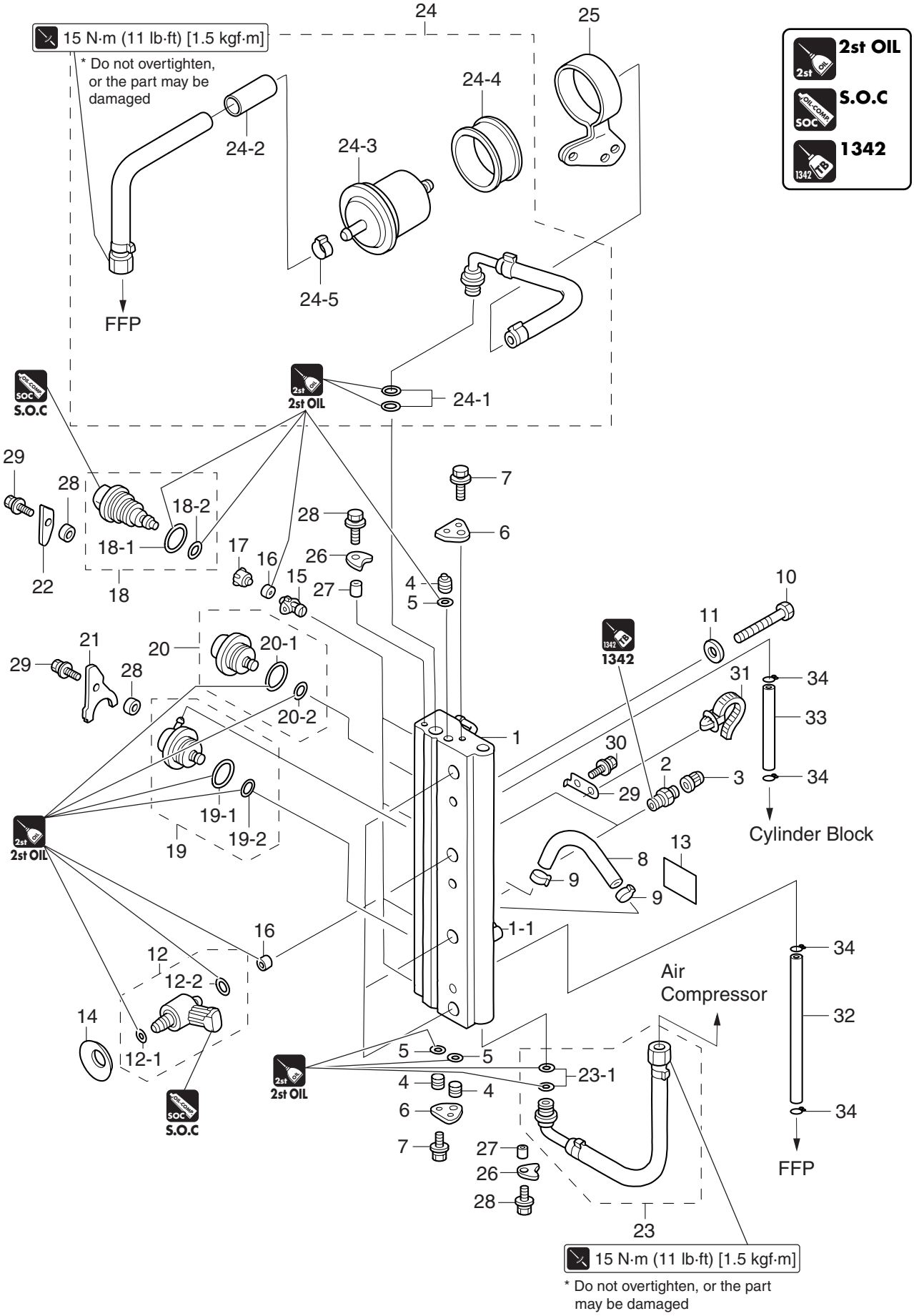
P/L Fig. 5



見出番号	部　品　名	個数	備　考
1	FFP (Fuel Feed Pump) Ass'y	1	
1-1	Hose Joint Adapter	1	
1-2	Metal Washer, 10.2-17-2	1	Do not reuse
1-3	Fuel Feed Pump	1	
1-4	FFP Case	1	
1-5	FFP Case (Upper)	1	
1-6	O-Ring,	1	Do not reuse
1-7	FFP Grommet (Upper)	1	
1-8	FFP Grommet (Lower)	1	
1-9	Cable Terminal (Positive)	1	
1-10	Cable Terminal (Negative)	1	
1-11	Cable Terminal Grommet	2	
1-12	Cable Terminal Grommet (Upper)	1	
1-13	FFP Cord	1	
1-14	FFP Cord Cover	1	
1-15	Bolt	1	M5 L=12mm W/SW
1-16	Washer	1	M5
1-17	Pipe Grommet	1	
1-18	Bolt	4	M5 L=18mm W/SW
1-19	Clamp, 6.5-47.5P	1	
2	Bolt	2	M6 L=30mm W/SW
3	Washer, 6-16-1.5	4	
4	Rubber Mount, 9-12-2	2	
5	Spacer, 6.2-9-15.7	2	
6	Rubber Mount, 8.5-18-7	2	

High Pressure Fuel Filter & Air Rail

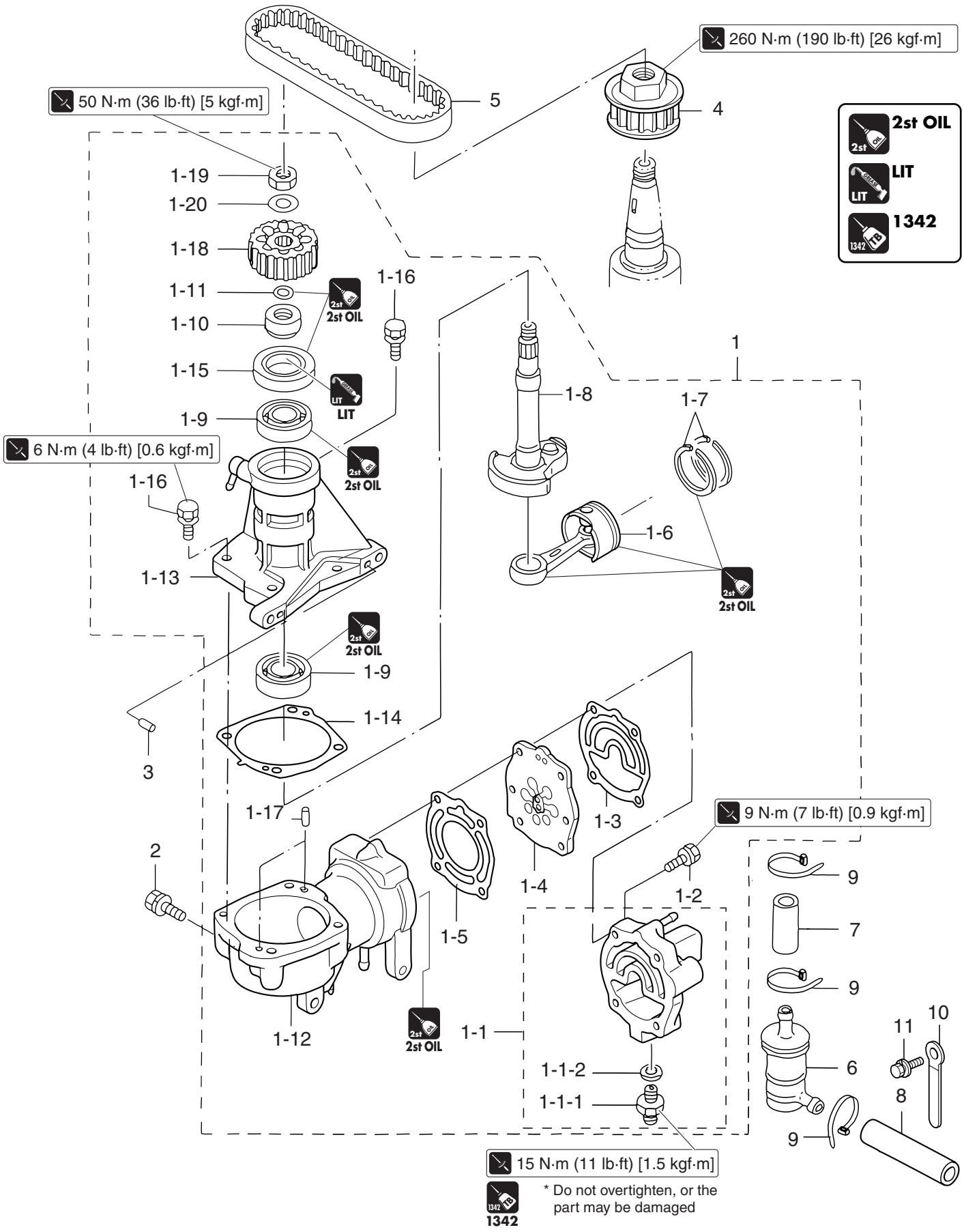
P/L Fig. 4



見出番号	部 品 名	個数	備 考
1	Air Rail	1	
1-1	L-Nipple	1	
2	Valve	2	
3	Valve Cap	2	
4	Plug, ø10.5	3	
5	O-Ring, 1.9-6.8	3	Do not reuse
6	Plug Stopper	2	
7	Bolt	4	M6 L=12mm W/SW
8	Air Hose	1	I/D=ø4 Liter=115 Fuel regulator - Air rail
9	Clamp, 29/64	2	Do not reuse
10	Bolt	3	M8 L=65mm
11	Washer	3	M8
12	Air Injector	4	
12-1	O-Ring, 5-52 (ø1-10)	4	Do not reuse
12-2	O-Ring, 2.4-9.6 (ø2.4-14.2)	4	Do not reuse
13	Air Rail Decal	1	
14	Air Injector Disc Spring	4	
15	Fuel Injector Insert	4	
16	Compression Seal	8	
17	Fuel Injector Adapter	4	
18	Fuel Injector	4	Mark : 37001 (Pink)
18-1	O-Ring, 2.8-20.2	4	Do not reuse
18-2	O-Ring, 3.5-7.5	4	Do not reuse
19	Fuel Regulator	1	
19-1	O-Ring, 2.5-20	1	
19-2	O-Ring, 2.5-5	1	
20	Air Regulator	1	
20-1	O-Ring, 2.5-20	1	
20-2	O-Ring, 2.5-5	1	
21	Fuel Injector Holding Plate	1	
22	Fuel Injector Holding Plate	3	
23	Air Hose Ass'y	1	
23-1	O-Ring, 1.9-9.8	2	Do not reuse
24	Fuel Hose Ass'y	1	
24-1	O-Ring, 1.9-9.8	2	Do not reuse
24-2	Protect Tube	1	L=150mm
24-3	High Pressure Fuel Filter	1	
24-4	Fuel Filter Rubber Mount	1	
24-5	Clamp, 21/32	4	
25	Fuel Filter Band	1	Do not reuse
26	Nipple Holding Plate	2	
27	Collar, 6.7-12.7-3	6	
28	Bolt	6	M6 L=16mm W/SW
29	Lead Wire Band Stay	2	
30	Bolt	2	M6 L=12mm W/SW
31	Lead Wire Band, 170	2	
32	Rubber Hose	1	Air rail - FFP case (Return)
33	Rubber Hose	1	Air rail - Cylinder (Regulator)
34	Clip, ø10	4	

Air Compressor

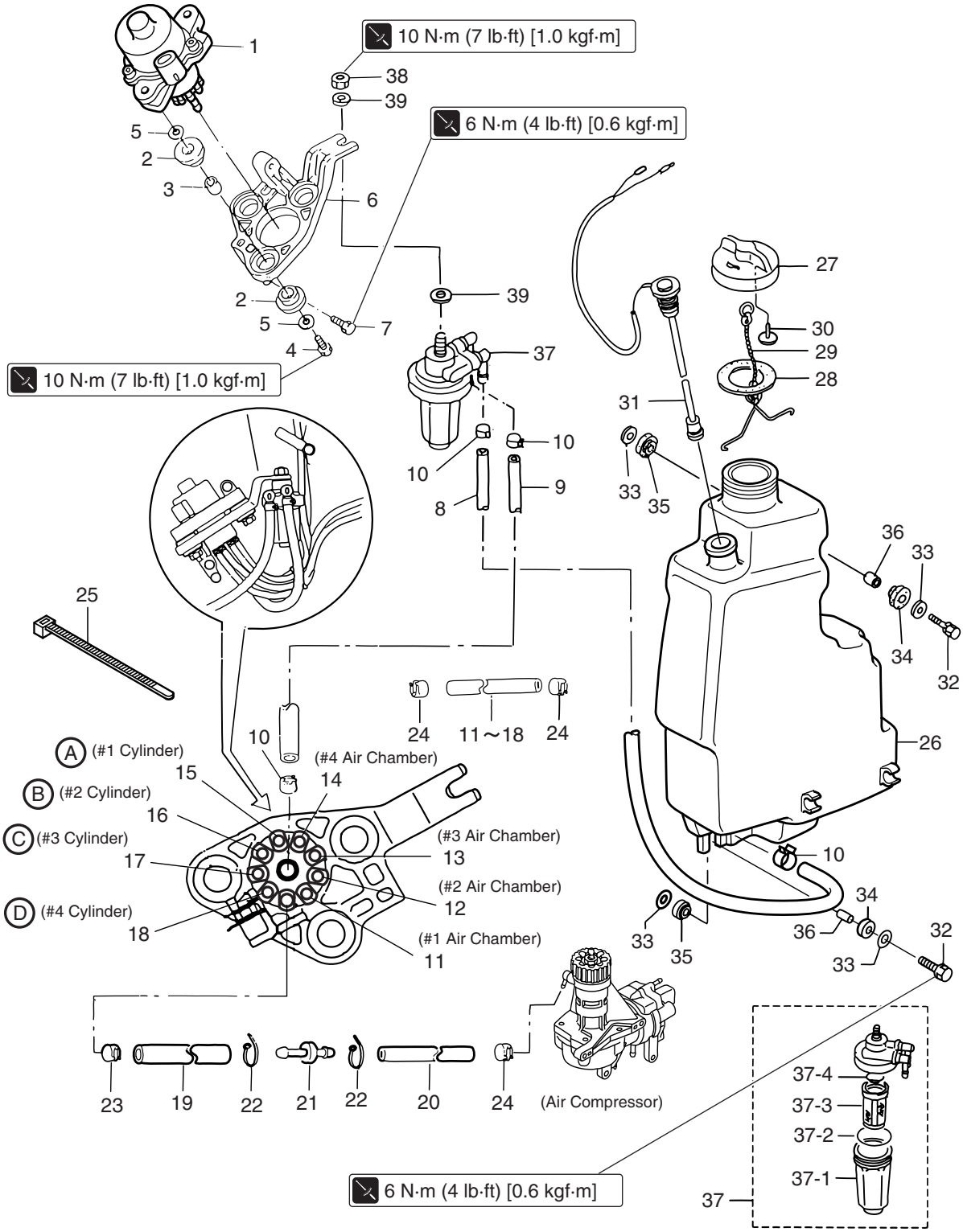
P/L Fig. 11



見出番号	部　品　名	個数	備　考
1	Air Compressor	1	
1-1	Compressor Head (with Nipple)	1	
1-1-1	Hose Joint Adapter	1	
1-1-2	Metal Washer, 10.2-17-2	1	Do not reuse
1-2	Bolt	4	M6 L=35mm W/PW
1-3	Compressor Head Gasket	1	Do not reuse
1-4	Reed Valve Ass'y	1	
1-5	Valve Seat Gasket	1	Do not reuse
1-6	Piston & Connecting Rod	1	
1-7	Piston Ring	2	
1-8	Crank Shaft	1	
1-9	Bearing, 6203	2	
1-10	Collar, 13.5-25-13	1	
1-11	O-Ring, 13-1.9	1	Do not reuse
1-12	Compressor Cylinder	1	
1-13	Compressor Housing	1	
1-14	Compressor Housing Gasket	1	Do not reuse
1-15	Oil Seal, 25-45-8	1	Do not reuse
1-16	Bolt	4	M6 L=25m W/PW
1-17	Dowel Pin, 4-10	2	
1-18	Driven Pulley	1	
1-19	Driven Pulley Nut, 10-P1.25	1	
1-20	Washer, 10.5-20-3.2	1	
2	Bolt	4	M8 L=35mm W/SW&PW
3	Dowel Pin, 6-12	2	
4	Drive Pulley	1	
5	Drive Belt	1	
6	Air Filter	1	
7	Air Hose	1	I/D=ø9 Liter=55
8	Air Hose	1	I/D=ø9 Liter=140
9	Lead Wire Band, 104	3	Do not reuse
10	Clamp, 6.5-47.5P	1	
11	Bolt	1	M6 L=12mm W/SW

Oil Pump

P/L Fig. 12



見出番号	部 品 名	個数	備 考
1	Electric Oil Pump	1	
2	Rubber Mount, 12-18-2.5	6	
3	Spacer, 8.4-12-17	3	
4	Bolt	3	M8 L=35mm
5	Washer, 8.4-24-1.5	6	
6	Oil Pomp Bracket	1	
7	Bolt	2	M6 L=30mm W/SW&PW
8	Oil Pipe A	1	Oil tank - Oil filter
9	Oil Pipe B	1	Oil filter - Oil pump
10	Clip, ø9.5	4	
11	Oil Pipe	1	Oil pump - #1 Air chamber
12	Oil Pipe	1	Oil pump - #2 Air chamber
13	Oil Pipe	1	Oil pump - #3 Air chamber
14	Oil Pipe	1	Oil pump - #4 Air chamber
15	Oil Pipe	1	Oil pump - #1 Cylinder
16	Oil Pipe	1	Oil pump - #2 Cylinder
17	Oil Pipe	1	Oil pump - #3 Cylinder
18	Oil Pipe	1	Oil pump - #4 Cylinder
19	Oil Pipe	1	Oil pump - Nipple joint
20	Oil Pipe	1	Nipple joint - Air compressor
21	Nipple Joint	1	
22	Lead Wire Band, 104	4	Do not reuse
23	Clip, ø7.8	1	
24	Clip, ø6.9	17	
25	Lead Wire Band, 158	3	Do not reuse
26	Oil Tank	1	
27	Oil Tank Cap	1	
28	Gasket, 36-52-2	1	
29	Tank Cap Hook	1	
30	Tank Cap Check Valve	1	
31	Oil Level Sensor	1	
32	Bolt	3	M6 L=30mm W/SW
33	Washer, 6.5-21-1.0	6	
34	Rubber Mount, 8.5-14-2.5	3	
35	Rubber Mount, 8.5-14-2.5	3	
36	Spacer, 6.2-9-15.7	3	
37	Oil Filter	1	
37-1	Cup	1	
37-2	O-Ring A	1	Do not reuse
37-3	Filter	1	
37-4	O-Ring B	1	Do not reuse
38	Nut	1	M8
39	Washer	2	M8

3. What is TLDI?

Direct Fuel Injection System

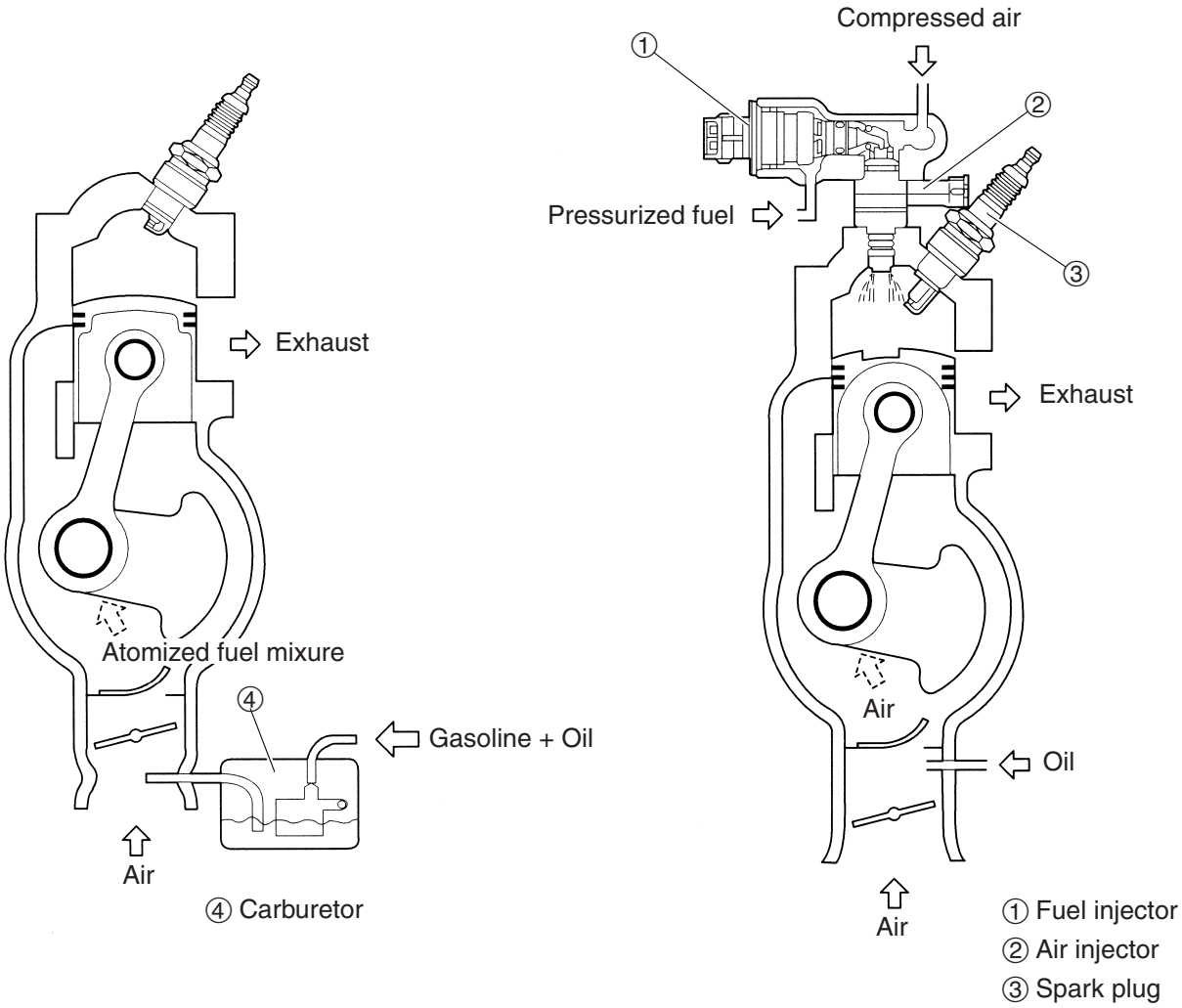
1. TLDI (Two-stroke Low-pressure Direct injection)

   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.

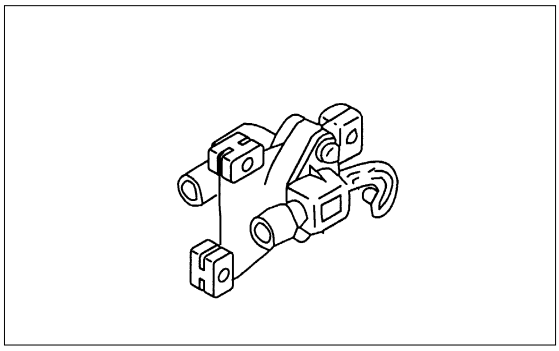
The inductive ignition of TLDI has spark plug ignition duration that is longer than that of conventional two stroke carbureted engines for surer combustion of the air-fuel mixture in the combustion chamber, ensuring more stabilized engine operation under varied operating environment. The adoption of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

1. TPS (Throtlle 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.

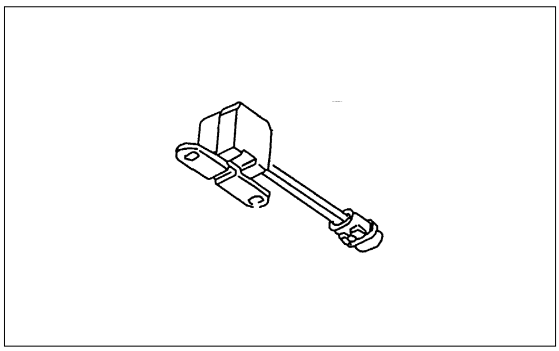
⚠ CAUTION

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



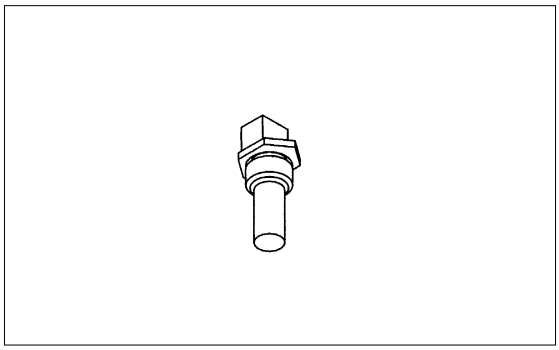
2. CPS (Crank Position Sensor)

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.



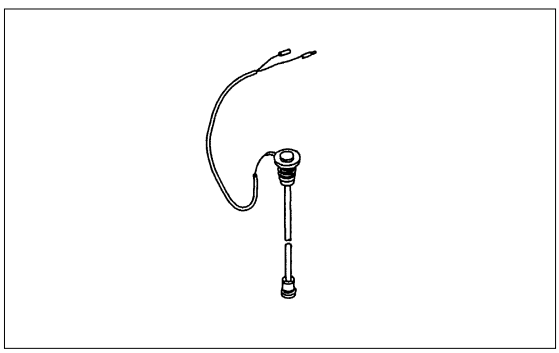
3. Water Temperature Sensor

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.



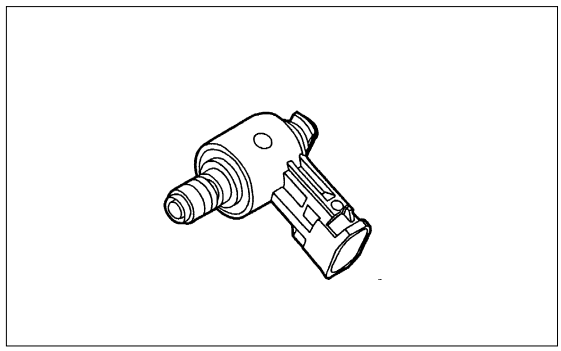
4. Oil Level Sensor

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.



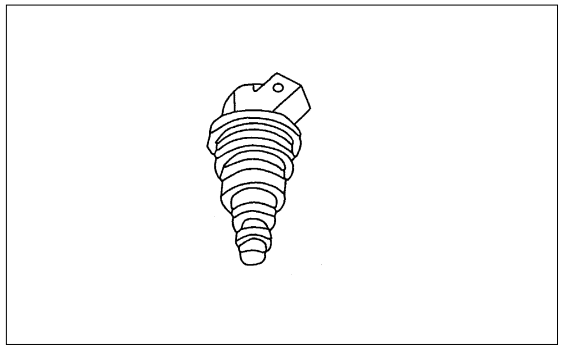
5. Air Injector

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

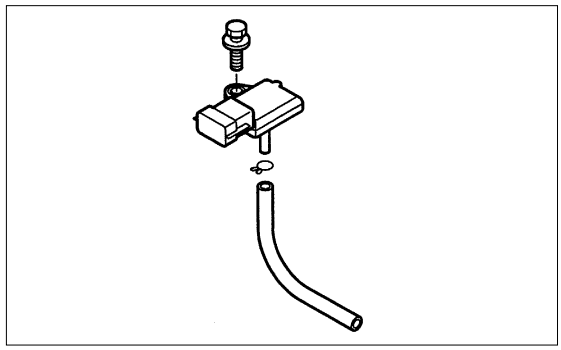
The fuel injector supplies the gasoline contained in the air rail to the air injector through the set piece. The component is controlled by ECU to supply the amount of fuel that is best suited to the current engine operation conditions based on the information from sensors.



7. MAP (Manifold Pressure) Sensor

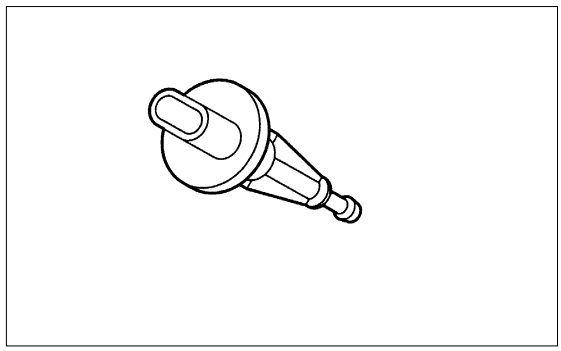
MAP sensor is located on the upper area of air chamber, and measures the air chamber inner pressure (vacuum pressure) and sends the signal to ECU.

ECU uses this signal to establish fuel injection amount and ignition timing.



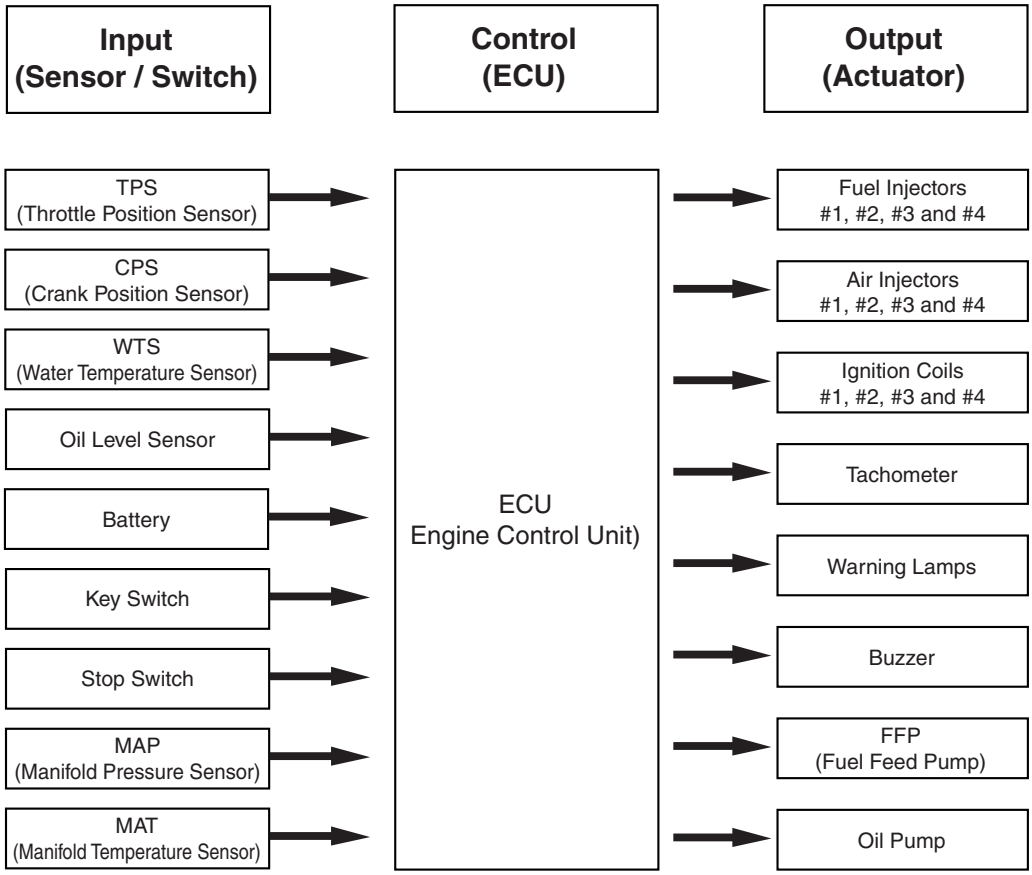
8. MAT (Manifold Temperature) Sensor

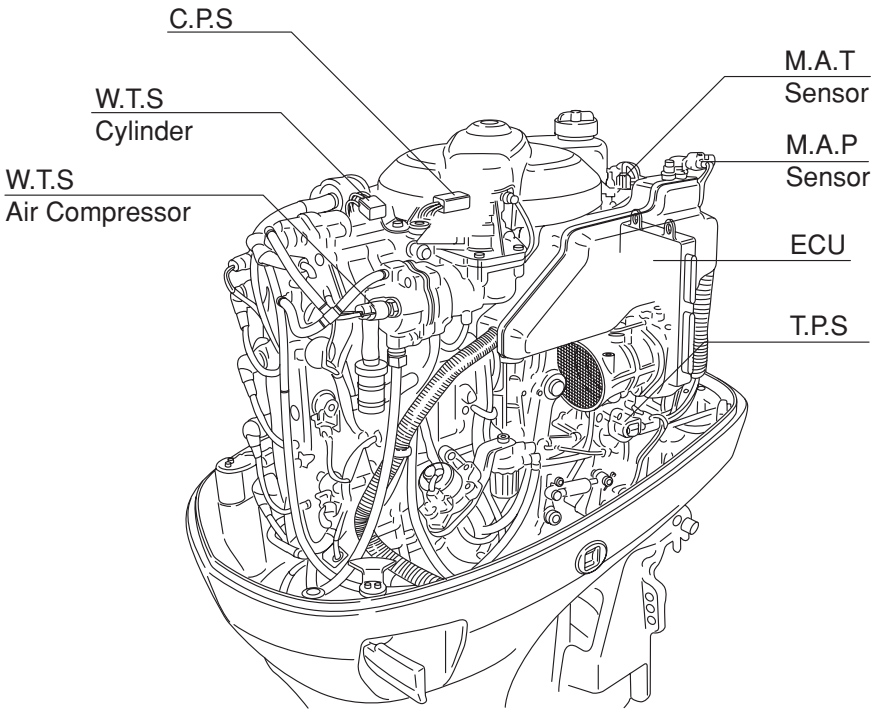
MAT sensor is located on the upper area of air chamber, and measures intake air temperature and sends the signal to ECU.



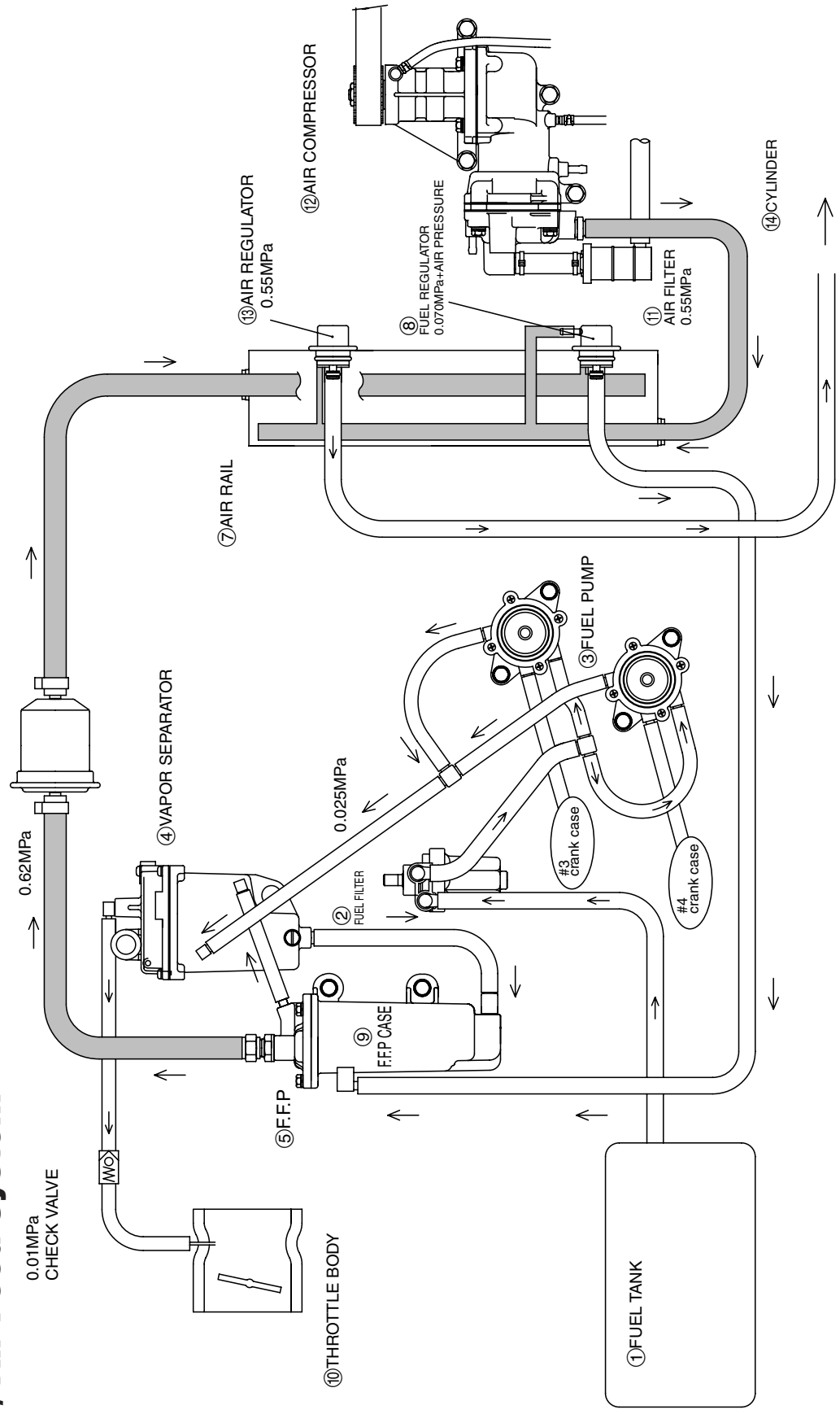
ECU

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.



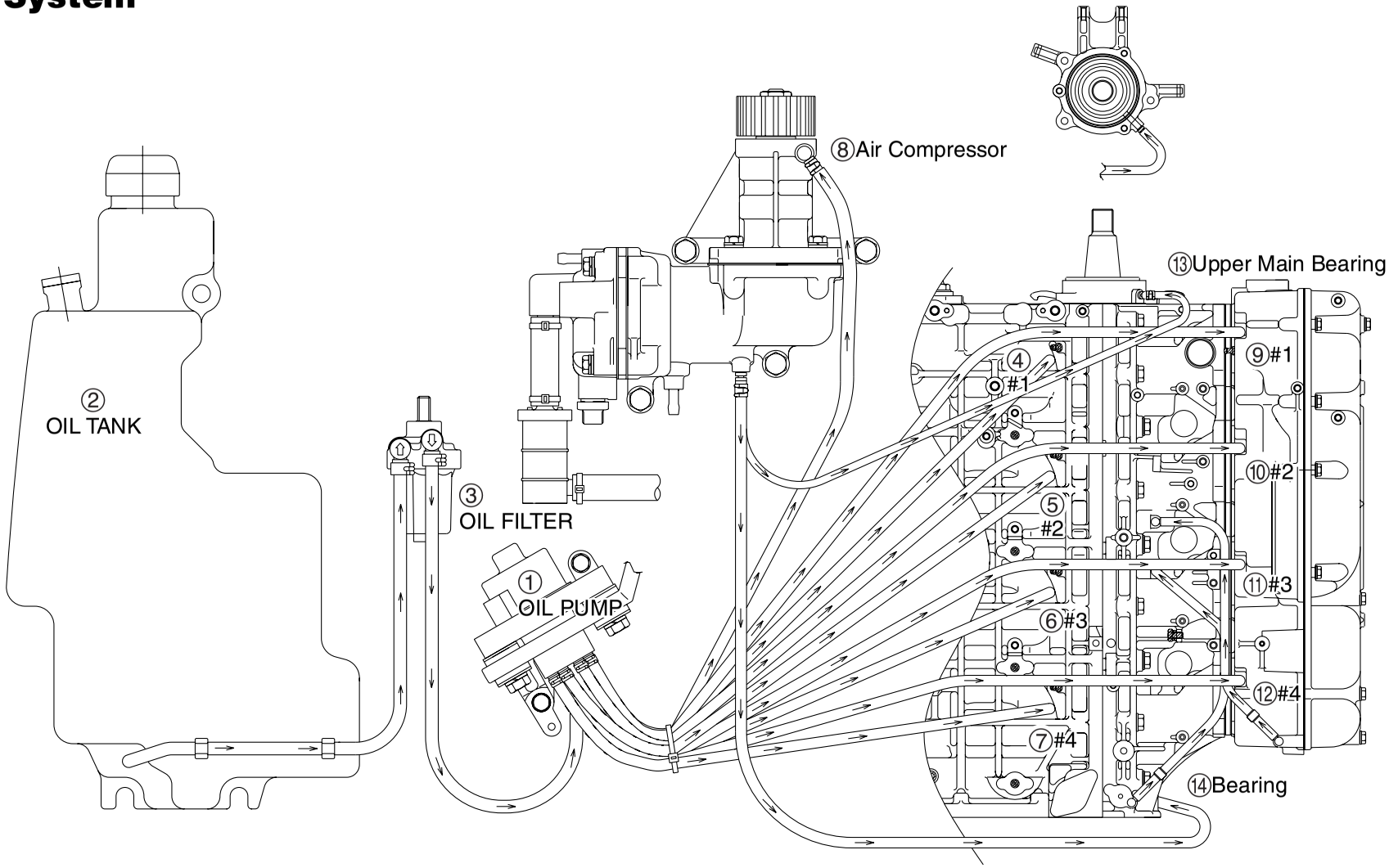


Fuel / Air Feed System



When the engine starts, the fuel pump ③ operates to feed gasoline from fuel tank ① to vapor separator ④ through the fuel filter ②.The gasoline is compressed with FFP ⑤, sent to air rail ⑦ through high pressure fuel filter ⑥ and then, injected into the combustion chamber. The pressure of ⑤ to ⑦ are controlled by the fuel regulator ⑧ so that the gasoline differential pressure is kept to 0.070MPa (10psi) for proper combustion. The gasoline that is not used here is decompressed and returned to ④ through FFP case ⑨. The returned gasoline contains small amount of air bubbles that are produced when the gasoline was compressed with ⑤. The air bubbles are sent to the throttle body ⑩ from upper part of ④ and are sucked as intake air of the engine.
In the same way, when the engine starts, the air compressor ⑫ operates to suck air through air filter ⑪. Moreover, the air that is compressed with ⑫ is sent to the air rail ⑦, and injected into the fuel combustion chamber through air injectors.
The air pressure is controlled to 0.55MPa (80psi) by the air regulator ⑬ to maintain appropriate combustion. The air that is not used here is decompressed and disposed to exhaust passage of the cylinders ⑭.

Oil System



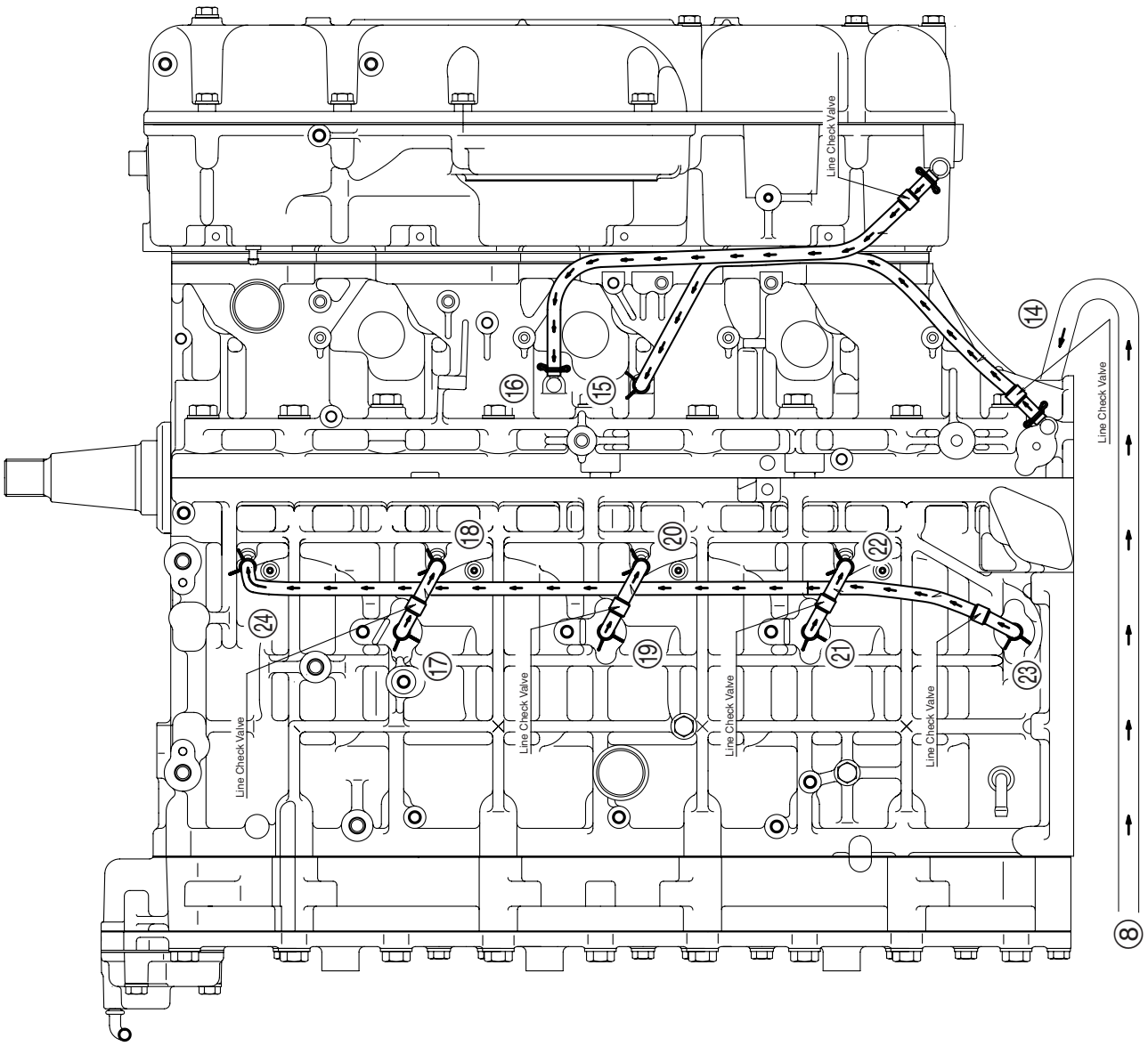
When engine starts, the oil pump ① operates to feed oil from oil tank ② to oil filter ③. The oil that passed the oil filter flows to the oil pump ①.

The oil is split into the ports of the following nine components here; cylinder #1 (crank case) ④, cylinder #2 (crank case) ⑤, cylinder #3 (crank case) ⑥, cylinder #4 (crank case) ⑦, air compressor ⑧, air box #1 ⑨, air box #2 ⑩, air box #3 ⑪ and, air box #4 ⑫. For ④, ⑤, ⑥ and ⑦, each cylinder is lubricated directly.

The oil that lubricated interior of the air compressor ⑧ flows to the crank case, where it lubricates upper main bearing ⑬ and bearing ⑭.

The ports ⑨, ⑩, ⑪ and ⑫ lubricate reed valves and crank shaft also.

Recirculation System



The oil that lubricates the air compressor flows to the crank case ⑭, and the oil that is deposited in the crank case flows to interior of crank case ⑮ of cylinder #3 to lubricate it.

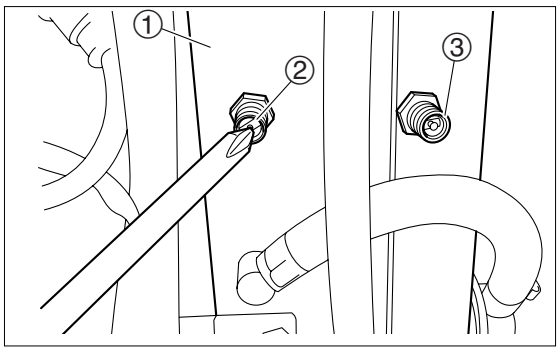
The oil that is deposited in the air box flows to interior of crank case ⑯ of cylinder #2 to lubricate it. Then, the oil that is deposited in the scavenging passage of each cylinder flows from #1 cylinder (scavenging passage) ⑰ to #2 cylinder liner ⑱, from #2 cylinder (scavenging passage) ⑲ to #3 cylinder liner ⑳, from #3 cylinder (scavenging passage)㉑ to #4 cylinder liner ㉒, and from #4 cylinder (scavenging passage) ㉓ to #1 cylinder liner ㉔ respectively to additionally lubricate the components.

4. Removing Air Rail

1) Decompression of Fuel Line and Air Line

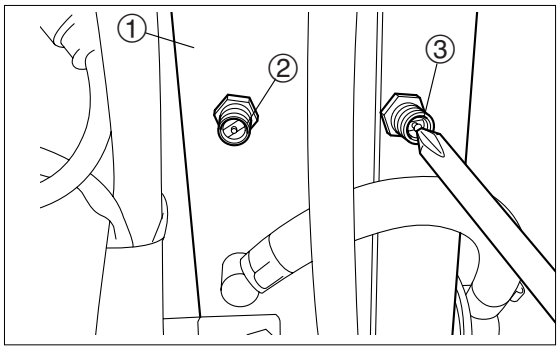
Decompress fuel line and air line before removing the air rail.

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.



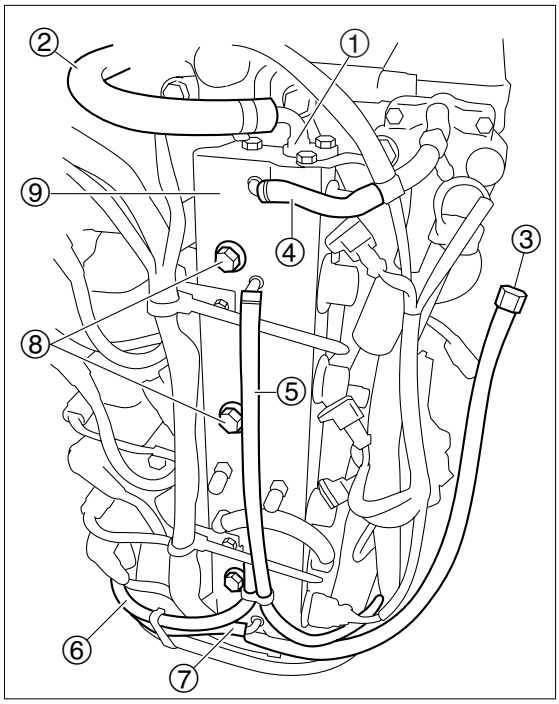
⚠ WARNING

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

2) Removing Air Rail Ass'y

1. Remove air rail ass'y.

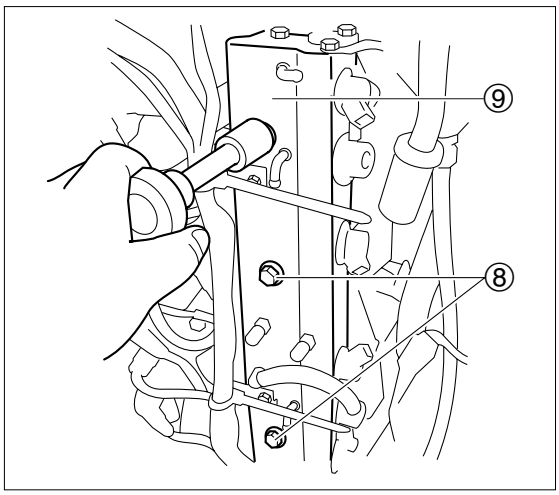
Remove stopper plate ① and pull out hose ②.



2. Remove compressor side hose joint ③ and remove air hose ass'y ③.

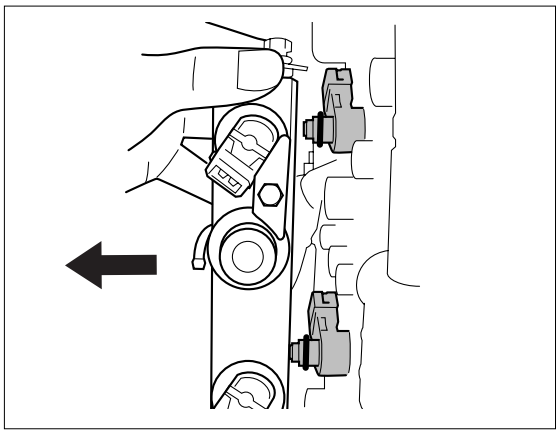
3. Remove cooling water outlet hose ⑦, and then, fuel return hose ⑥, air exhaust hose ⑤ and cooling water inlet hose ④.

4. Loosen three bolts ⑧ that secure air rail, and remove air rail ass'y ⑨ carefully.



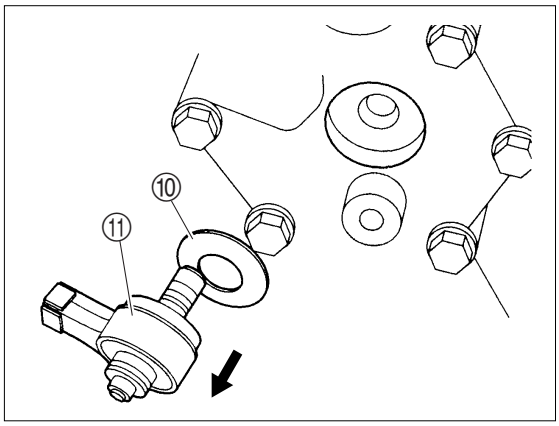
Disconnect fuel injector cord wires before removing the air rail.
Refer to "Chapter 5 Removing Cord Ass'y.

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



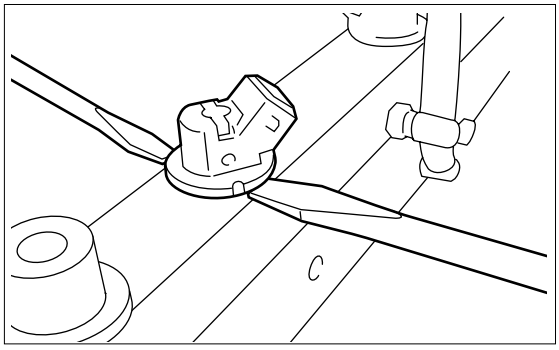
Be careful not to drop O ring located on the air injectors.
Pull the air rail straight without applying force to the air injectors.

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



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

7. 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.

5. Assembling Air Rail

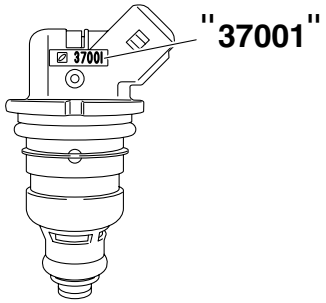
1) Installing Injectors and Regulators

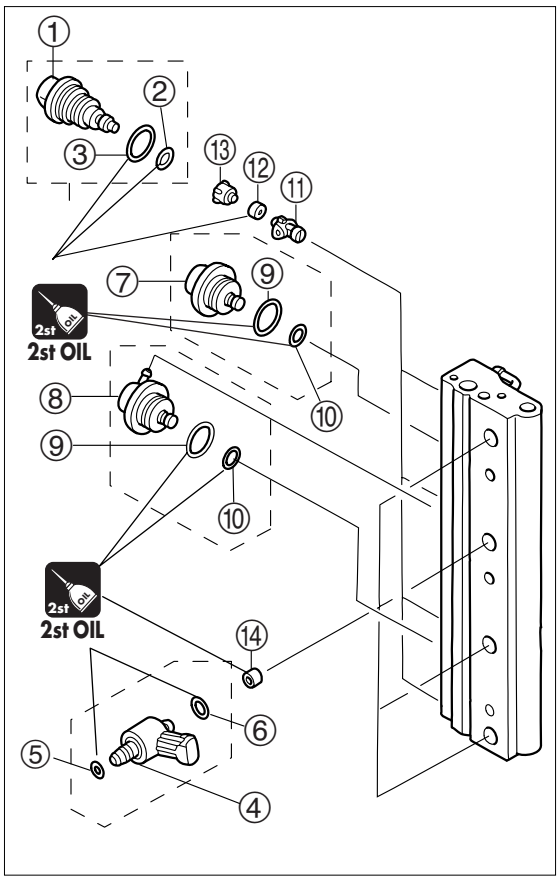
1. Use O ring set tool to attach O rings ② and ③ to fuel injector ①.

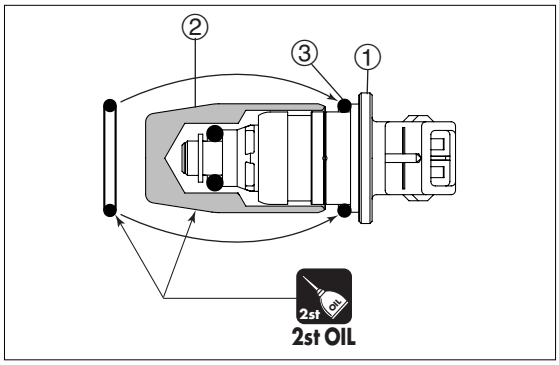
O Ring Set Tool :
P/N. 3T5-72863-0

⚠ CAUTION

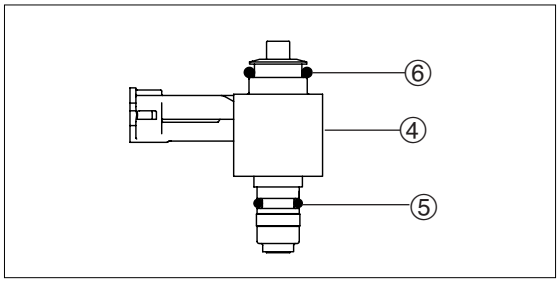
To avoid incorrect installation of the fuel injectors, check the marking "37001 (37003)" on the pink (blue) plastic area of each injector.
115A :
Marking of "37001" on the pink plastic area
40/50B and 70/90B :
Marking of "37003" on the blue plastic area



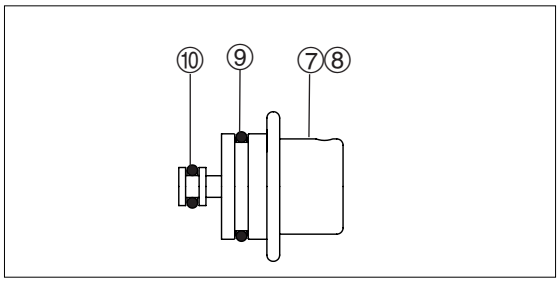




2. Attach O rings ⑤ and ⑥ to air injector ④.

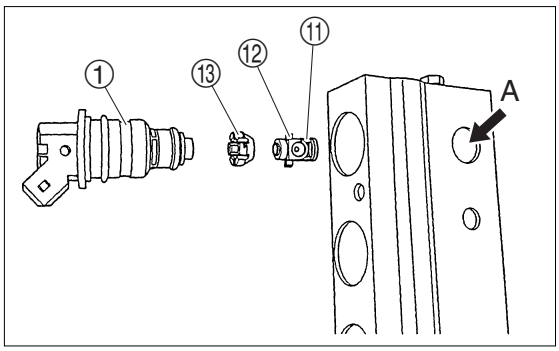


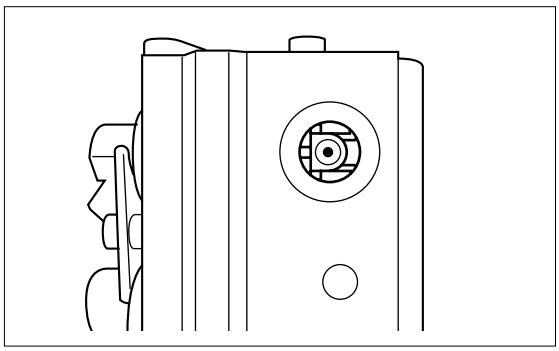
3. Attach O rings ⑨ and ⑩ to air regulator ⑦ and fuel regulator ⑧.



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.





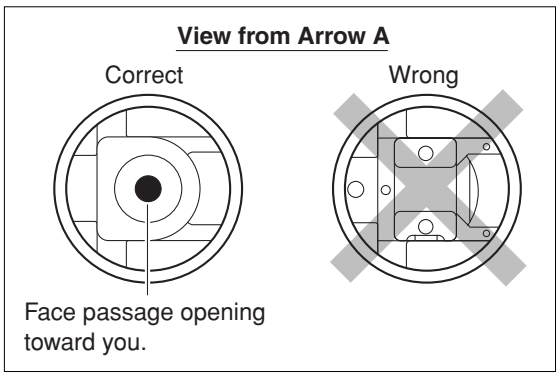
5. Attach fuel injector adapter ⑬ and fuel injector ① to the air rail.

6. Attach compression seal ⑭ to air injector ④, and then, attach the assembly to the air rail.

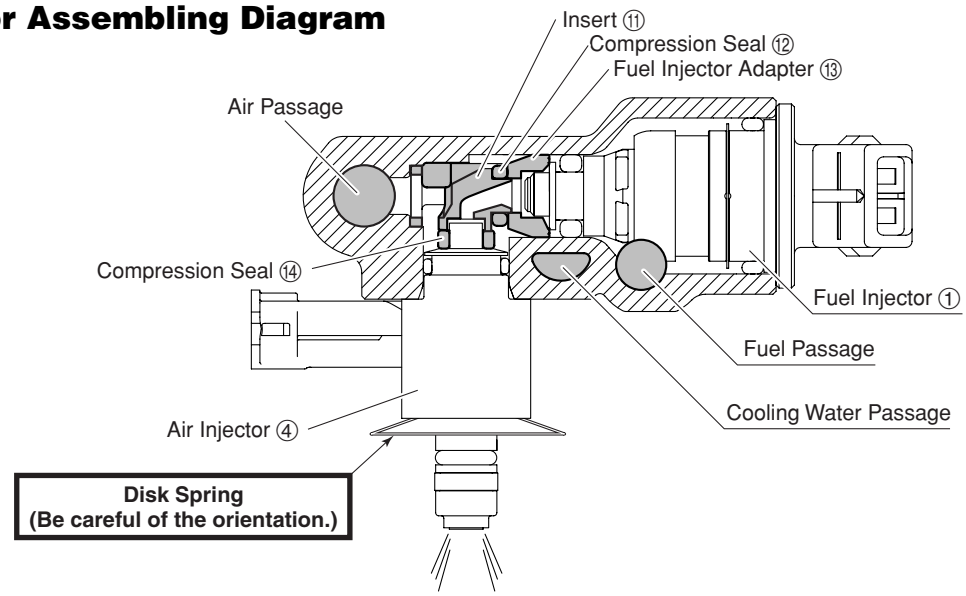
7. Install air regulator ⑦ and fuel regulator ⑧.

⚠ CAUTION

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



Injector Assembling Diagram



8. Attaching Hose Clamps

(1) Attach the following parts.

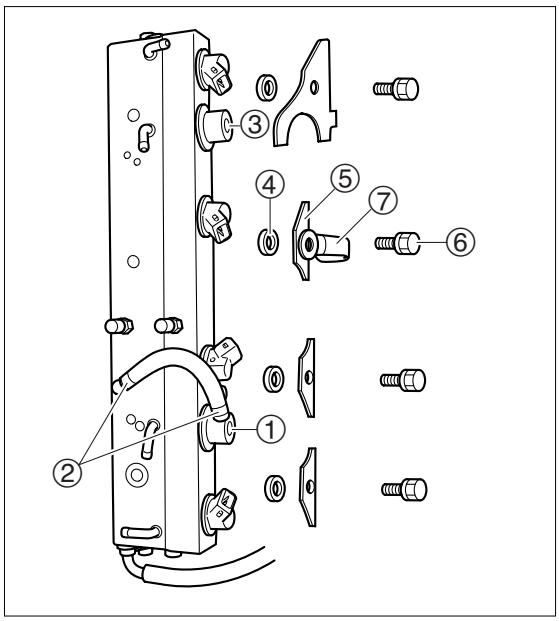
Install fuel regulator ① and air regulator ③, secure them using collars ④, plate ⑤ and bolt ⑥, and attach clamp ⑦.

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



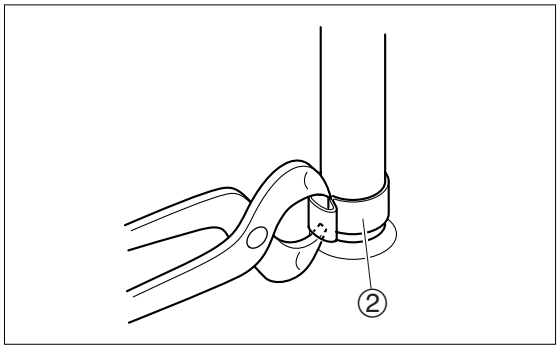
② **Do not reuse**

(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.



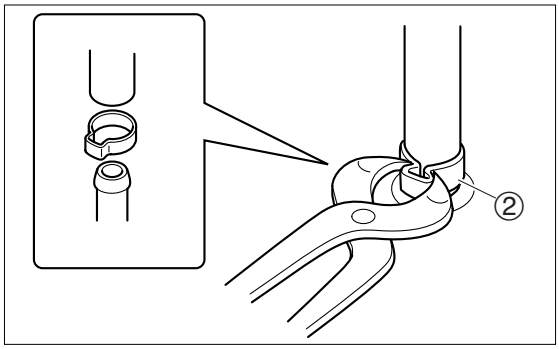
② **Do not reuse**

(3) Attaching hose clamp.

Crush hose clamp ② as shown to tighten the hose securely.

⚠ WARNING

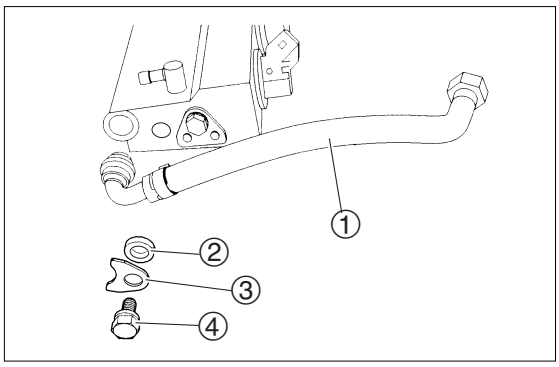
Do not reuse hose clamp. Be sure to use new one.



② **Do not reuse**

9. Attach the following parts.

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



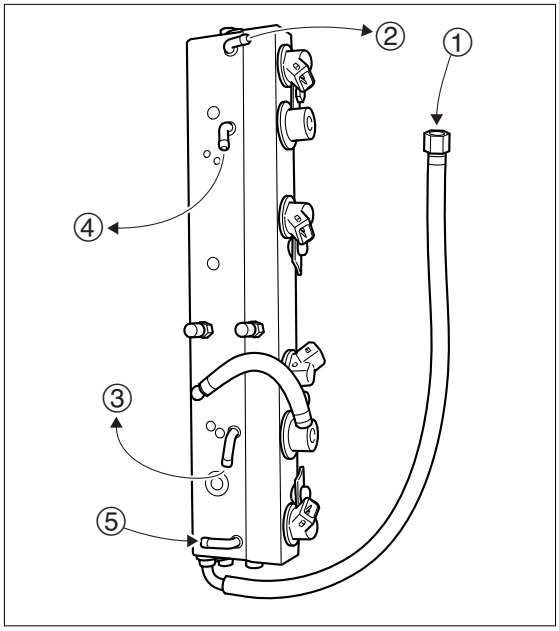
(2) Arrange the pipes as shown.

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

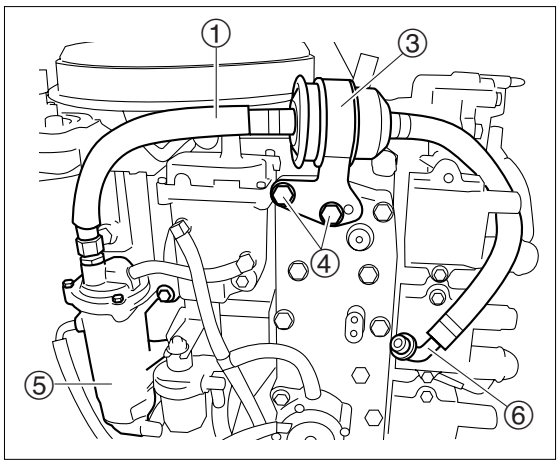


6. Removing Fuel System

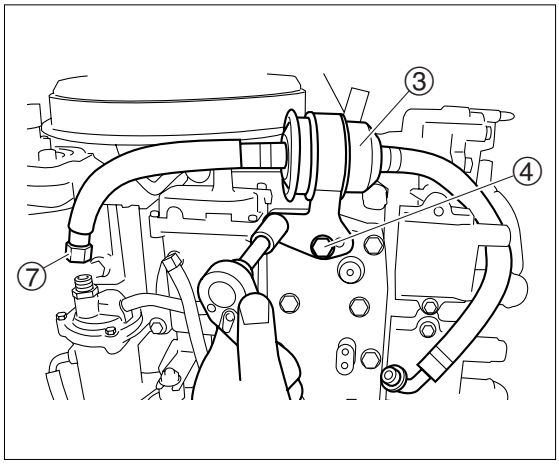
1) Removing Fuel Hose Ass'y

Remove following parts.

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



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) Attaching Fuel Hose Ass'y

Reverse the removing steps.

Fuel Filter Band Securing Bolt ④

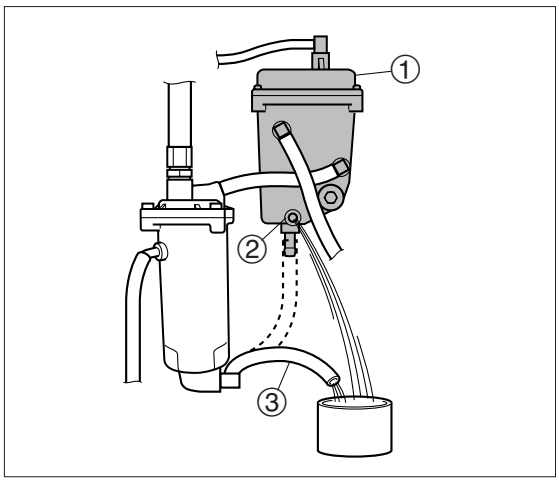
Fuel Filter Band Bolt ④ :
20 N·m (14 lb·ft) [2.0 kgf·m]

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.

3) Draining Fuel from FFP Vapor Separator



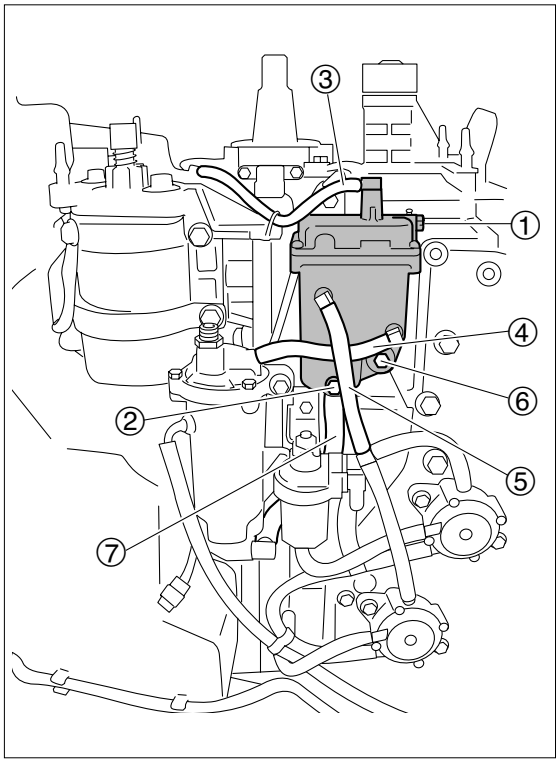
1. Decompress fuel and air pressures.

> **⚠ 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.

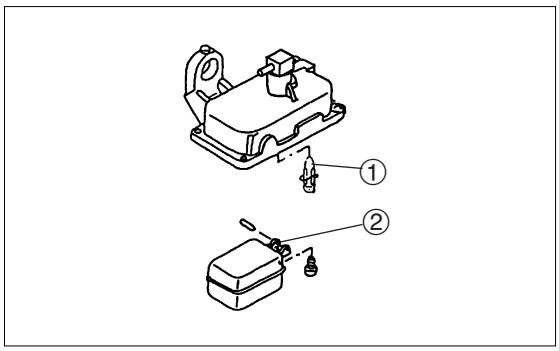
Remove following parts to remove vapor separator.

Bolts ⑥ : 2 pcs.
Fuel Outlet Hose ⑦ : Vapor Separator → FFP

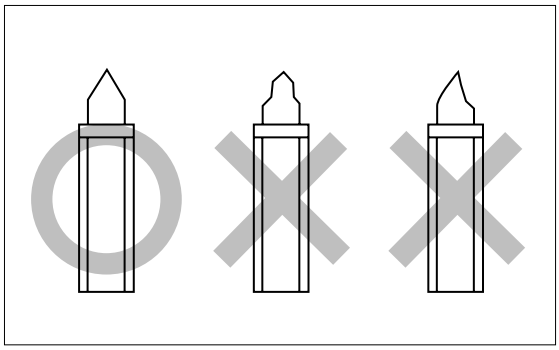
> Use a container to catch fuel that spills from hose ⑦ when it is disconnected.

5) Disassembly and Inspection of Vapor Separator

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



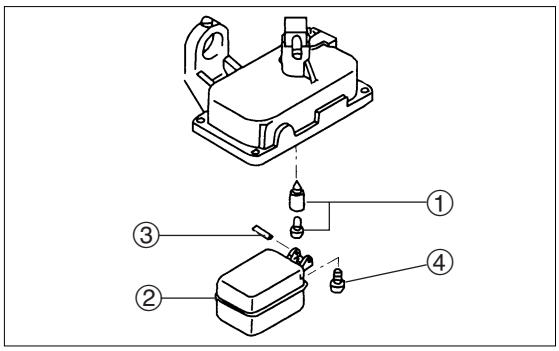
2. Inspection of Vapor Separator
   1. Check needle valve ① for deformation and wear.
   2. Check float ② for deformation, crack and other defects.
      Replace if necessary.
   3. Check if any dirt or dust is in the vapor separator.
      Replace if necessary.



4

6) Assembly of Vapor Separator

1. Assemble following parts.
   ① Float Valve
   ② Float
   ③ Float Arm Pin
   ④ Tighten screw.

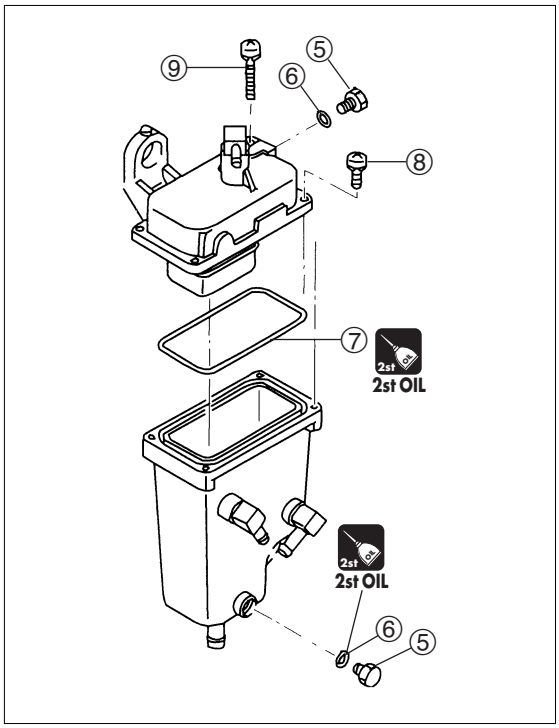


Screw ④ :
1.6 N·m (1.1 lb·ft) [0.16 kgf·m]

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

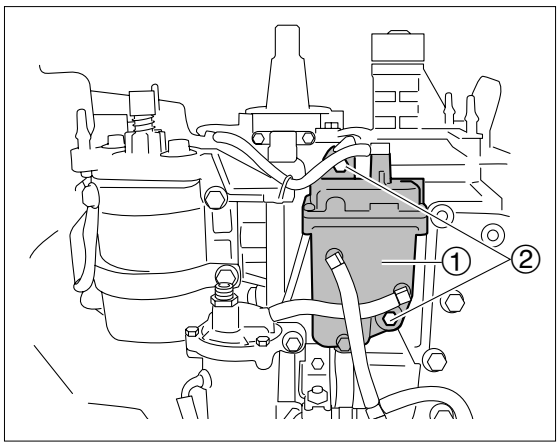


⑦ O Ring
⑧ Tighten Screw.
⑨ Tighten Screw.

Screws ⑧ and ⑨ :
1.6 N·m (1.1 lb·ft) [0.16 kgf·m]

O Ring ⑦ :
Genuine Engine Oil

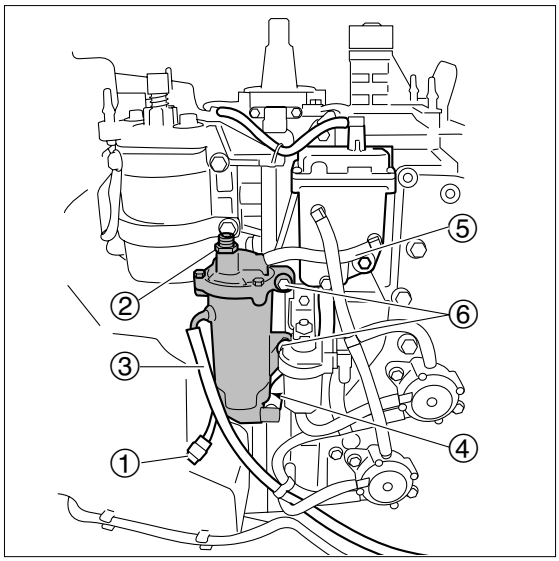
7) Assembly of Vapor Separator Ass'y



1. 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

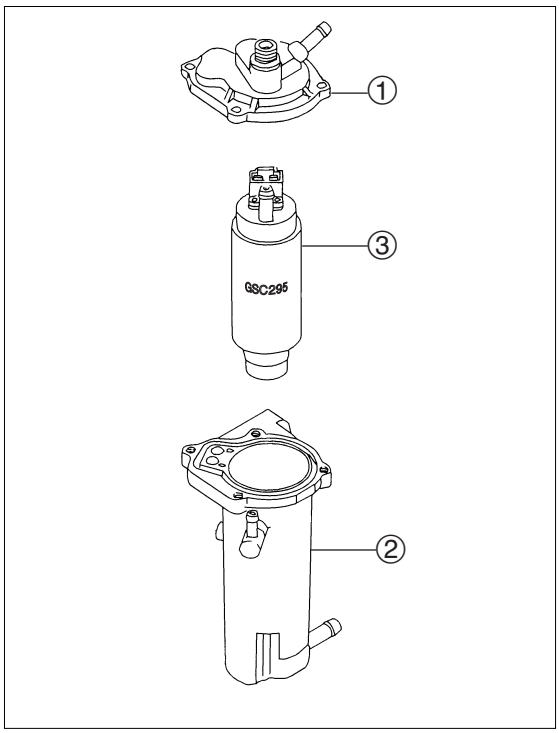
1. Remove parts in the order described below.
   Disconnect FFP connector 1, loosen hose joint ②, and then remove fuel hose ass'y.

2. Remove following hoses.
   Fuel Return Hose ③ : Air Rail → FFP
   Vapor Return Hose ④ : FFP → Vapor Separator
   Fuel Hose ⑤ : Vapor Separator → FFP

3. Loosen two bolts ⑥ and remove FFP.

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

9) Disassembly and Inspection of FFP



1. Loosen upper case ① securing bolts and take out FFP from FFP case ②.

2. Inspection of FFP
   Check if any contamination is found in the case ②.
   Clean if necessary.

3. 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 ⑧ and metal washer ⑨ to upper case ⑩.

Hose Joint Adapter ⑧ :
14 - 16 N·m (10 - 12 lb·ft) [1.4 - 1.6 kgf·m]

Degrease edge and then apply adhesive ⑧ :
ThreeBond 1342

Replace metal washer ⑨ with new one if FFP is disassembled.

2. Attach pipe grommet ① and lower grommet ⑫ to FFP ⑪.

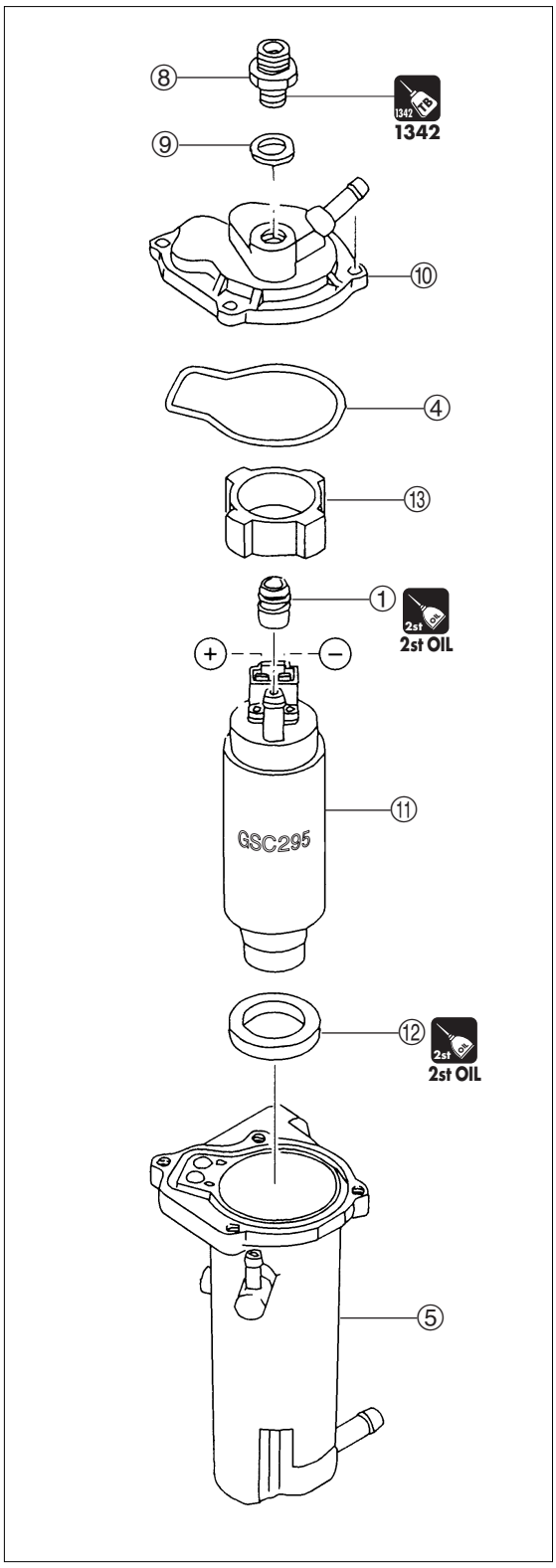
Pipe Grommet ①, Lower Grommet ⑫ :
Genuine Engine Oil

3. Install FFP ⑪ to case ⑤.

Proper orientation of ⑪ to ⑤ is as shown. Put upper case ⑩ on the top and check the position.

⚠ CAUTION

To avoid the use of FFP body ⑪ on another model, the body is marked with "GSC295". Check the mark.
115A :
"GSC295"
40/50B, 70/90B :
"GSC434"



4. Attach upper grommet ⑬ and cable terminal grommets ③.

Terminal area of parts ③, ⑦ and ⑬ :
Genuine Engine Oil

Attach black wire ⑦ (-) and red wire ⑦ (+) of cable terminal to FFP case.

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

5. Connect FFP cords ⑭ to their corresponding terminals ⑦.

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

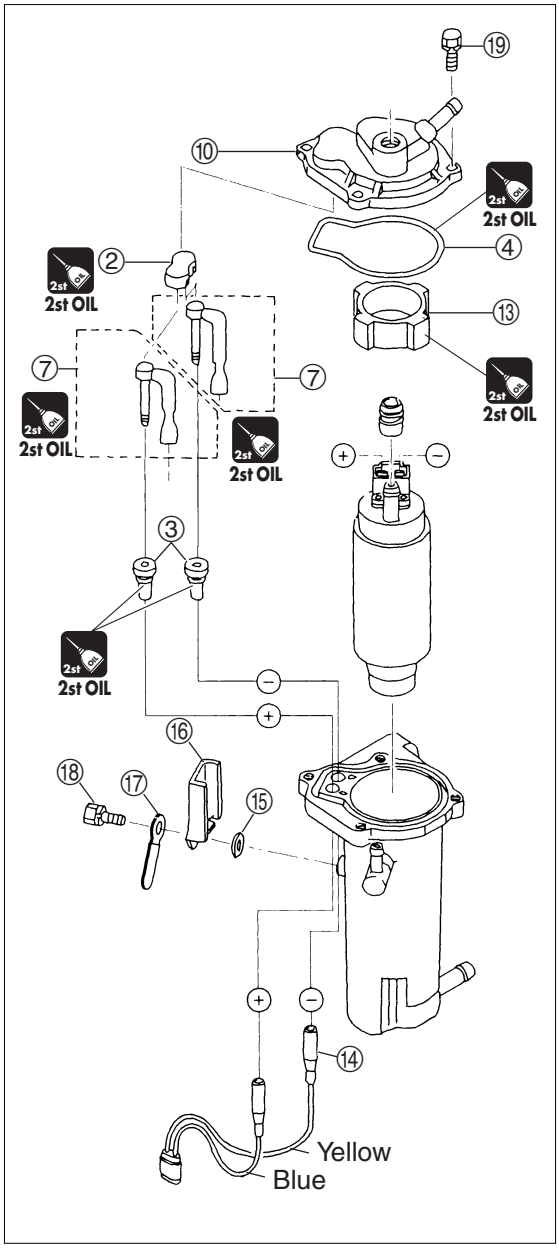
Attach cord cover ⑯ and clamp ⑰ to the body by using spacer (washer) ⑮ and bolt ⑱.

FFP Bolt ⑱ :
3.2 N·m (2.3 lb·ft) [0.32 kgf·m]

6. Attach cable terminal grommet (upper) ②, put seal ring (O ring) ④ and upper case ⑩ and then, secure the parts with bolts ⑲.

Cable Terminal Grommet Upper ②, O Ring ④ :
Genuine Engine Oil

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



4

11) Attaching 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]

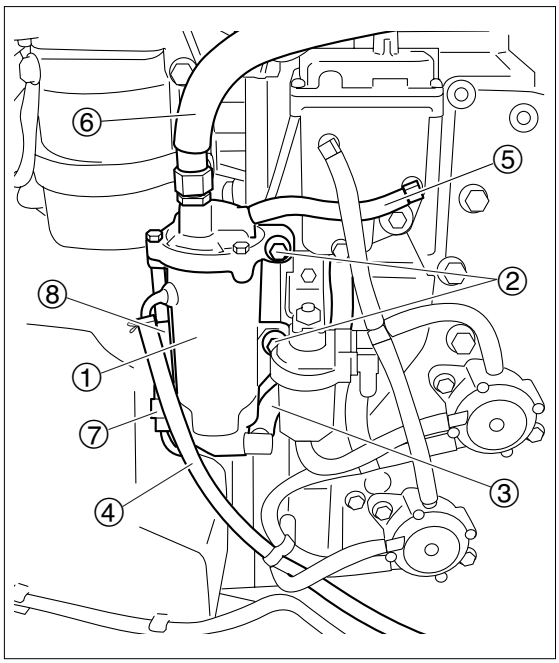
Put fuel hose ③, fuel return hose ④ and vapor return hose ⑤ and secure them by using hose clips.

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.



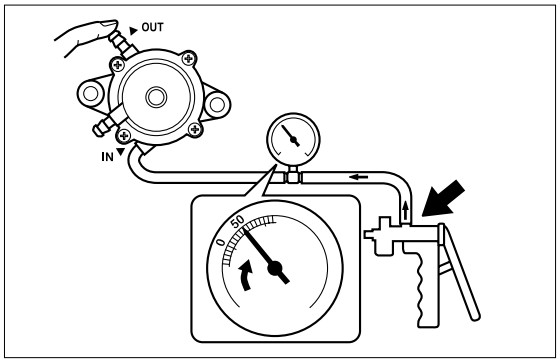
12) Inspection of Fuel Pump

1. Remove fuel hoses (2) from fuel pump.

> **⚠ CAUTION**
>
> **Catch fuel that spills when the hoses are removed.**

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

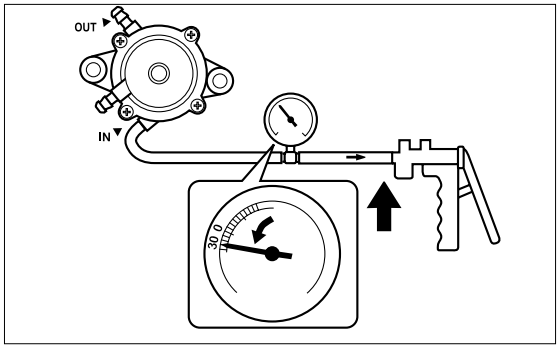
3. Close fuel pump outlet with a finger and apply specified pressure. Check if no air leaks through diaphragm.



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

Specified Pressure :
0.05 MPa (7 psi) [0.5 kgf/cm²]

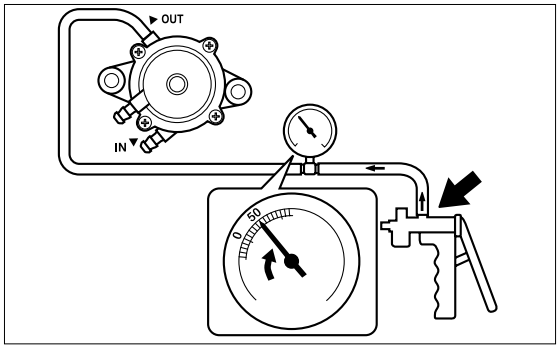
4. Apply specified vacuum pressure to check that no air leaks through check valve located in the fuel pump.



Specified Vacuum Pressure :
-0.03MPa (-4 psi) [-0.3 kgf/cm²]

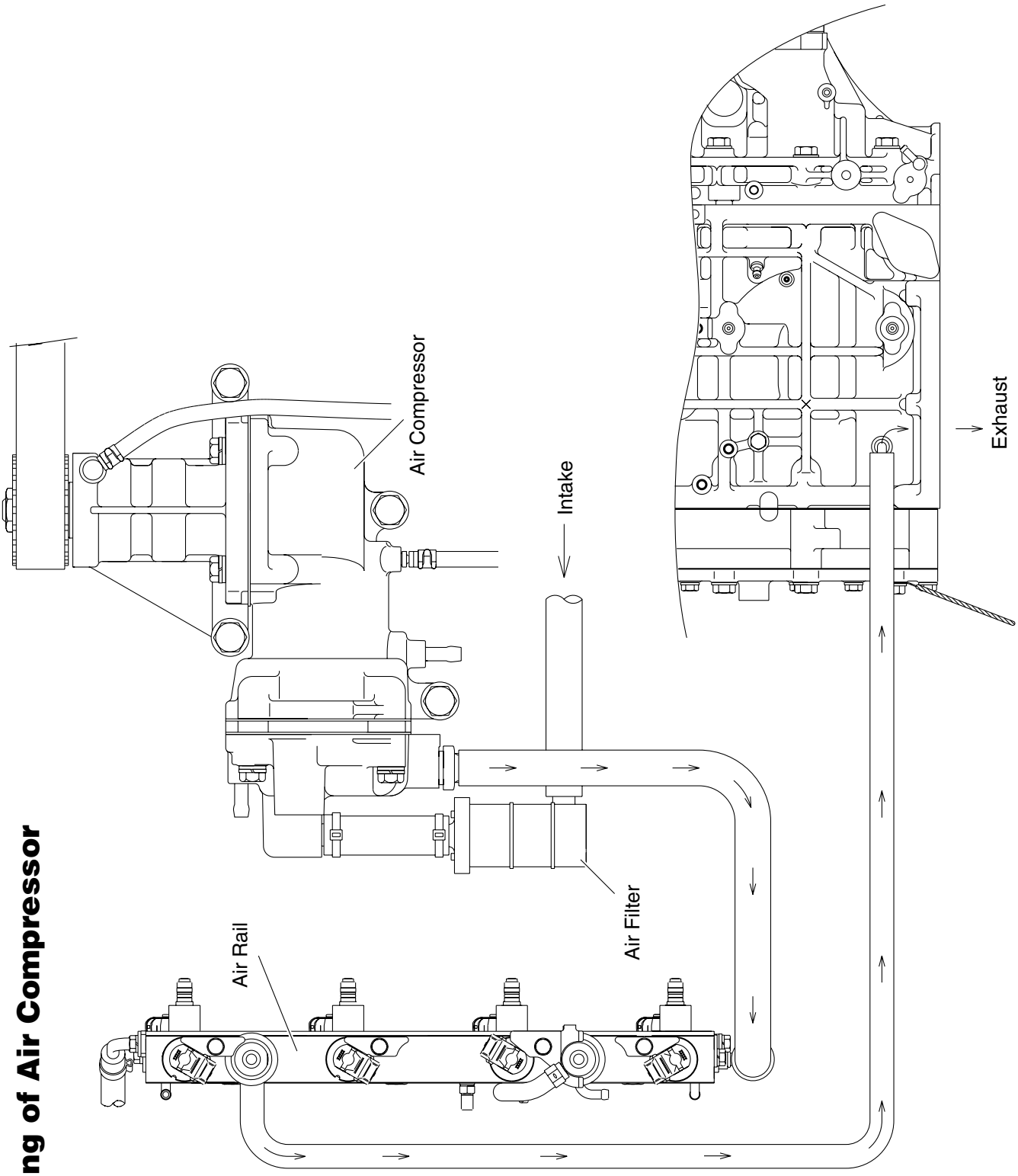
5. Connect vacuum / pressure gauge to outlet of fuel pump.

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



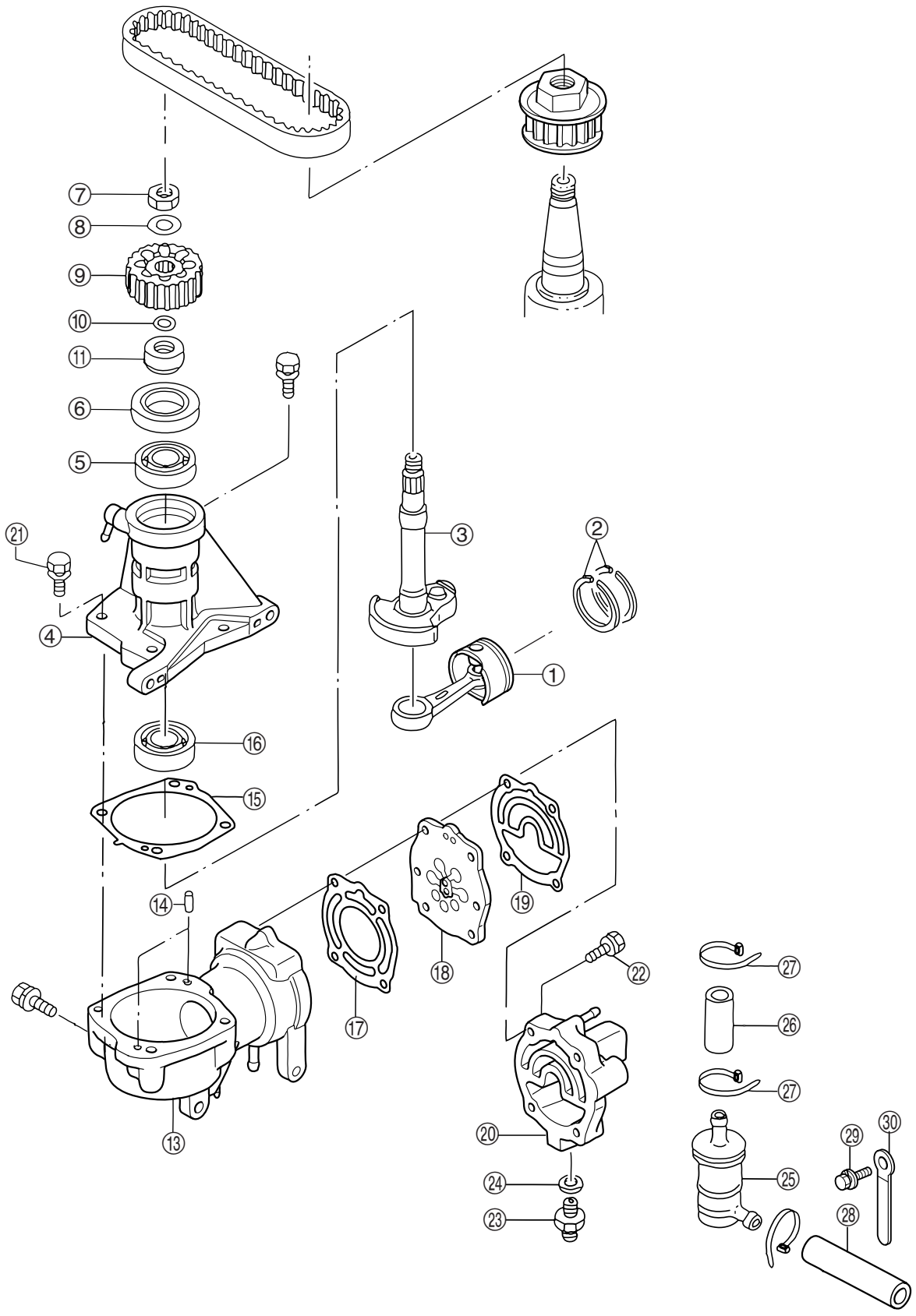
Air-tightness of fuel pump can be increased by making the interior wet with gasoline.

Specified Pressure :
0.03 MPa (4 psi) [0.3 kgf/cm²]



Air Piping of Air Compressor

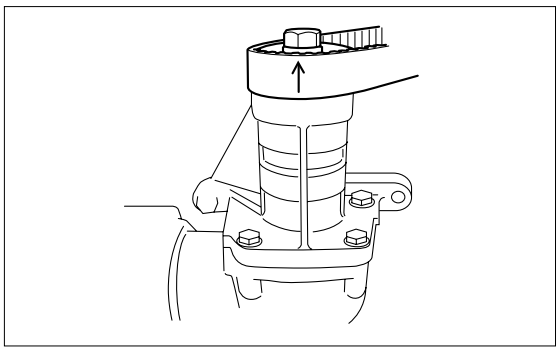
Structure of Air Compressor



7. Removing Air Compressor

1) Removing Drive Belt

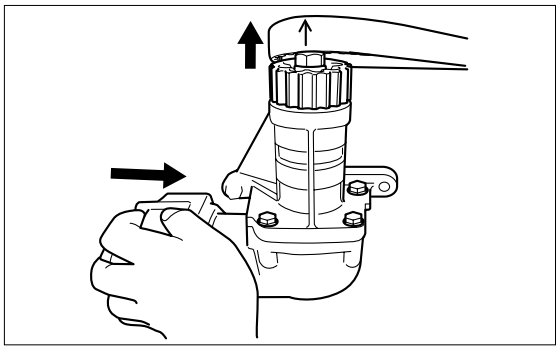
1. Mark drive belt with an arrow as shown to indicate orientation.



⚠ 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.



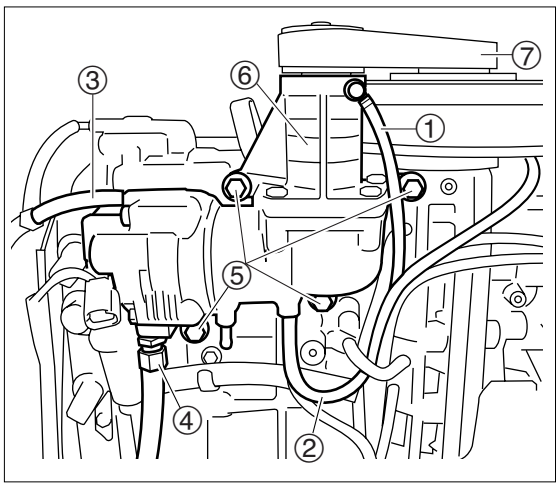
3. Move the belt upward to remove.

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. Loose the clamps of oil pipe ①, Recirculation pipe ② and cooling water pipe ③ at compressor side and pull hoses out.



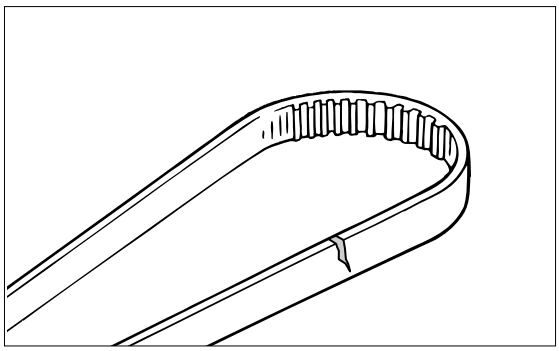
2. Loosen nut of high pressure air hose ④ and disconnect the hose.

3. Remove bolts ⑤ 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.

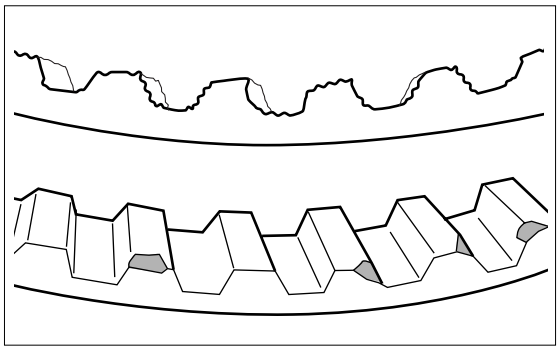
3) Inspection of Drive Belt

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

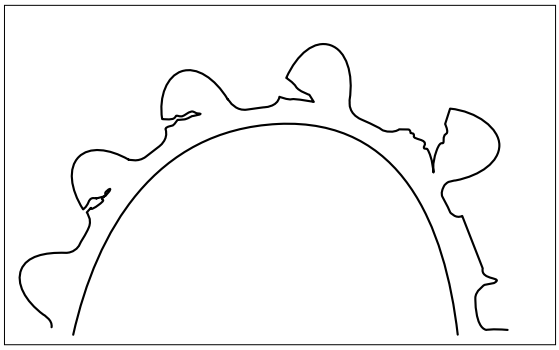


2. Check drive belt for missing tooth (teeth) and adherence of oil.

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.



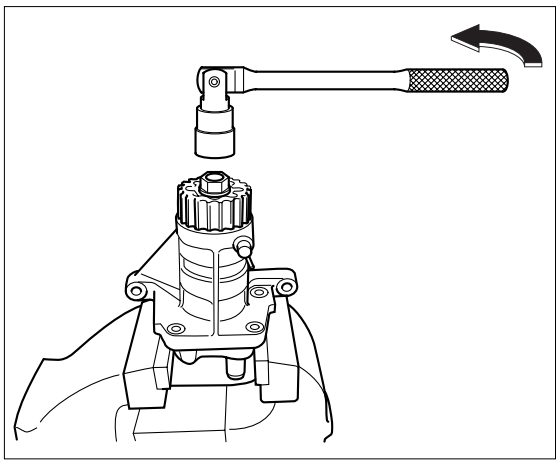
4) Removing Driven Pulley

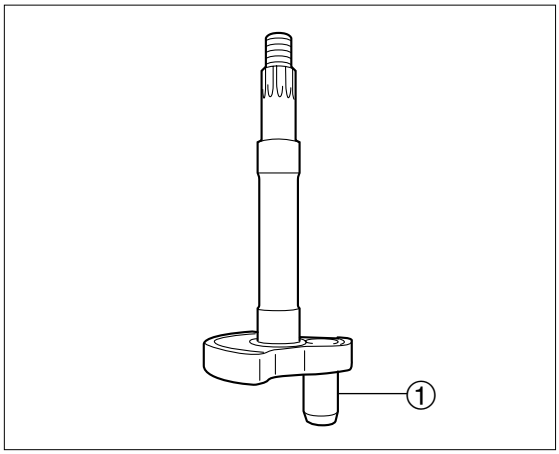
1. Remove compressor cylinder.

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

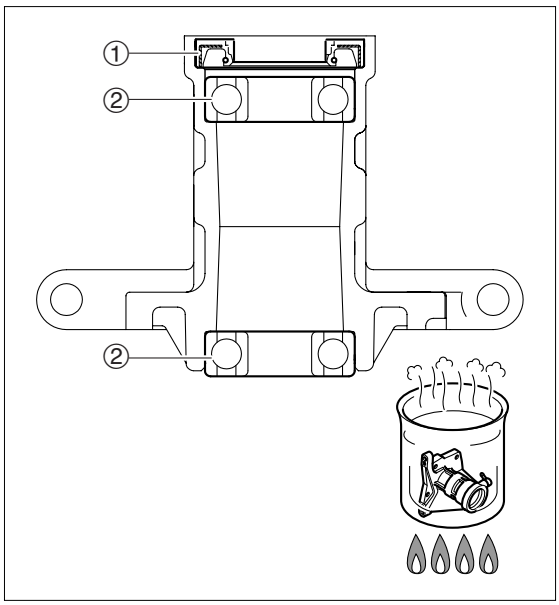
1. Remove oil seal ① and bearing ②.

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.

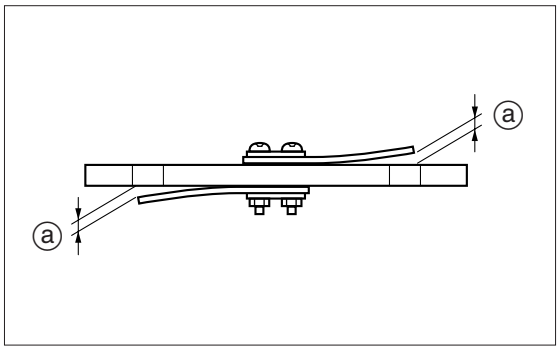


① ② **Do not reuse**

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 ⓐ :
0.2 mm (0.008 in)or less



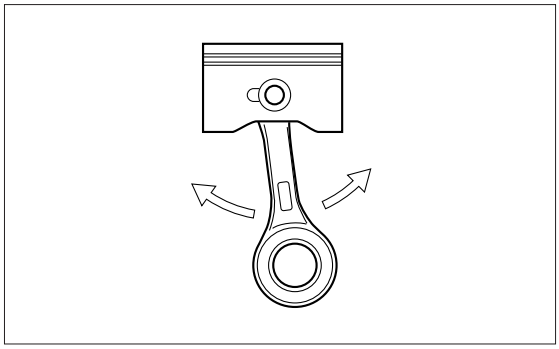
7) Inspection of Cylinder and Piston

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.

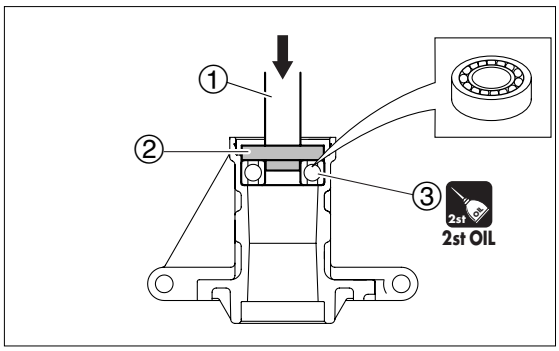


8) Assembly of Compressor Housing

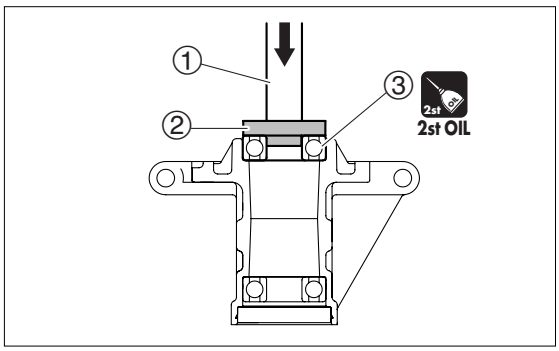
1. Apply two stroke engine oil to periphery of bearing ③, and install it into compressor housing by using a press.

Driver Rod ① :
P/N. 3AC-99702-0
Bearing Attachment ② :
P/N. 3T1-99905-0

Do not reuse removed bearing.



③ Bearing **Do not reuse**

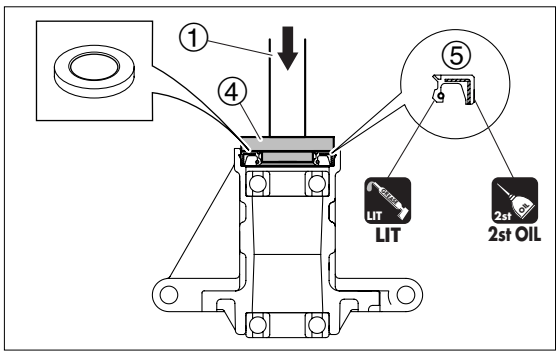


③ Bearing **Do not reuse**

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.



⑤ Oil Seal **Do not reuse**

9) Installation of Crank Shaft

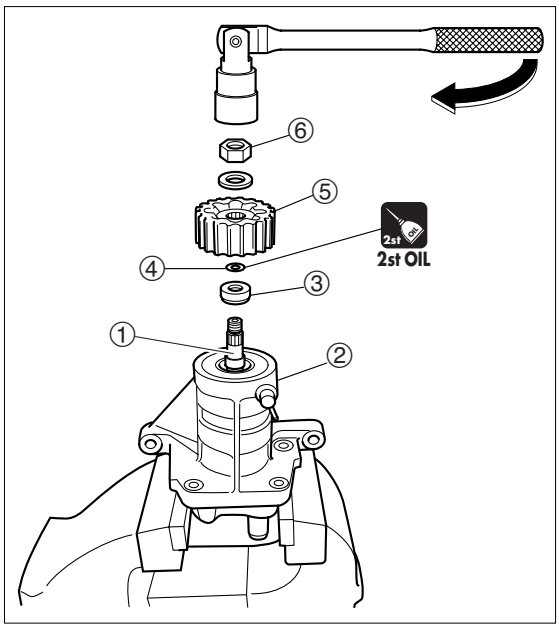
1. Install crank shaft ① to the housing, and fix the crank shaft at its lower end by using a vice.

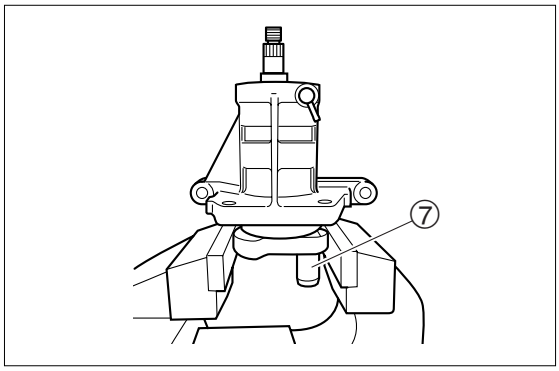
2. Attach collar ③, O ring ④, and driven pulley ⑤, and tighten nut ⑥ to the specified torque.

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.





4

10) Installation of Piston

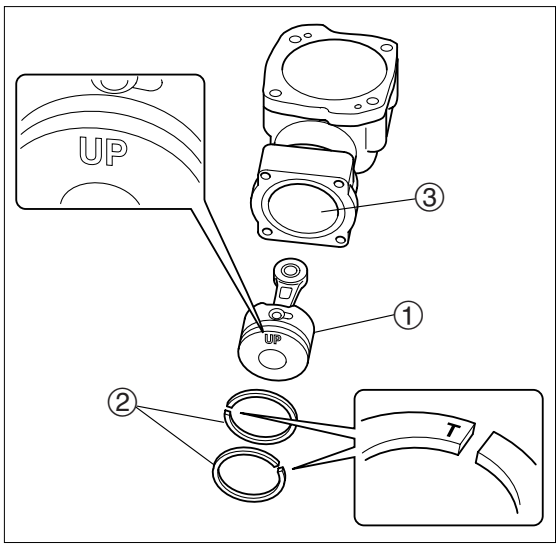
1. Attach piston rings ② to piston ①.

⚠ CAUTION

Bring piston ring gaps away from each other.

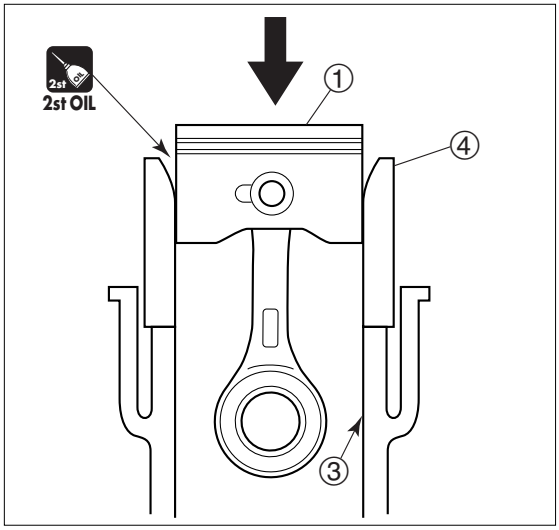
⚠ CAUTION

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



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.

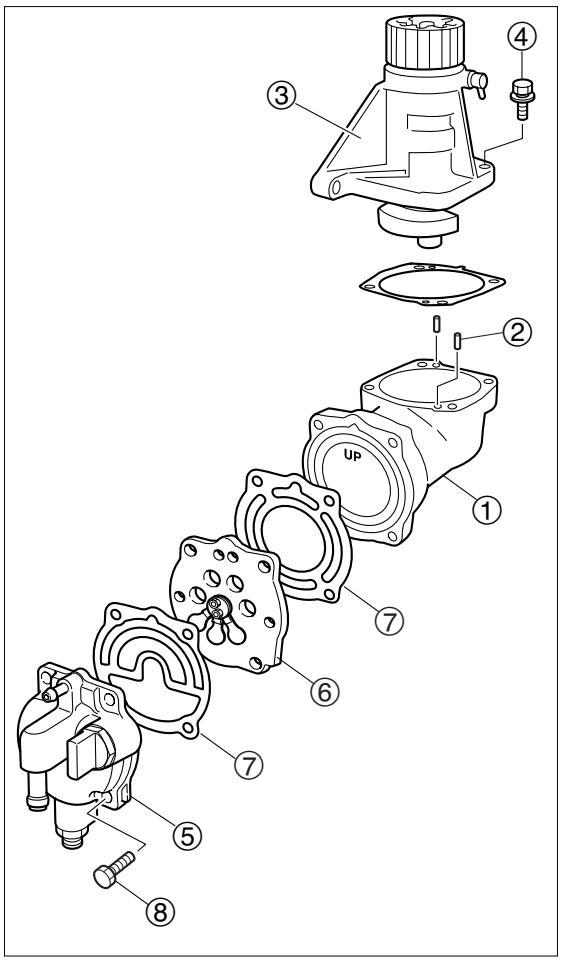
Compressor Housing Bolt ④ :
6N·m (4 lb·ft) [0.6kgf·m]

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]



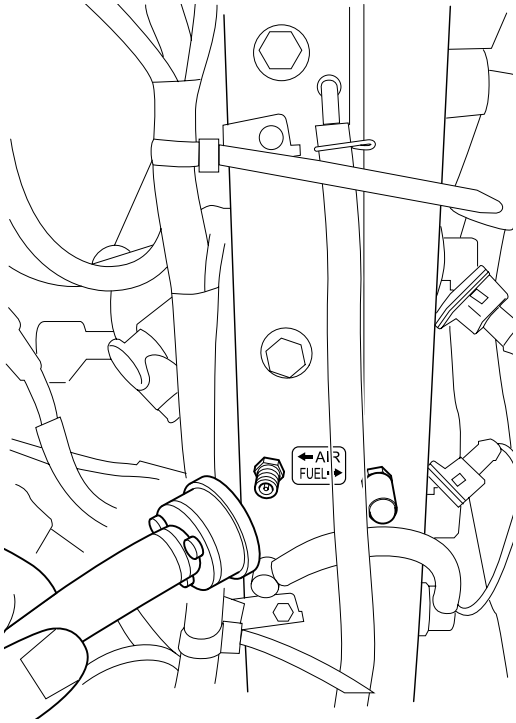
4

12) Measurement of Fuel Pressure and Air Pressure

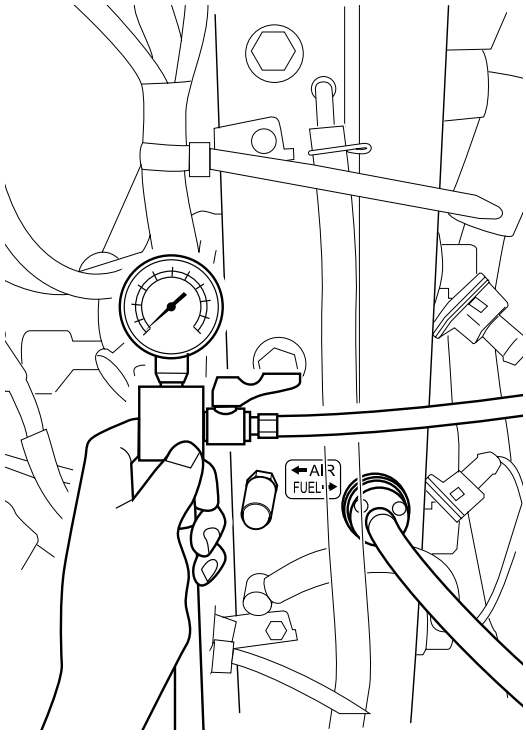
1. Use pressure gauge ass'y to measure fuel pressure and air pressure in the air rail.

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

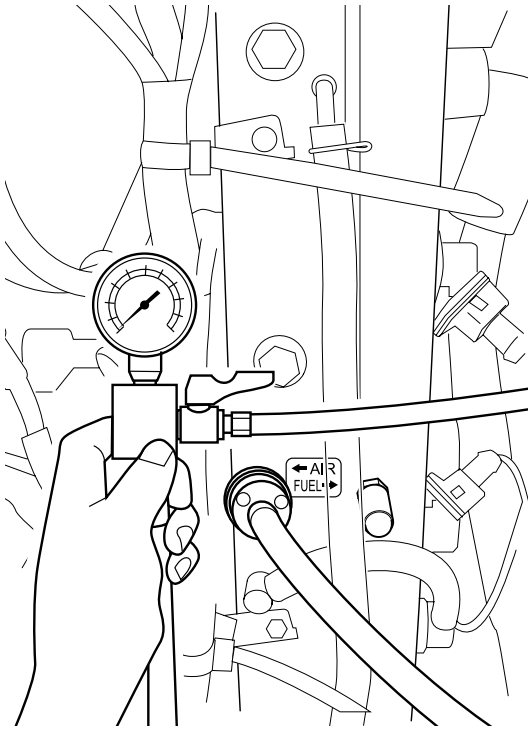
Perform the measurements by using the method described below.



Fuel Pressure



Air Pressure



How to Use Pressure Gauge

1. Pressure Gauge Ass'y

   Measurement of Fuel Pressure and Air Pressure

   1. Set the lever of cock (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.**

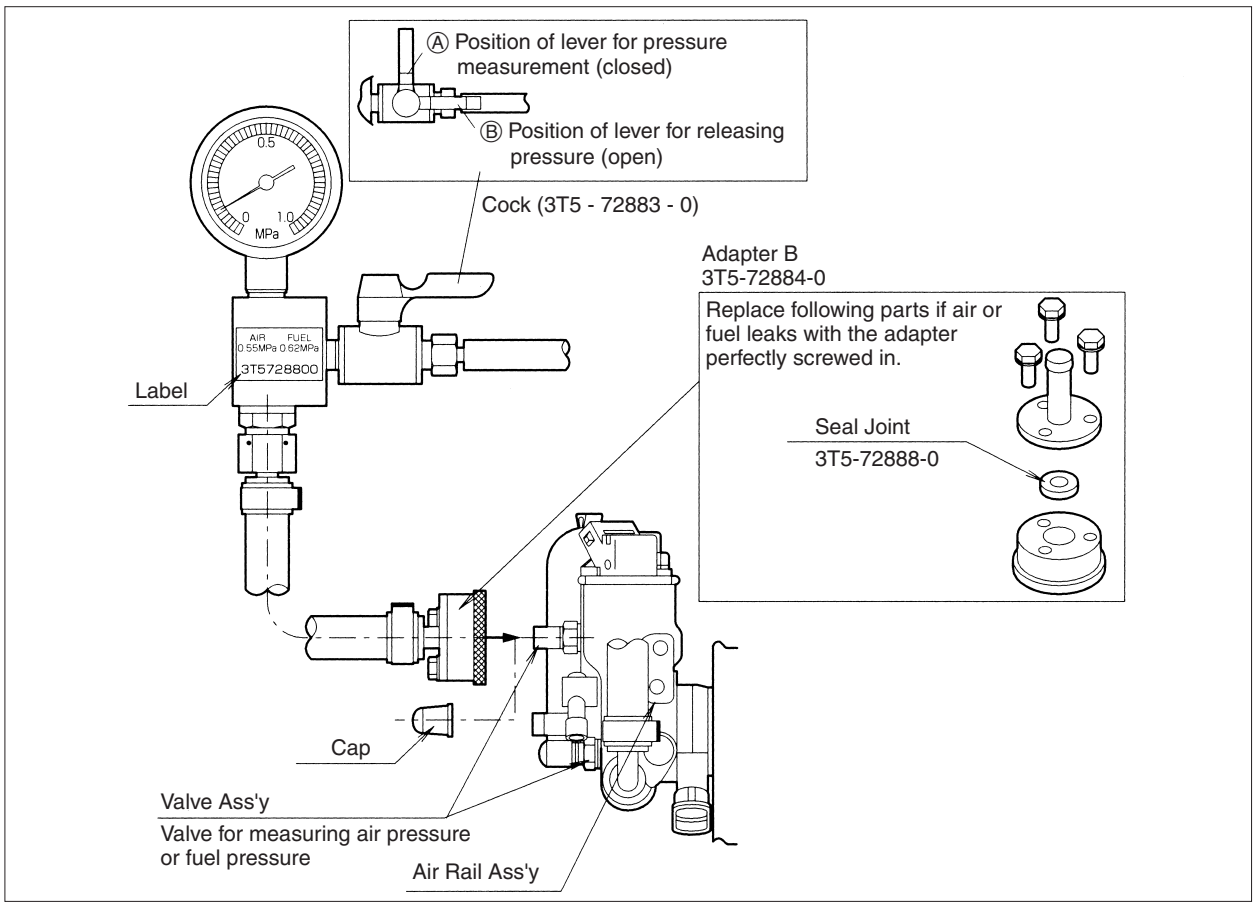
3. Turn key switch from "OFF" to "START" position to crank the engine for approximately 15 seconds. (Run the engine for 15 seconds at idling speed of 700 rpm.)
4. The fuel system and air system are normal when the gauge indicates specified air and fuel pressures.

   (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	0.55 MPa (80 psi) [5.5 kgf/cm²]	0.52 - 0.58 MPa (75.25 - 83.95 psi) [5.2 - 5.8 kgf/cm²]	The pressure reduces gradually after stopping the cranking.
FUEL PRESSURE	0.62 MPa (90 psi) [6.2 kgf/cm²]	Air Pressure +0.06 - 0.08 MPa (8.70 - 11.60 psi) [0.6 - 0.8 kgf/cm²]	

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 (98AB-5-0200) when the cock lever is set to position "B" (open). Bring cock side below the valve to drain fuel completely from the hose (98AH-8-1000) before removing adapter B.



13) Inspection of Oil Filter

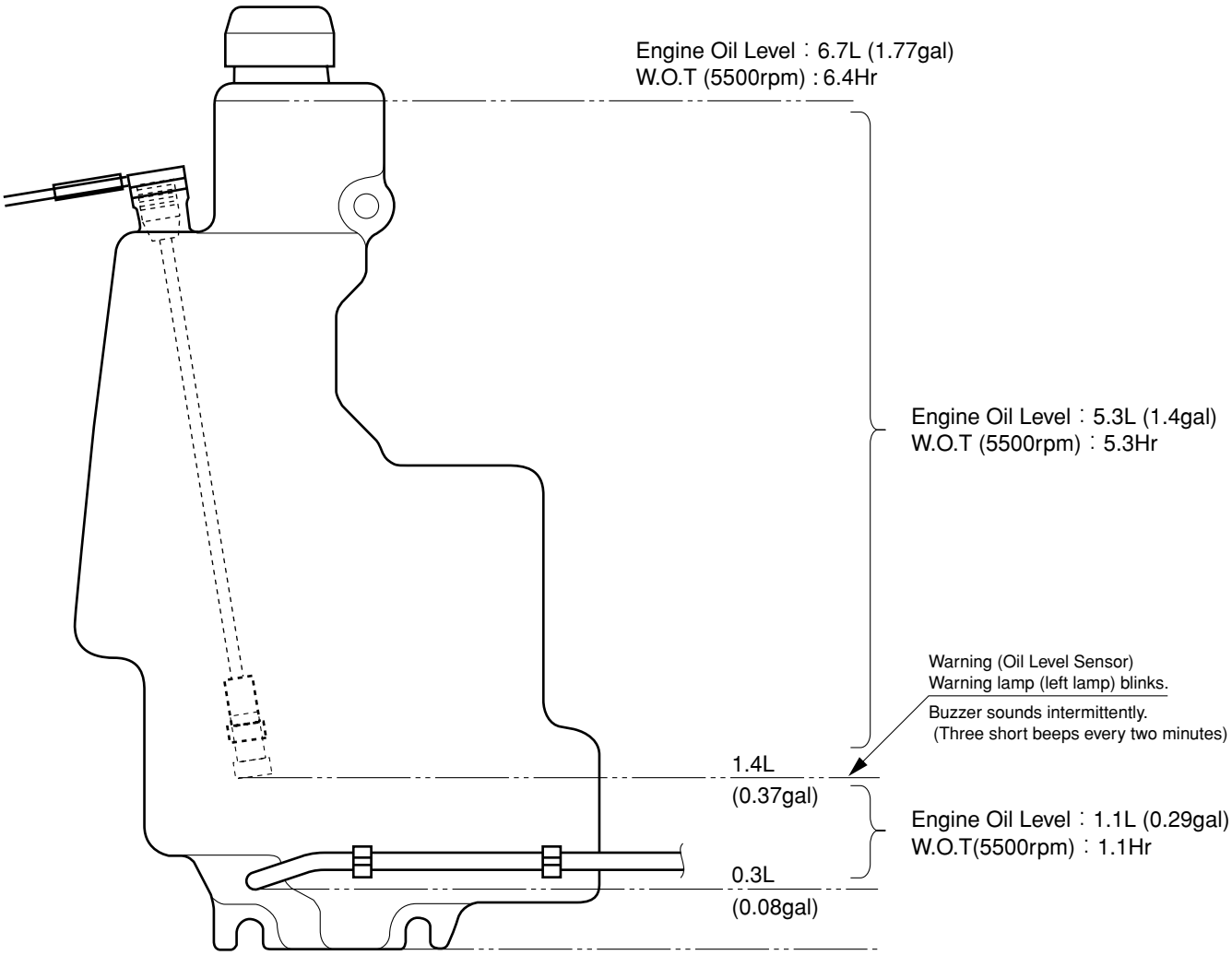
Check if oil filter is cracked, damaged or leaks, or if dirt or water is in it.

Clean or replace if necessary.

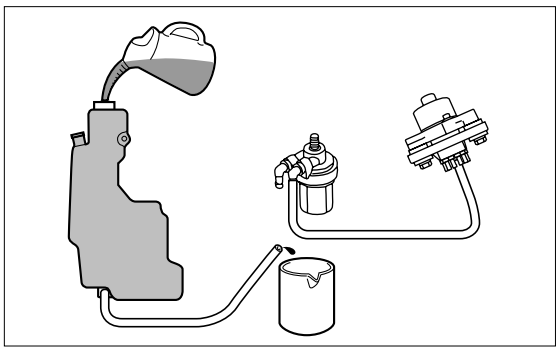
14) Inspection of Oil Tank

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

Clean or replace if necessary.



15) Air Bleeding



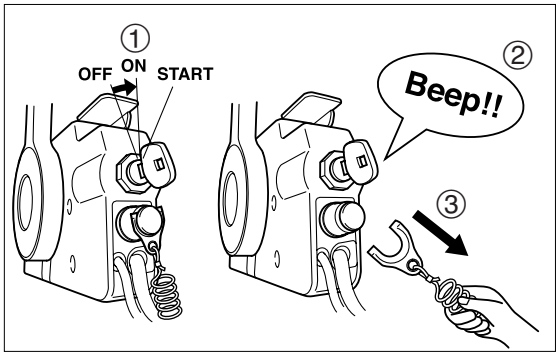
1. Visually check if any air is found in the oil line from oil tank to cylinder block, and if any air is found, bleed the air by using the following procedure.

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 black on filter.

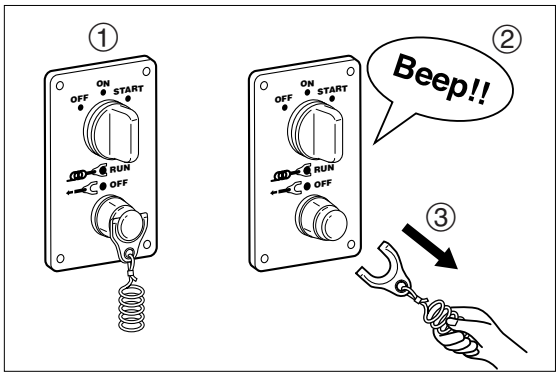
⚠ CAUTION

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



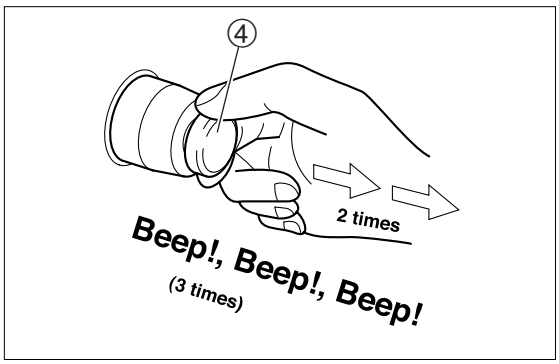
4. Set key switch ① to "ON".

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



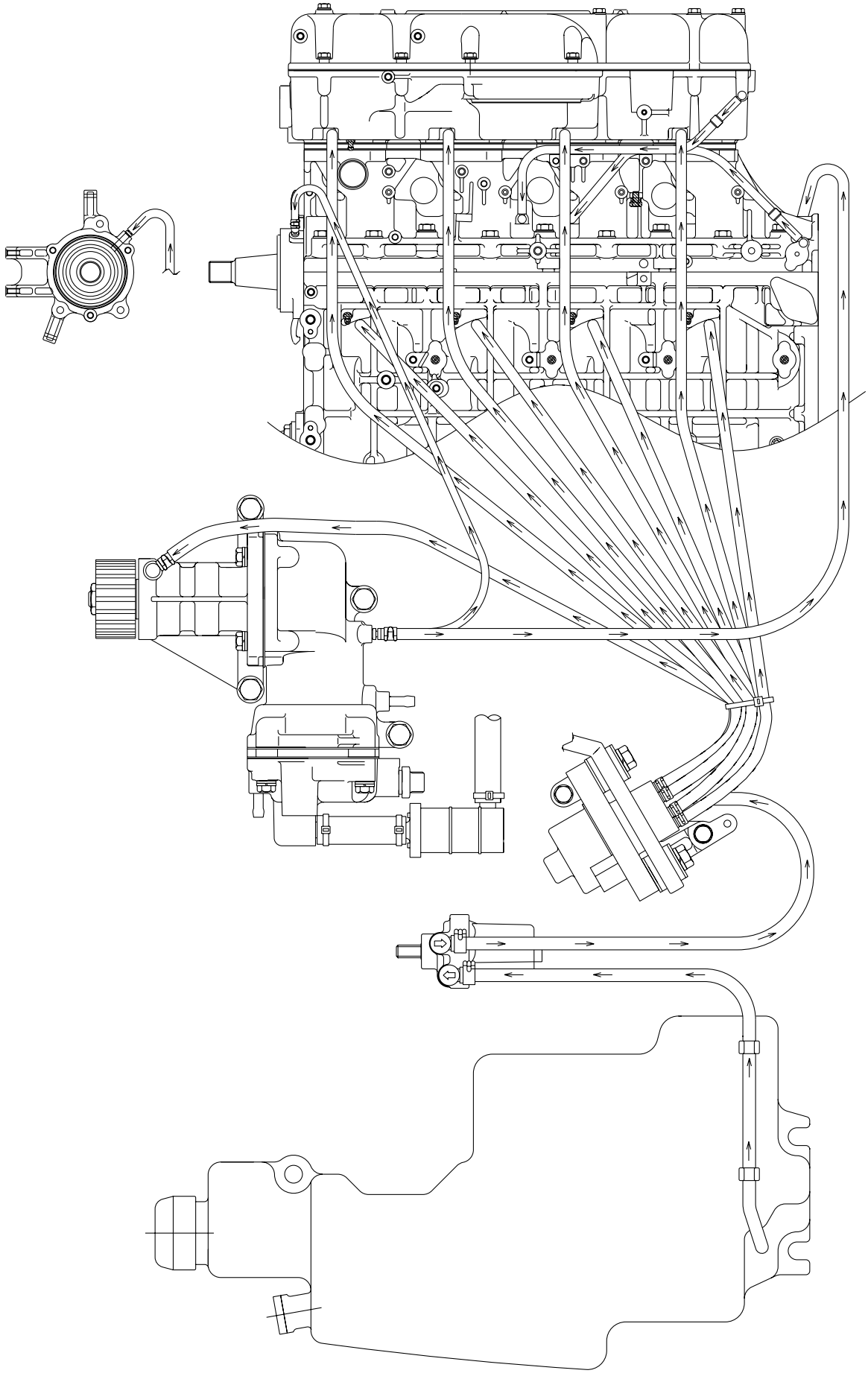
6. Pull stop switch ④ twice within two seconds.

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.



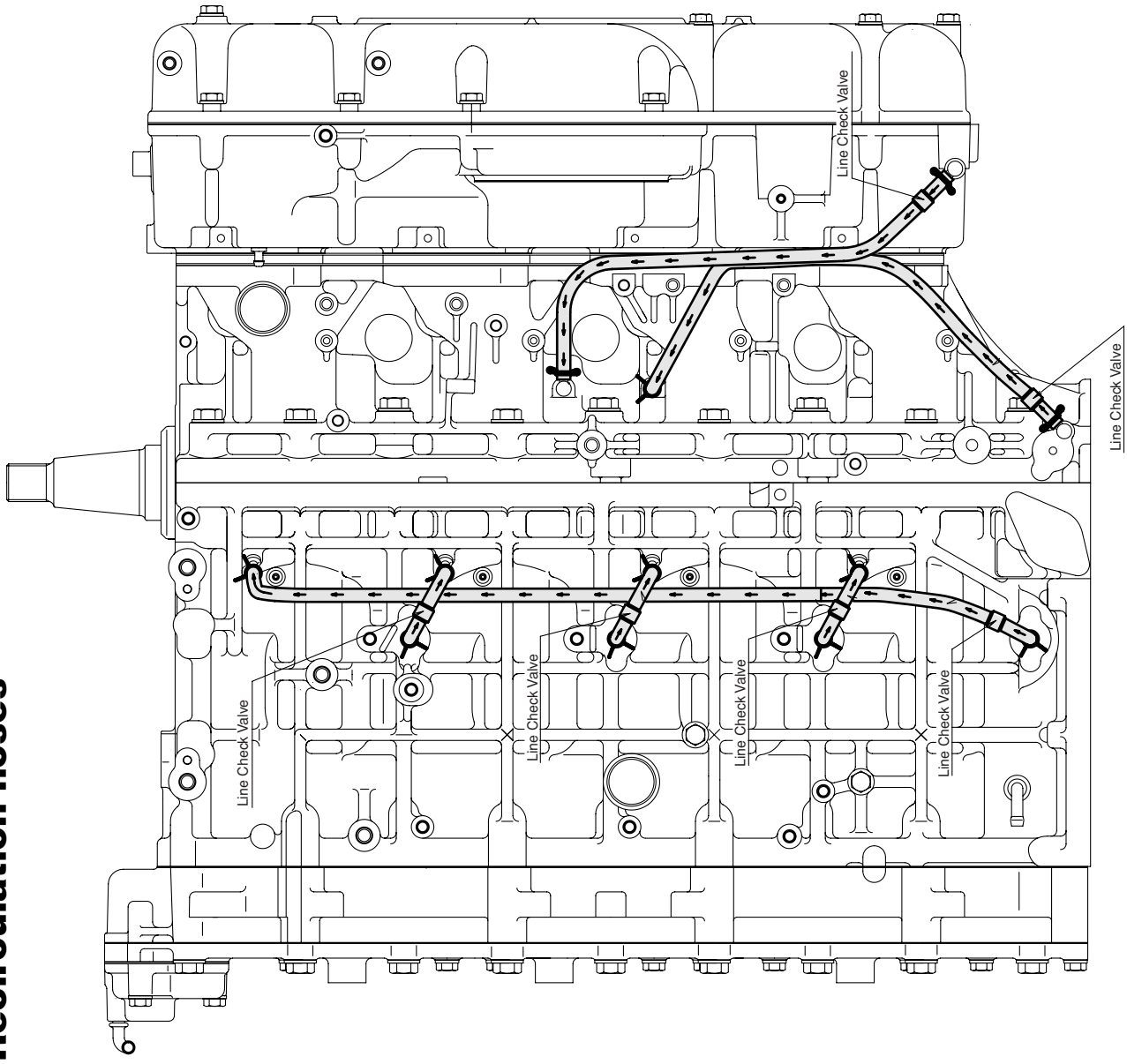
7. The oil pump continues to operate to feed oil. When air is bled from the oil, set the key switch to "OFF".

The oil pump stops automatically at approximately one minute.



Arrangement of Oil Feed Lines

Arrangement of Recirculation hoses



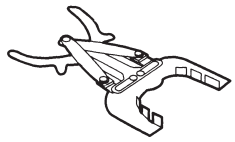
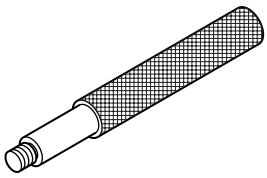
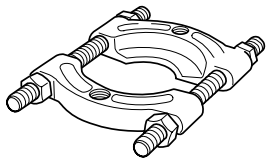
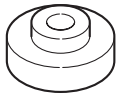
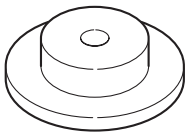
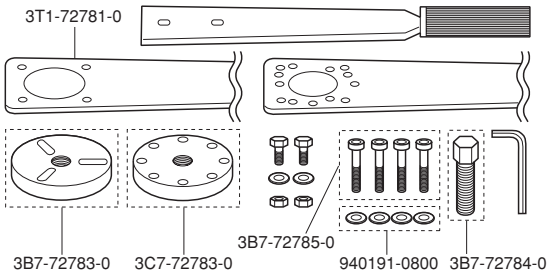
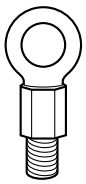
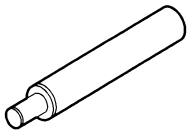
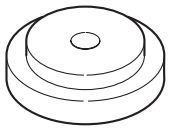
5

Power Unit



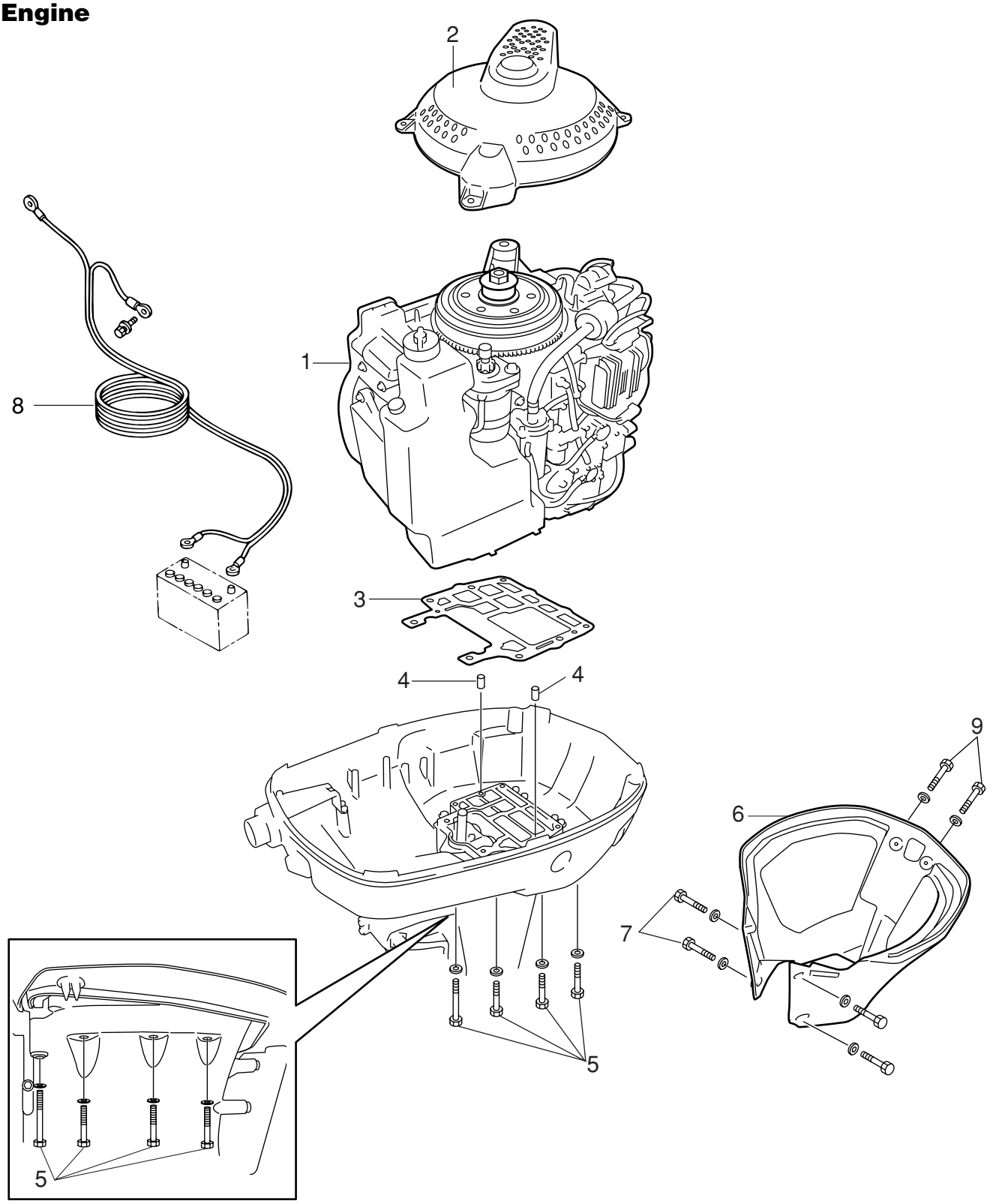
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1. Special tools

			ø34.5 X ø19 
Piston Ring Tool P/N. 353-72249-0	Driver Rod P/N. 3AC-99702-0	Universal Puller Plate P/N. 3AC-99750-0	Oil Seal Attachment P/N. 3C7-99820-0
Removing or attaching piston rings	Used in combination with center place and various attachments	Removing reverse (C) gear bearing	Used to press-fit crank case head oil seal
ø57.5 X ø34.5 			
Oil Seal Attachment P/N. 3E0-99820-0	Flywheel Puller Kit P/N. 3T1-72211-0		Eye Bolt P/N. 3T1-72212-0
Used to press-fit crank case head oil seal	Removing or attaching flywheel		Used to hook power unit when hanging
	ø51.5 x ø39.5 		
Piston Pin Tool P/N. 3T1-72215-0	Oil Seal Attachment P/N. 3U1-99820-0		
Removing or attaching piston pin	Used to press-fit coil bracket oil seal		

2. Parts Layout

Engine

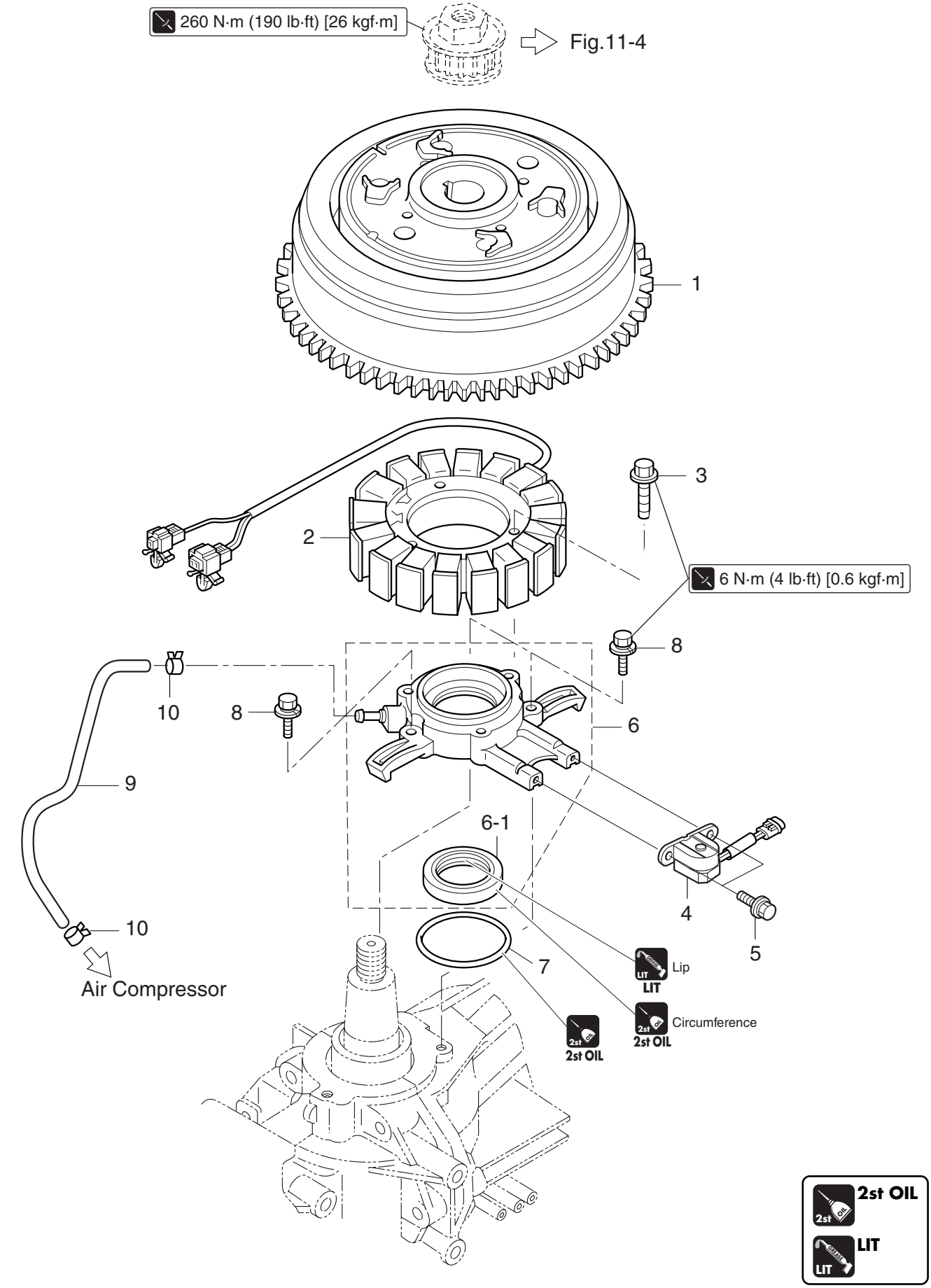


Ref. No.	Description	Q'ty	Remarks
1	Power Unit	1	
2	Ring Gear Cover Ass'y	1	
3	Gasket	1	
4	Dowel Pin	2	
5	Bolt	8	L=107mm x 6, L=120mm x 2

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

Magneto

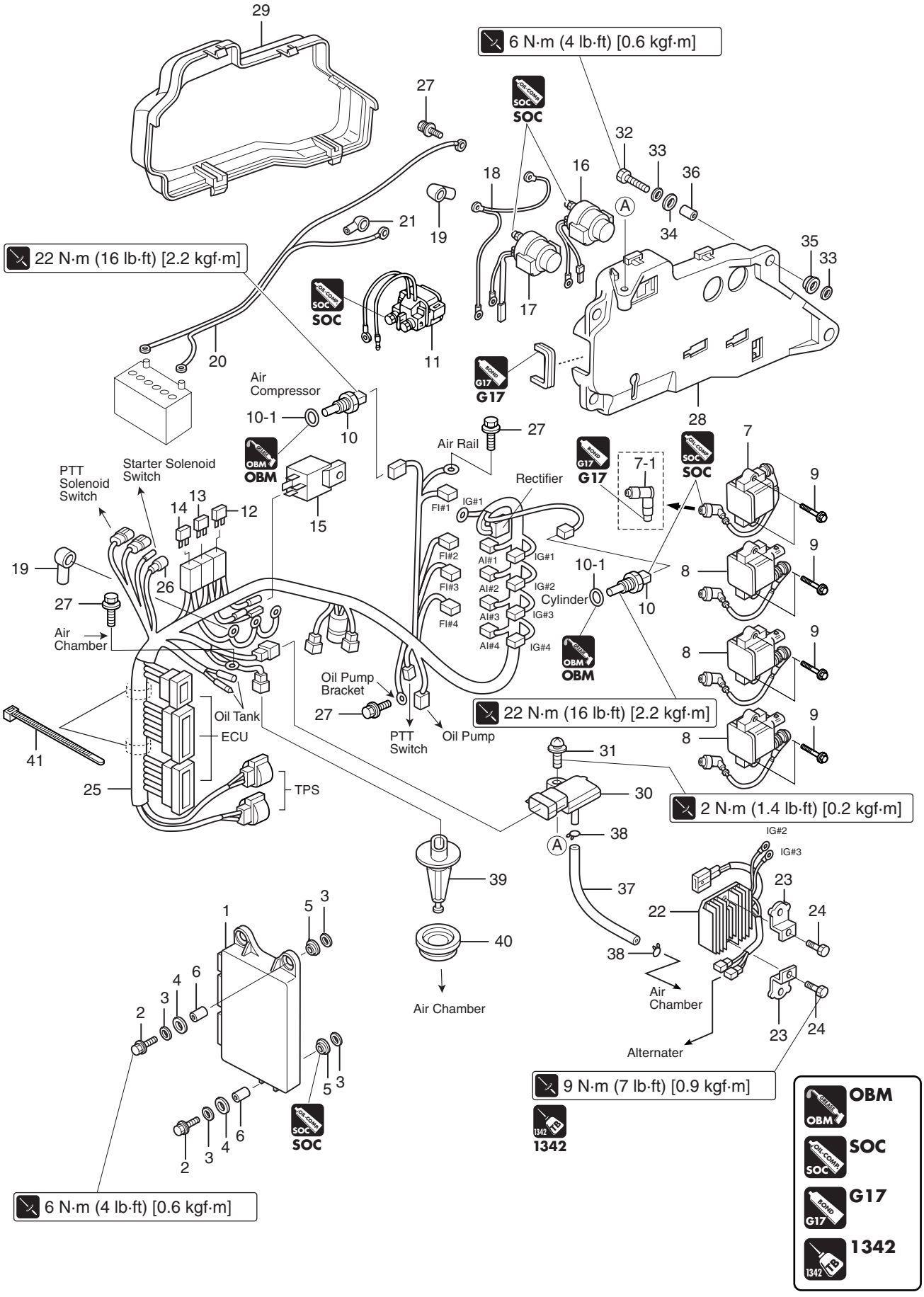
P/L Fig. 8



Ref. No.	Description	Q'ty	Remarks
1	Flywheel	1	
2	Alternator	1	
3	Bolt	3	M6 L=35mm W/PW
4	Pick-UP Coil	1	Crank position sensor
5	Bolt	2	M5 L=12mm W/SW
6	Coil Bracket Ass'y	1	with Oil seal
6-1	Oil Seal, 35-58-9	1	Do not reuse.
7	O-Ring, 2.4-59.6	1	Do not reuse.
8	Bolt	3	M6 L=20mm W/PW
9	Oil Pipe	1	Compressor - Coil bracket
10	Clip, ø6.9	2	

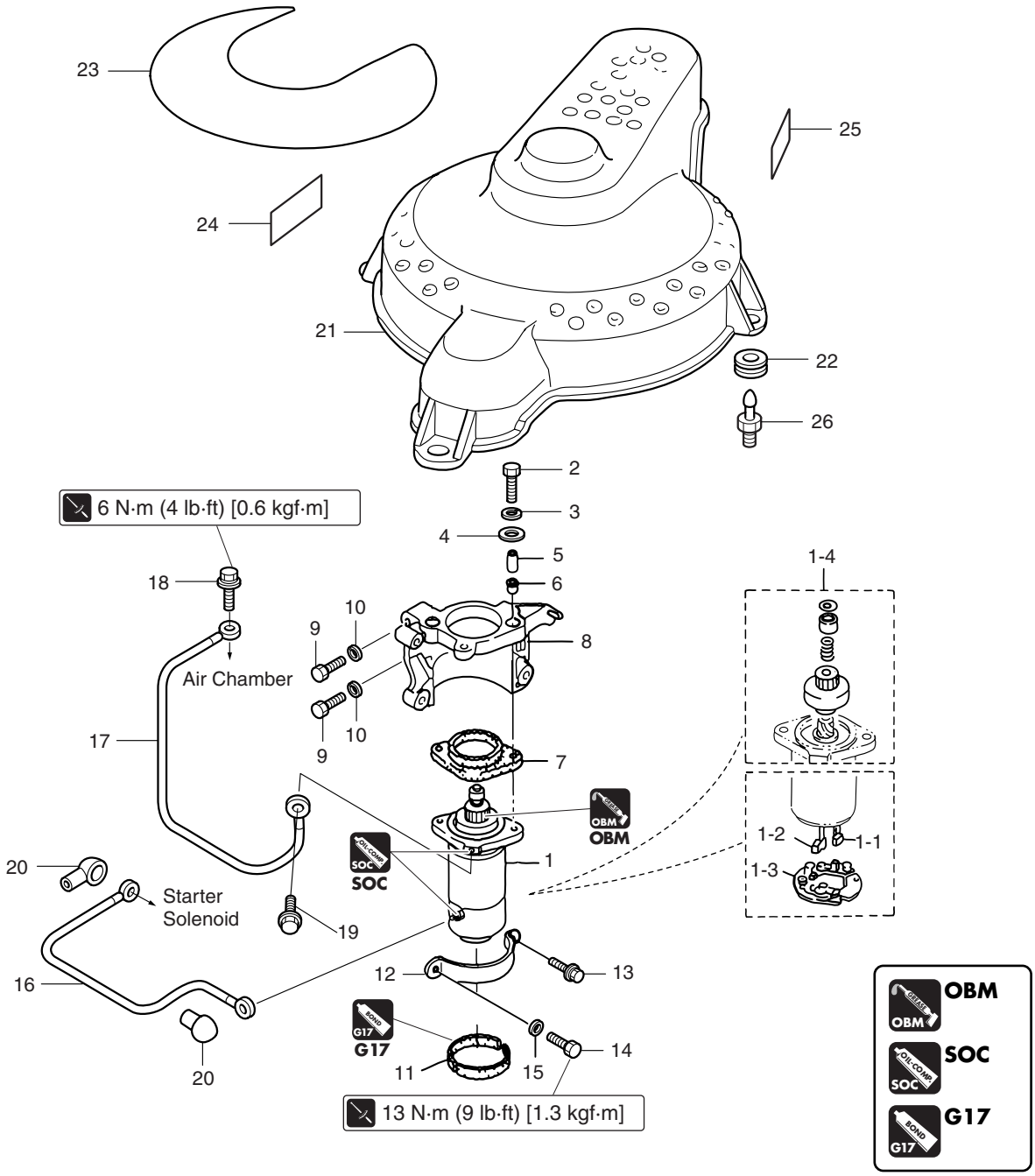
Electric Parts

P/L Fig. 9



Ref. No.	Description	Q'ty	Remarks
1	ECU	1	
2	Bolt	3	M6 L=30mm W/SW
3	Washer, 6.5-21-1	6	
4	Rubber Mount, 8.5-14-2.5	3	
5	Rubber Mount, 8.5-14-2.5	3	
6	Spacer, 6.2-9-16.6	3	
7	Ignition Coil, # 1	1	
7-1	Plug Cap (with Resistance)	4	
8	Ignition Coil, # 2 & # 3 & # 4	3	
9	Bolt	8	M6 L=35mm W/SW&PW
10	Water Temperature Sensor	2	
10-1	O-Ring, 2-10	2	Do not reuse.
11	Starter Solenoid	1	
12	Fuse, 15A	2	
13	Fuse, 25A	2	
14	Fuse, 30A	2	
15	Relay	1	
16	PTT Solenoid Switch "A"	1	UP
17	PTT Solenoid Switch "B"	1	DN
18	Ground Cable	1	
19	Terminal Cap	6	
20	Battery Cable	1	L=3,000mm
21	Terminal Cap	1	
22	Rectifier	1	
23	Rectifier Plate	2	
24	Bolt, 6-30 Pre-coated	2	
25	Cord Ass'y "A"	1	
26	Cable Terminal Plug	1	
27	Bolt	5	M6 L=12mm W/PW
28	Solenoid Switch Bracket	1	with Rubber protector
29	Bracket Cover	1	
30	MAP Sensor	1	
31	Tapping Screw, 6-25	1	
32	Bolt	4	M6 L=30mm W/SW
33	Washer, 6.5-16-1.5	8	
34	Rubber Mount, 8.5-14-2.5	4	
35	Rubber Mount, 8.5-14-2.5	4	
36	Spacer, 6.2-9-15.7	4	
37	Rubber Hose	1	
38	Clip, ø7	2	
39	MAT Sensor	1	
40	MAT Sensor Grommet	1	
41	Lead Wire Band, 158	2	

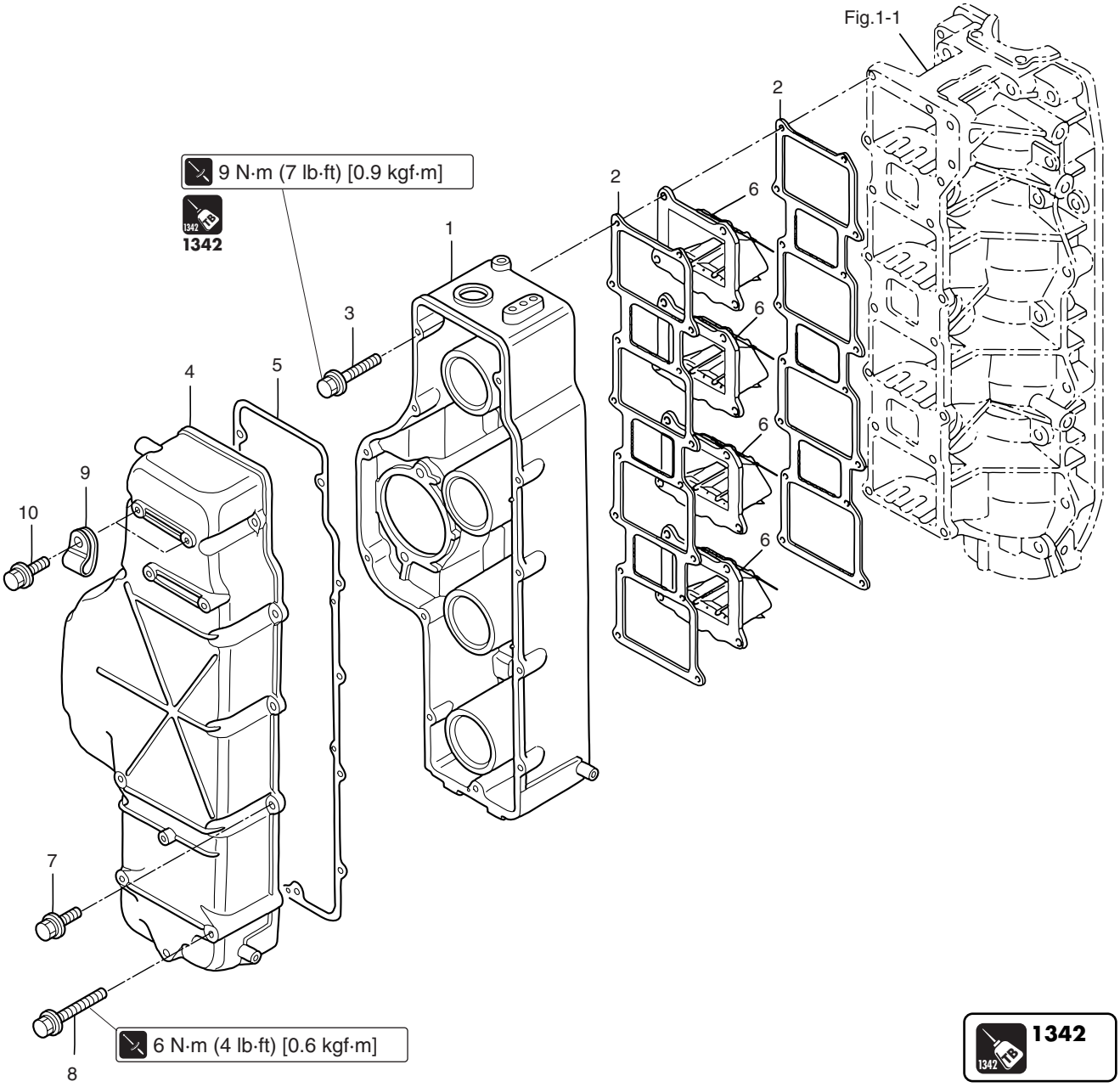
Electric Parts (Starter Motor) P/L Fig. 10



Ref. No.	Description	Q'ty	Remarks
1	Starter Motor	1	
1-1	Positive Brush (+)	2	
1-2	Negative Brush (-)	2	
1-3	Brush Spring	4	
1-4	Pinion	1	
2	Bolt	2	M8 L=40mm
3	Spring Washer	2	M8
4	Washer, 8.5-24-1.5	2	
5	Spacer, 8.4-12-21.5	2	
6	Starter Motor Mount "A"	2	
7	Starter Motor Mount "B"	1	
8	Starter Motor Bracket	1	
9	Bolt	3	M8 L=45mm
10	Spring Washer	3	M8
11	Starter Motor Damper	2	

Ref. No.	Description	Q'ty	Remarks
12	Starter Motor Band	1	
13	Bolt	1	M8 L=40mm W/PW
14	Bolt	1	M8 L=20mm
15	Washer	1	M8
16	Starter Cable	1	L=500mm
17	Starter Cable	1	L=300mm
18	Bolt	1	M6 L=12mm W/PW
19	Bolt	1	M8 L=16mm W/PW
20	Terminal Cap	2	
21	Ring Gear Cover	1	
22	Grommet, 16-2.5	4	
23	Caution Decal "B"	1	
24	Fuse Decal	1	
25	Spark Plug Decal	1	
26	Ring Gear Cover Hook	4	

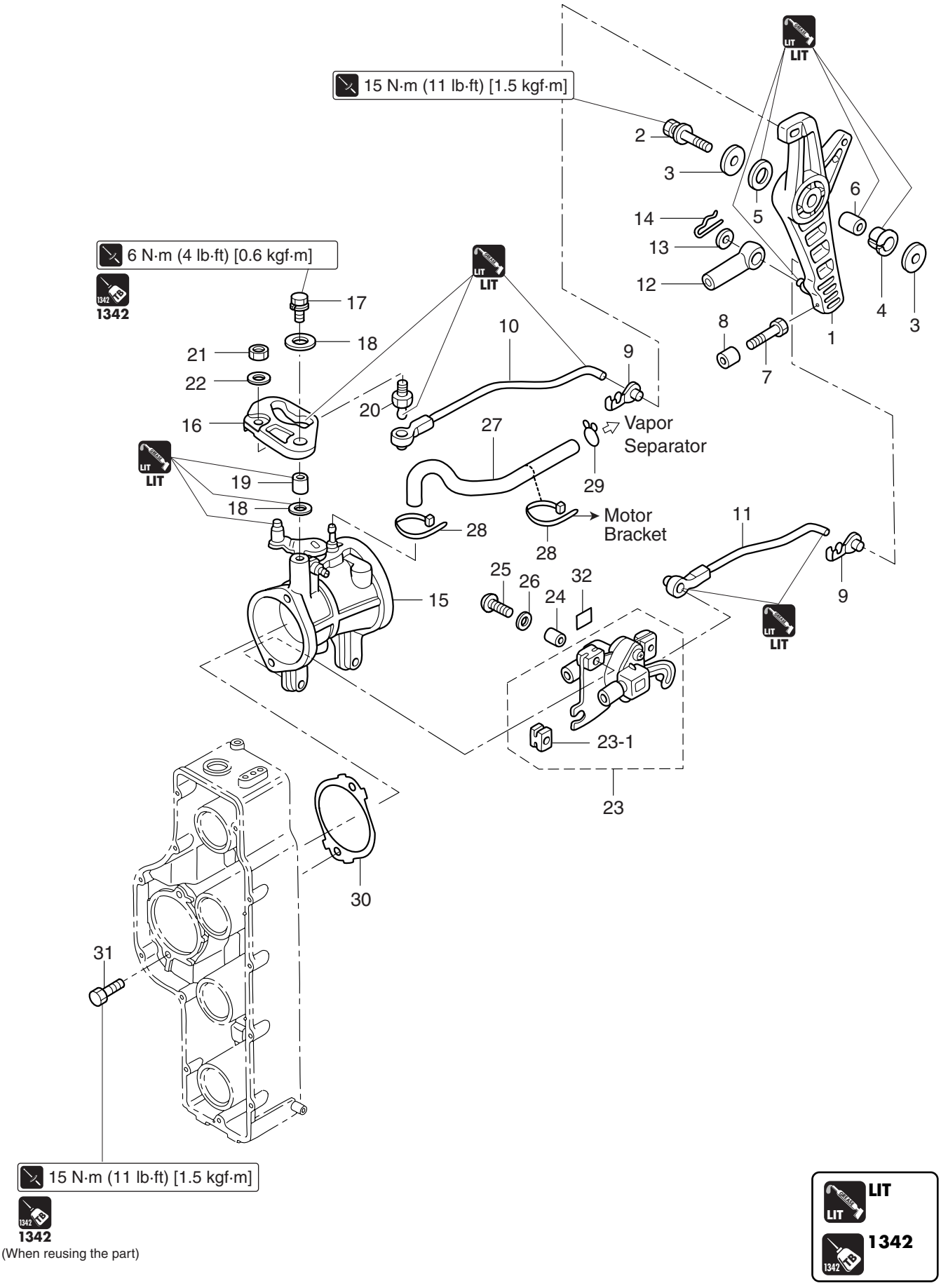
Air Chamber



Ref. No.	Description	Q'ty	Remarks
1	Air Chamber	1	
2	Intake Manifold Gasket	2	Do not reuse.
3	Bolt, 6-35 Pre-coated	16	M6 L=35mm
4	Air Chamber Cover	1	
5	Air Chamber Cover Gasket	1	Do not reuse.
6	Reed Valve Ass'y	4	
7	Bolt	8	M6 L=25mm W/PW
8	Bolt	4	M6 L=65mm W/PW
9	Clamp, 6.5-14L	2	
10	Bolt	2	M6 L=12mm W/PW

Throttle

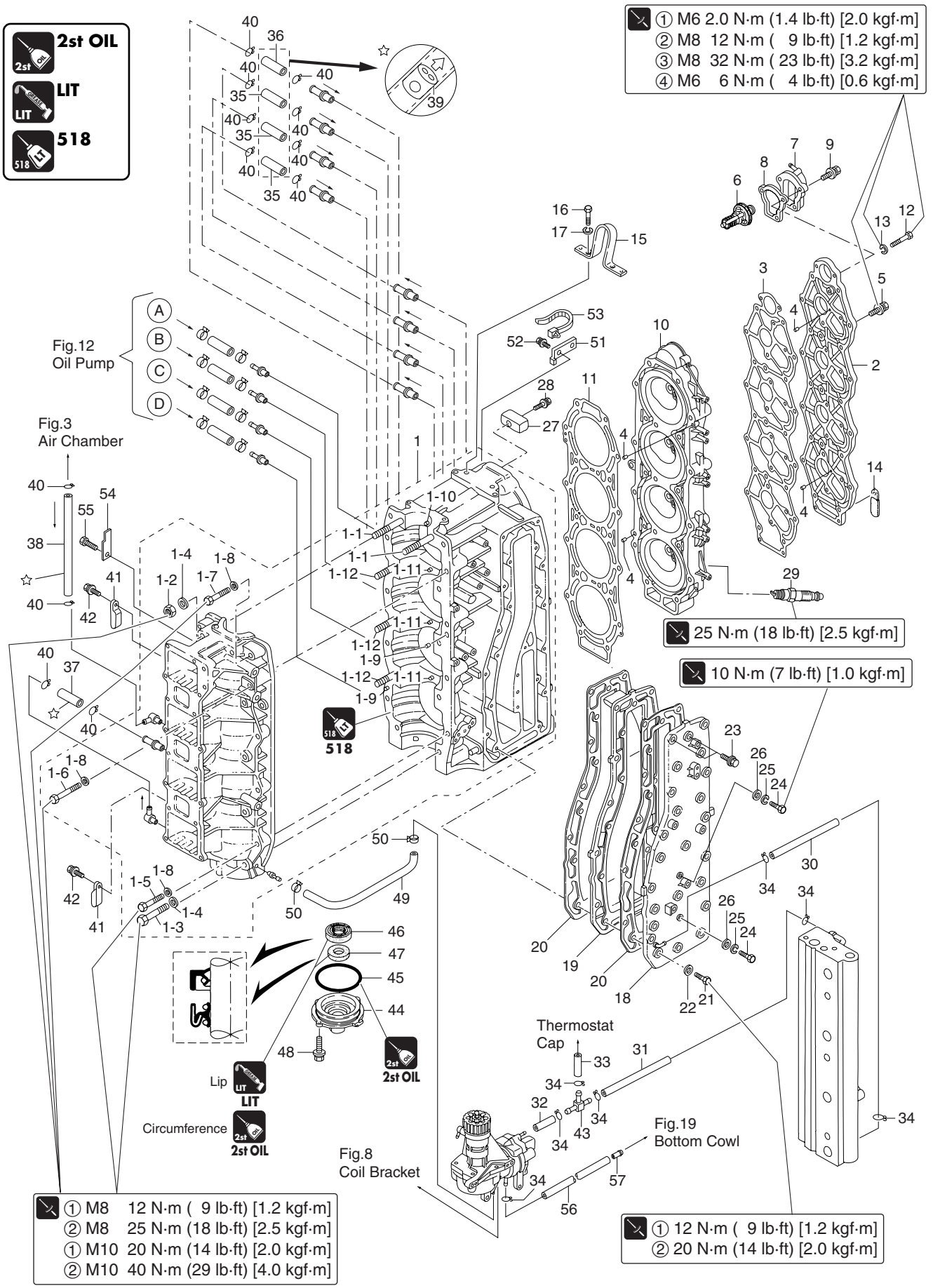
P/L Fig. 7



Ref. No.	Description	Q'ty	Remarks
1	Advancer Arm	1	
2	Bolt	1	M8 L=35mm W/SW
3	Washer, 8.5-24-1.5	2	
4	Bushing, 12-14-15.5	1	
5	Washer, 12.5-24-1	1	
6	Collar, 8.4-12-17	1	
7	Bolt	1	M6 L=12mm
8	Collar, 6.2-9-3	1	
9	Rod Snap, 5-3	2	
10	Throttle Link Rod	1	Old Part No. 3T9-63716-0
11	TPS Link Rod	1	
12	Cable Joint	1	
13	Washer, 8.5-18-1.6	1	or 353-83719-0
14	Snap Pin, d=8	1	
15	Throttle Body	1	
16	Throttle Cam	1	
17	Bolt	1	M6 L=25mm W/SW
18	Washer, 6.5-21-1	2	
19	Collar, 6.5-10.5-10	1	
20	Ball Joint "B"	1	
21	Nut	1	M6
22	Washer	1	M6
23	TPS	1	
23-1	Rubber Mount	3	
24	Collar, 4.2-6-10.5	3	
25	Screw	3	M4 L=20mm
26	Washer, 4.2-12.5-0.8	3	
27	Fuel Hose	1	
28	Lead Wire Band, 104	2	
29	Clip, ø7	1	
30	Throttle Body Gasket	1	**Do not reuse.**
31	Bolt, 8-25 Pre-coated	2	M8 L=25mm
32	TPS Decal	1	

Cylinder Crank Case

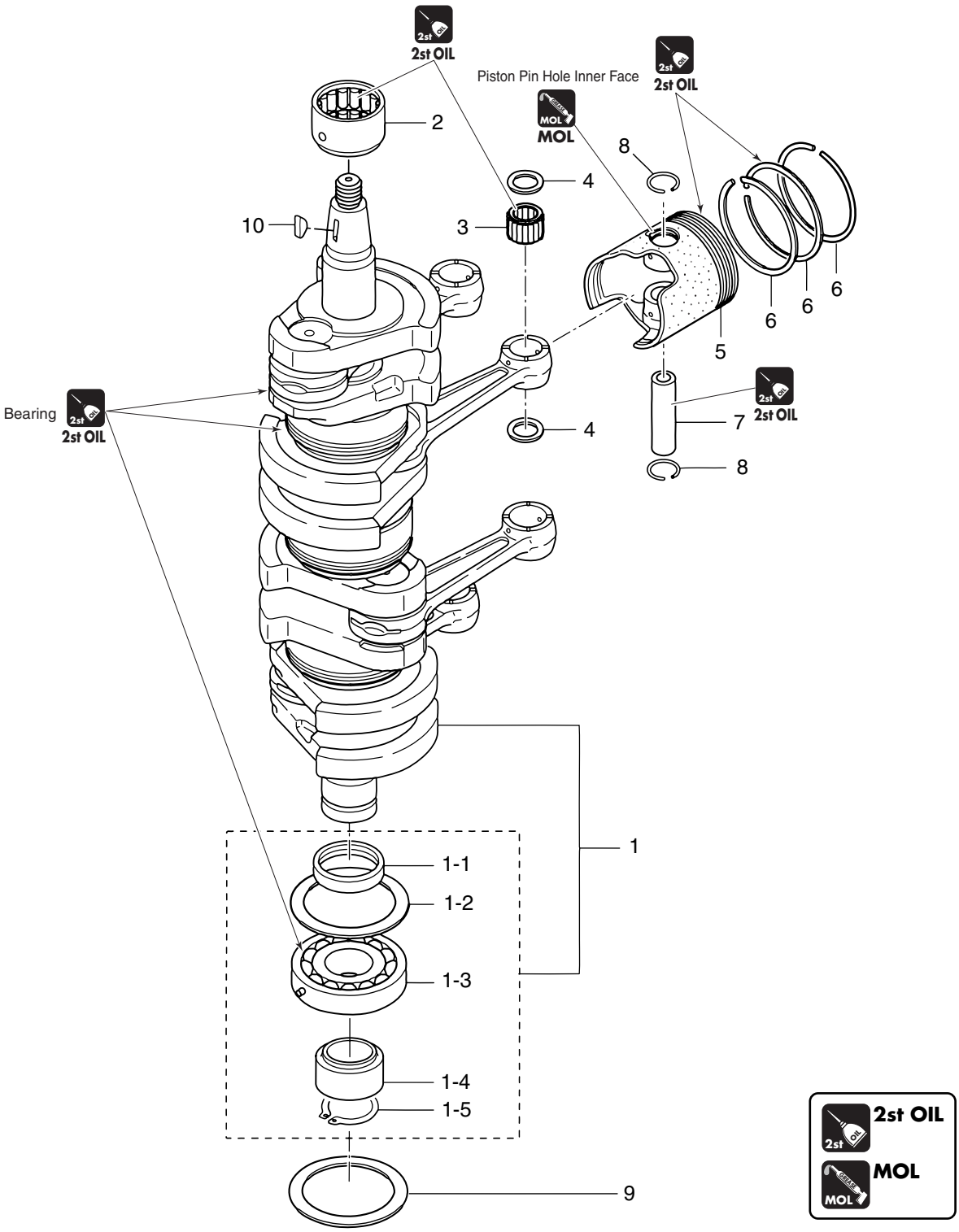
P/L Fig. 1



Ref. No.	Description	Q'ty	Remarks
1	Cylinder-Crank Case	1	
1-1	Stud Bolt	2	M10 L=65mm
1-2	Nut, 10-P1.25	5	M10 P=1.25mm
1-3	Bolt	5	M10 L=65mm
1-4	Washer, 10.5-20-3.2	10	
1-5	Bolt	9	M8 L=50mm
1-6	Bolt	1	M8 L=65mm
1-7	Bolt	2	M8 L=40mm
1-8	Washer, 8.5-19.5-3.2	12	
1-9	Dowel Pin, 6-12	2	
1-10	Main Bearing Dowel Pin	1	
1-11	Main Bearing Dowel Pin	3	
1-12	Stud Bolt	3	M10 L=55mm
2	Cylinder Head Cover	1	
3	Cylinder Head Cover Gasket	1	Do not reuse.
4	Dowel Pin, 4-10	4	
5	Bolt	10	M6 L=25mm W/SW&PW
6	Thermostat	1	
7	Thermostat Cap	1	
8	Thermostat Cap Gasket	1	Do not reuse.
9	Bolt	3	M6 L=40mm W/PW
10	Cylinder Head	1	
11	Cylinder Head Gasket	1	
12	Bolt	14	M8 L=75mm
13	Washer, 8.5-19.5-3.2	14	
14	Clamp, 8.5-85P	1	
15	Hanger	1	
16	Bolt	2	M8 L=20mm
17	Spring Washer	2	M8
18	Exhaust Cover (Outer)	1	
19	Exhaust Cover (Inner)	1	
20	Exhaust Cover Gasket	2	Do not reuse.
21	Bolt	21	M8 L=35mm
22	Washer	21	M8
23	Bolt	2	M8 L=40mm W/PW
24	Bolt	2	M6 L=30mm
25	Spring Washer	2	M6
26	Washer	2	M6
27	Anode	1	
28	Bolt	1	M6 L=30mm
29	Spark Plug	4	NGK : IZFR5J
30	Rubber Hose	1	I/D:ø5 L=360, Exhaust cover - Air rail
31	Rubber Hose	1	I/D:ø5 L=65, Air rail-T-nipple
32	Rubber Hose	1	I/D:ø5 L=65, T-nipple - Air compressor
33	Rubber Hose	1	I/D:ø5 L=115, T-nipple - Thermostat cap
34	Clip, ø10	7	
35	Lubrication Hose	3	I/D:ø4 L=80, Cylinder #1,2,3 (Starboard)
36	Lubrication Hose	1	I/D:ø4 L=480, Cylinder #4 (Starboard)
37	Lubrication Hose	1	I/D:ø4 L=300, Crank case (Starboard)
38	Lubrication Hose	1	I/D:ø4 L=280, Crank case (Starboard)
39	Check Valve	6	
40	Clip, ø7	12	
41	Clamp, 6.5-14L	2	
42	Bolt	2	M6 L=12mm W/SW
43	T-Nipple (with Valve)	1	
44	Crank Case Head	1	
45	O-Ring, 2-74.5	1	Do not reuse.
46	Oil Seal, 35-58-9	1	Do not reuse.
47	Oil Seal, 19.6-35-10	1	Do not reuse.
48	Bolt	2	M6 L=20mm W/PW
49	Oil Pipe	1	Compressor - #4 Crankcase
50	Clip, ø6.9	2	
51	Lead Wire Band Stay	1	
52	Bolt	1	
53	Lead Wire Band, 170	1	
54	Clamp	1	
55	Bolt	1	
56	Water Nipple Hose	1	
57	Water Nipple	1	

Piston & Crank Shaft

P/L Fig. 2



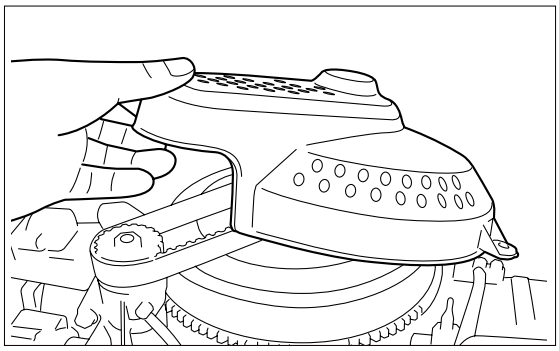
Ref. No.	Description	Q'ty	Remarks
1	Crank Shaft Ass'y	1	
1-1	Spacer, 40-52-7	1	
1-2	Washer, 66-85-2	1	
1-3	Ball Bearing, 6208	1	Do not reuse.
1-4	Spacer, 35-48.6-16	1	
1-5	C-Ring, d=35	1	
2	Main Bearing (Upper)	1	
3	Needle Bearing, 23-28-28	4	
4	Small End Bearing Washer	8	

Ref. No.	Description	Q'ty	Remarks
5	Piston (STD)	4	
	Piston (0.5mm O/S)	4	Option
6	Piston Ring (STD)	12	
	Piston Ring (0.5mm O/S)	12	Option
7	Piston Pin	4	
8	Piston Pin Clip	8	Do not reuse.
9	Washer, 66-85-2	1	
10	Magneto Key	1	

3. Inspection Items

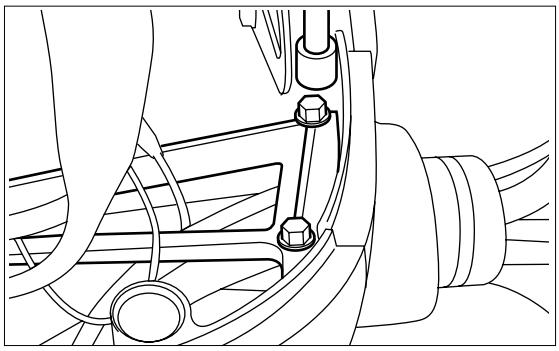
1) Removing Power Unit

1. Remove ring gear cover.

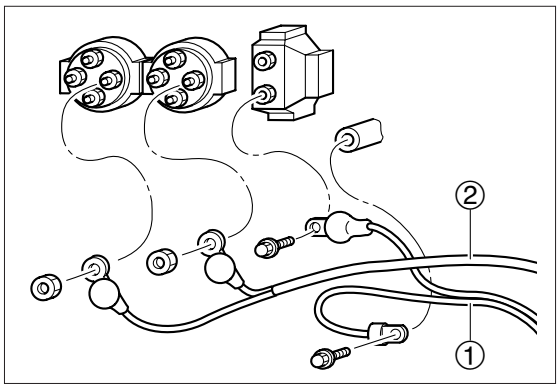


Disconnect battery cables from battery terminal.

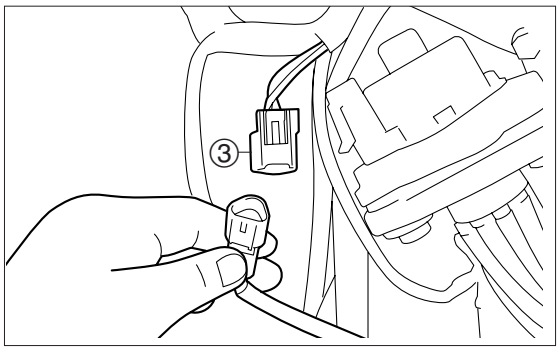
2. Remove clamps that secure shift cable and remote control cable from bottom cowl.



3. Remove bracket cover, and then, remove battery cables ① and PTT cable ② from solenoid switch and other parts.

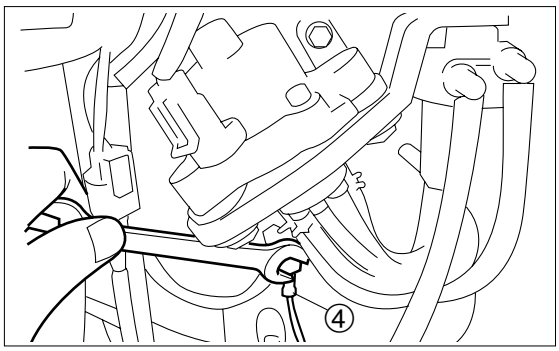


4. Disconnect connector ③ of PTT switch.

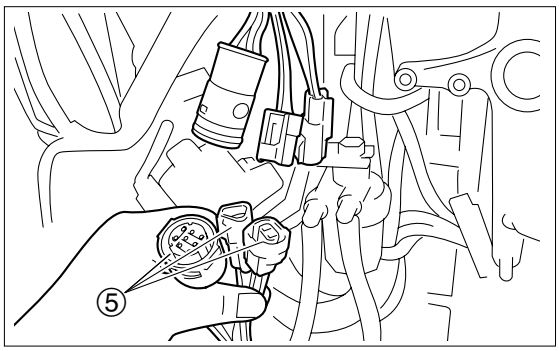


5

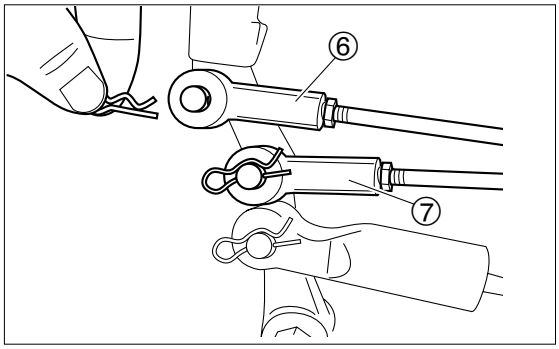
5. Disconnect earth wire ④ located below electric oil pump.



6. Disconnect remote control harness connectors ⑤.

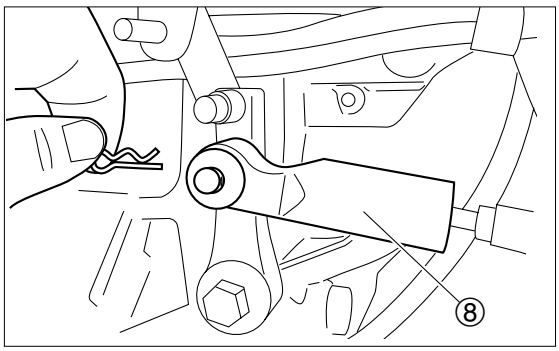


7. Remove "R" shaped pins and then throttle cable ⑥ and shift cable ⑦.

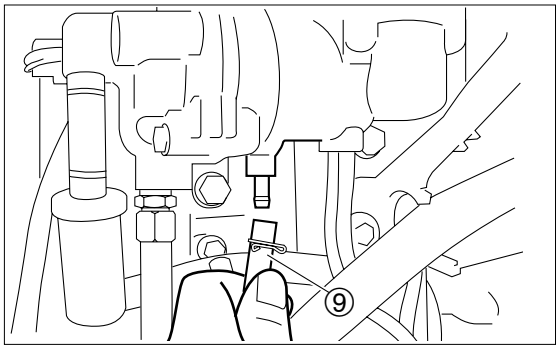


8. Remove shift assist ass'y ⑧ from shift arm.

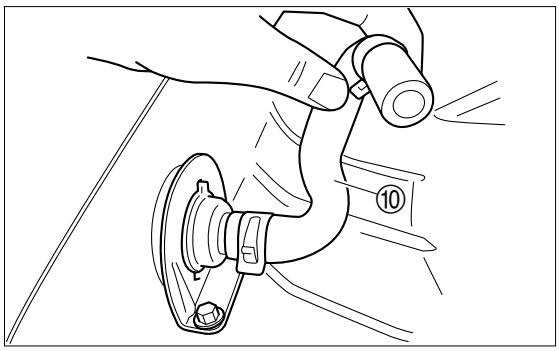
Be careful not to lose washers that are removed together with cables.



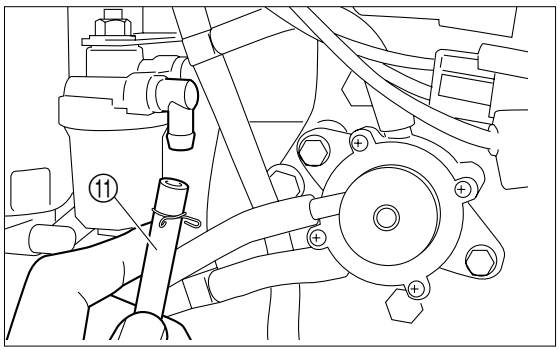
9. Loosen clip of cooling water check port hose ⑨ clip located below air compressor and disconnect the hose.



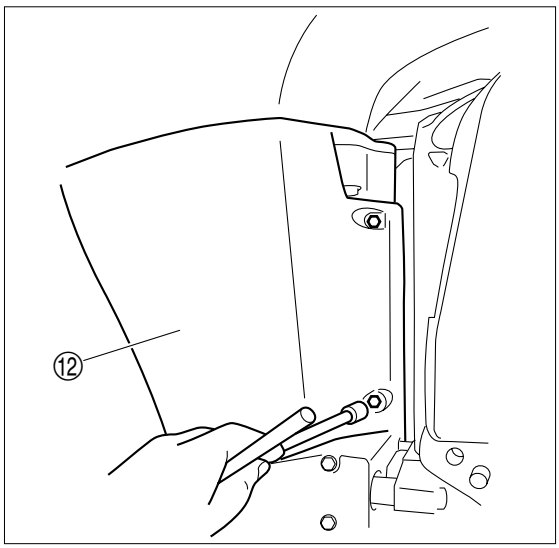
10. Disconnect hose ⑩ for flushing device located on the port side of bottom cowl.



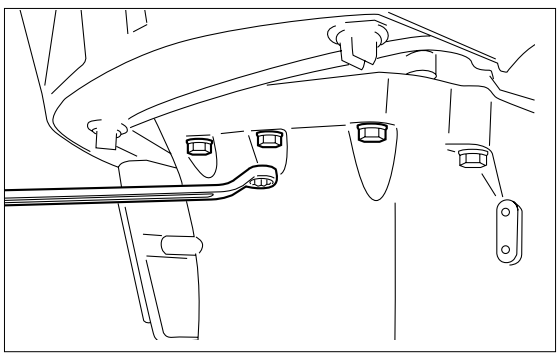
11. Disconnect fuel hose ⑪ from fuel filter.



12. Remove apron ⑫.



13. Loosen engine mount bolts and then remove them.

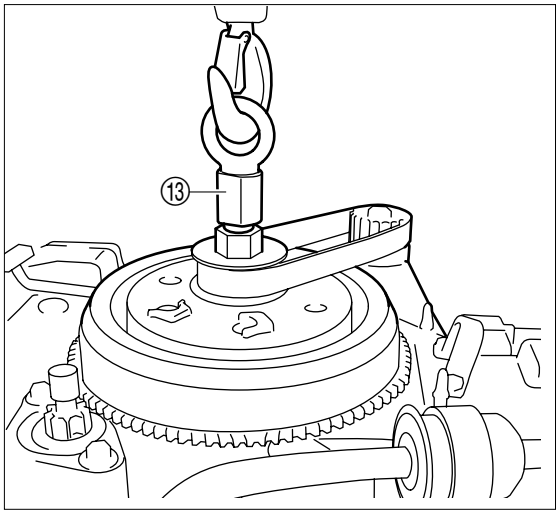


5

14. Hoist power unit by using eye bolt ⑬.

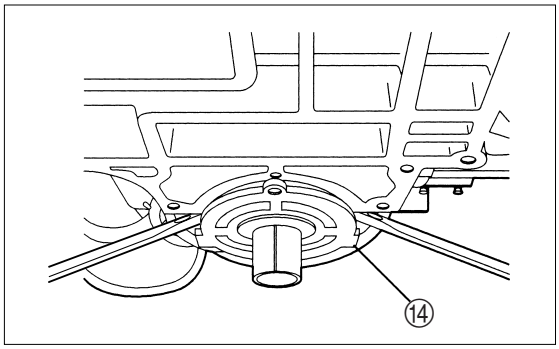
Eye Bolt ⑬ :
P/N. 3T1-72212-0

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



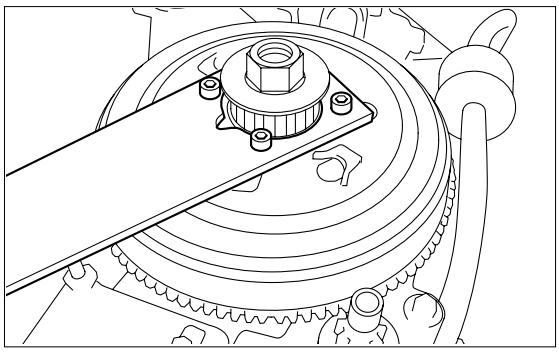
15. Remove 2-carank case bolts. Remove crank case head ⑭.

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

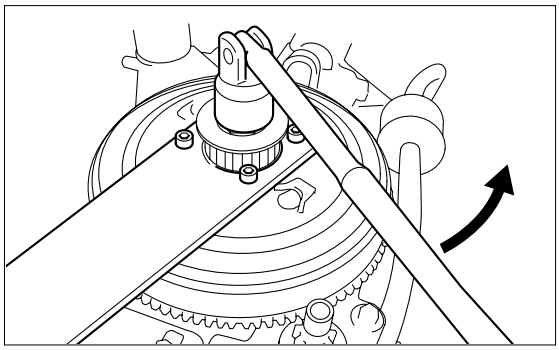


2) Removing Flywheel

1. Attach flywheel puller kit to flywheel.

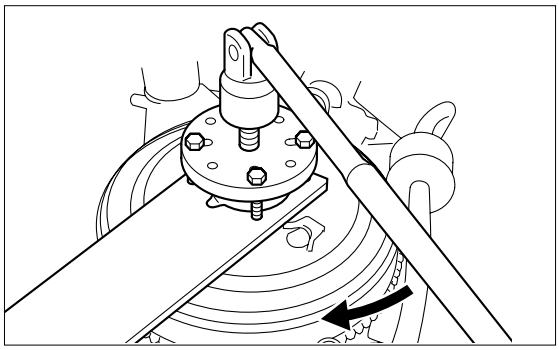


2. Fix flywheel puller, and loosen drive pulley (Magneto nut) and remove it.



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

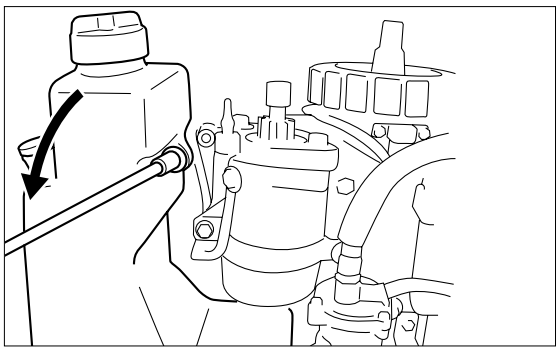
3. Remove magneto by using pressing bolt.



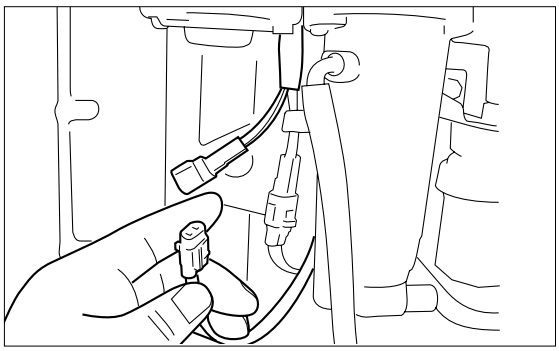
> Turn center bolt clockwise to remove flywheel.

3) Removing Stator Coil

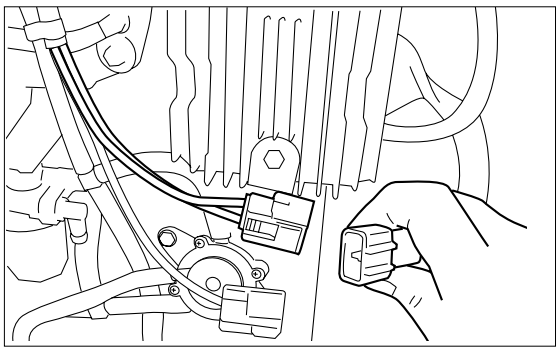
1. Remove oil tank installation bolt (upper one) and move oil tank a little.



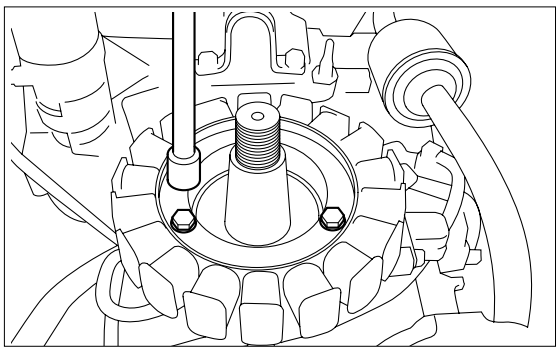
2. Disconnect CPS connector that is located in the back of oil tank.



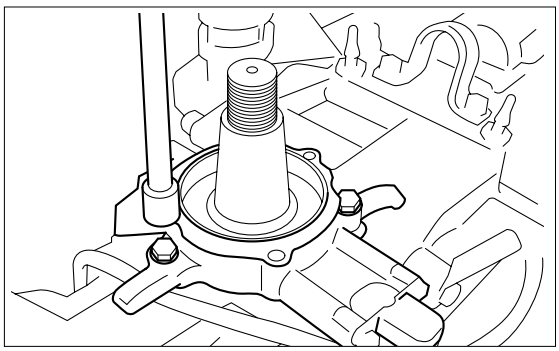
3. Disconnect alternator connectors.



4. Loosen alternator securing bolts and remove alternator.



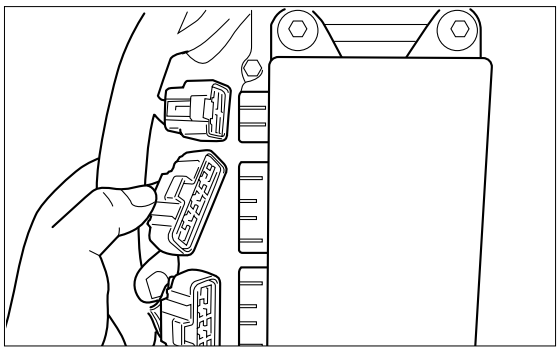
5. Loosen coil bracket securing bolts and remove bracket.



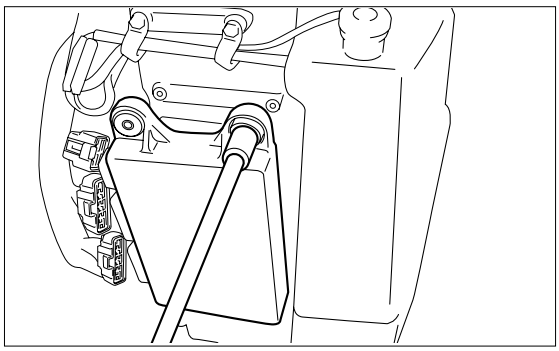
4) Removing Cord Ass'y

Removing ECU

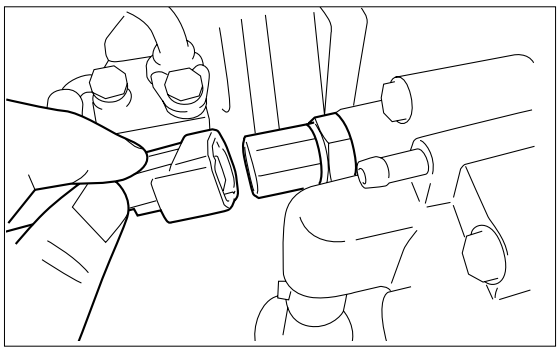
1. Disconnect ECU connectors while pushing hook of ECU connector and pull apart.



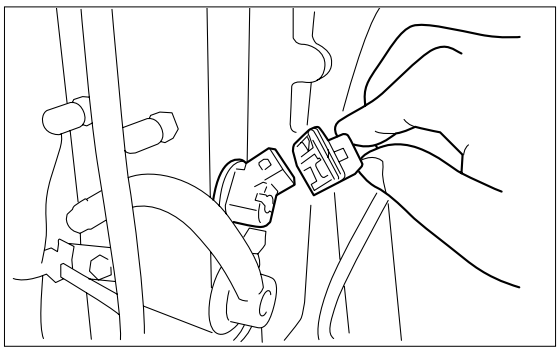
2. After removing top two ECU mount rubber bolts, remove ECU by pulling it upward.



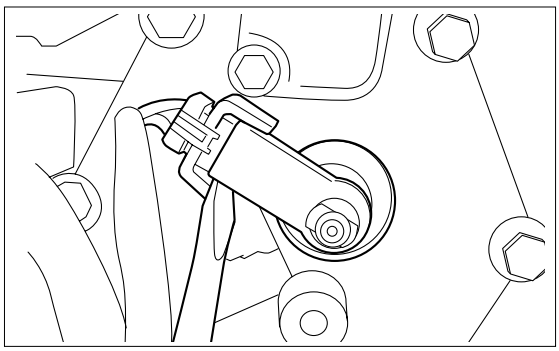
3. Disconnect air compressor water temperature sensor connector while pushing hook of the connector.



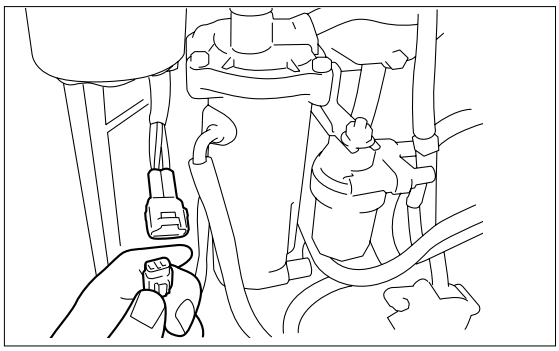
4. Disconnect fuel injector connector while pushing hook of the connector. Repeat this step for four cylinders.



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 four cylinders.

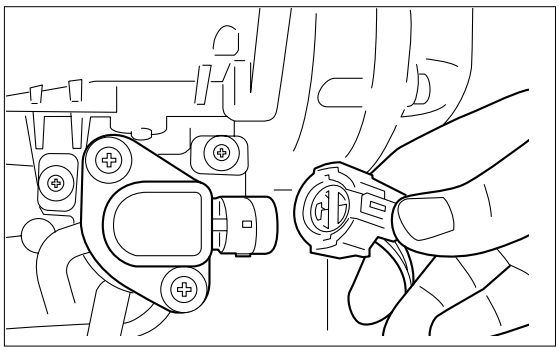


6. Disconnect FFP connector while pushing hook of the connector.

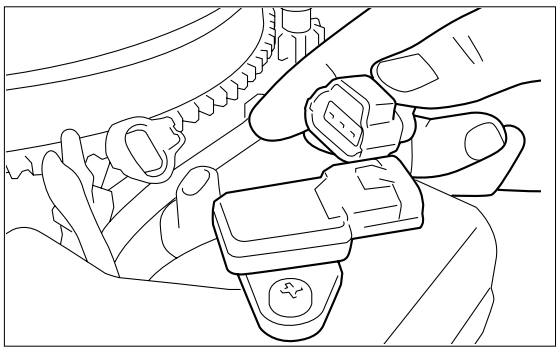


7. Disconnect TPS connectors while pushing hook of the connector.

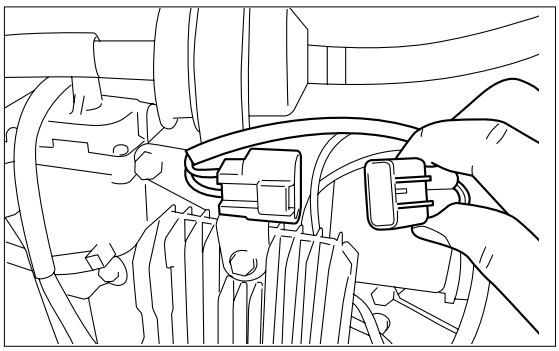
Connector on the front → Blue
Connector in the back → Gray



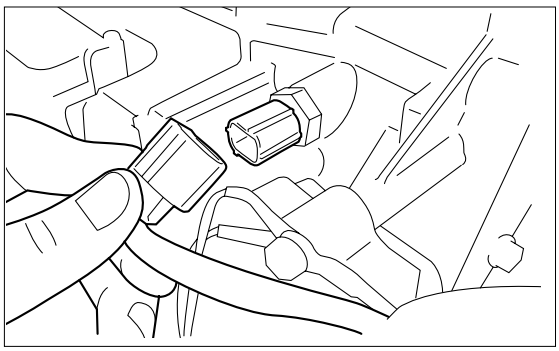
8. Disconnect MAP and MAT sensor connector while pushing hook of the connector.



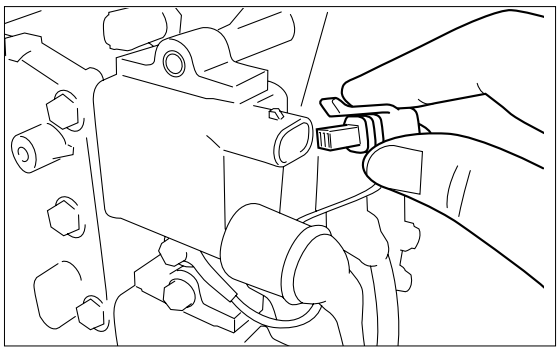
9. Disconnect rectifier connector while pushing lock of the connector.



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

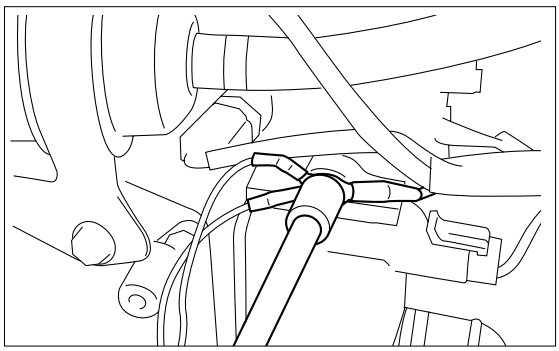


11. Disconnect ignition coil connector while pulling lock of the connector. Repeat this step for four cylinders.



Removing Ignition Coils

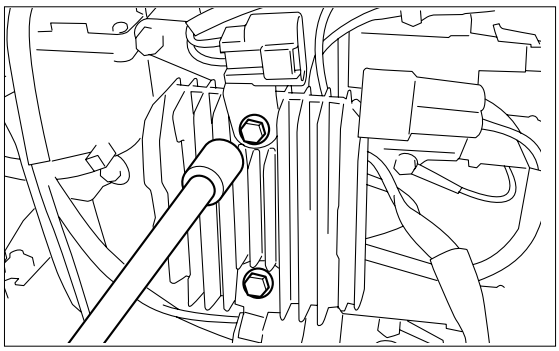
1. Loosen mounting bolt of ignition coils #1, #2, #3 and #4, and remove the coils.



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

Removing Rectifier

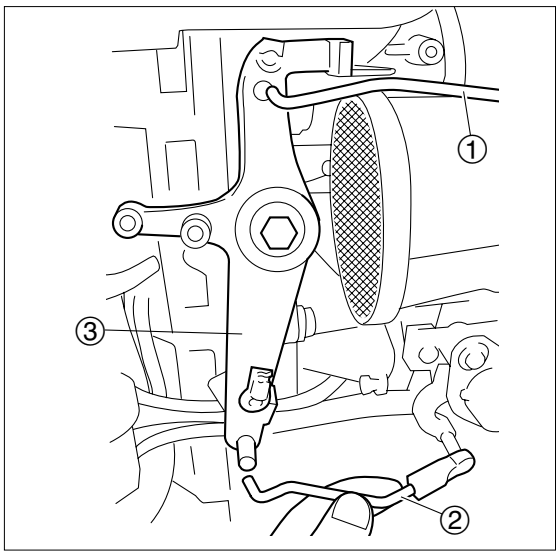
1. Loosen two rectifier mounting bolts and remove the unit.



> Rectifier plate is secured together with the unit.

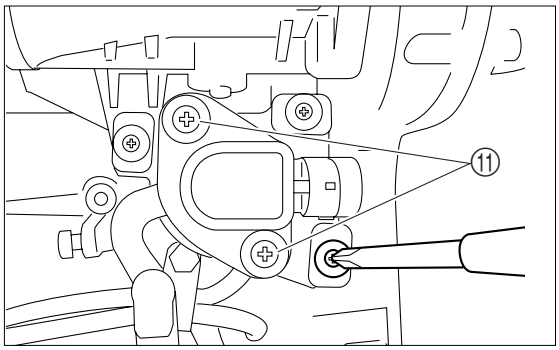
5) Removing Throttle Link

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.

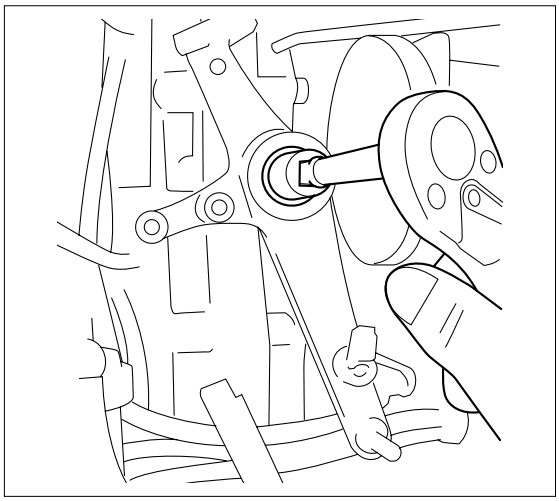
2. Remove throttle position sensor's lower mounting screw. That is rubber mounted.



⚠ WARNING

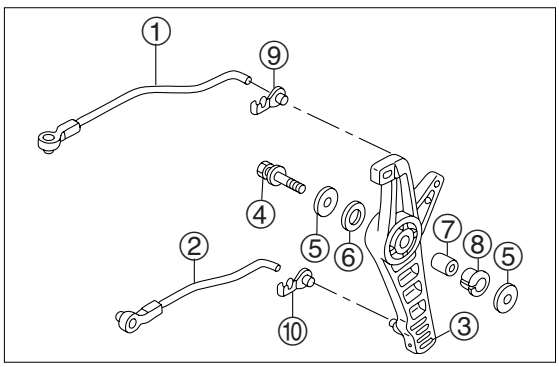
Remove only as an assembly.
Do not remove the two-philips screws ⑪ (with yellow paint that hold sensors together.)

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



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

Throttle Link Rod Snap ⑨
Rod Snap ⑩

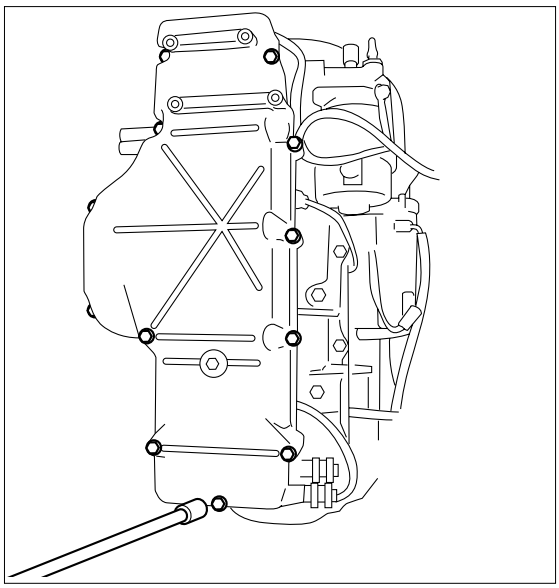


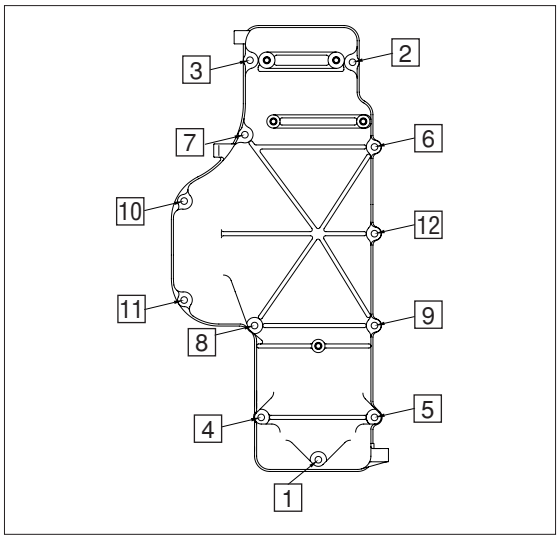
> Check link rod snap for wear and damage.

6) Removing Air Chamber

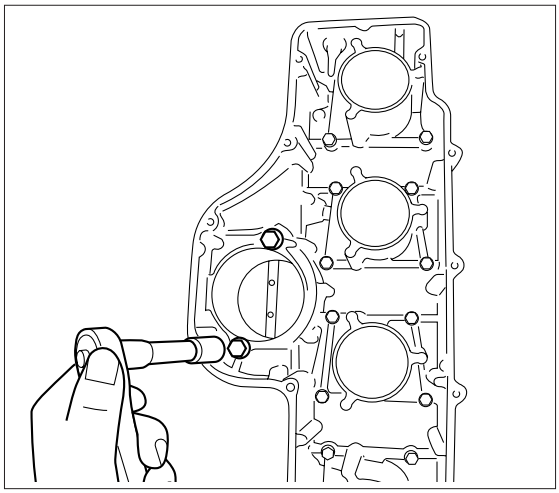
1. Loosen air chamber cover mounting bolts in the order shown, remove them, and remove air chamber cover.

> When air chamber cover is removed, the oil collected in the cover may flow out. Use rag to catch the oil.



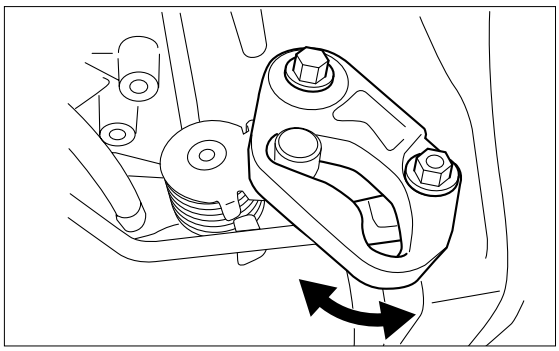


2. Loosen throttle body mounting bolt and remove the throttle body.



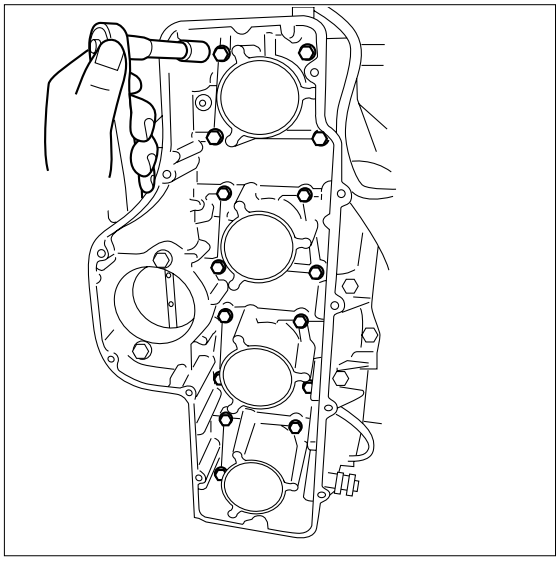
7) Inspection of Throttle Body

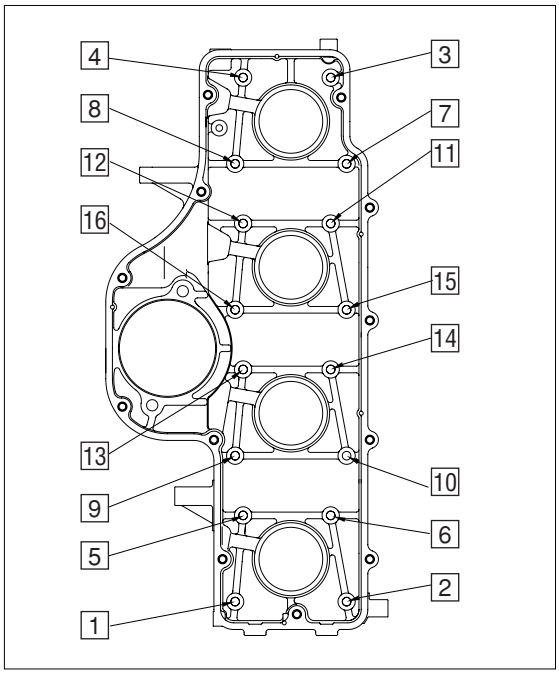
1. Check throttle body for wear of throttle cam and cam roller, and check if throttle cam and roller move smoothly.



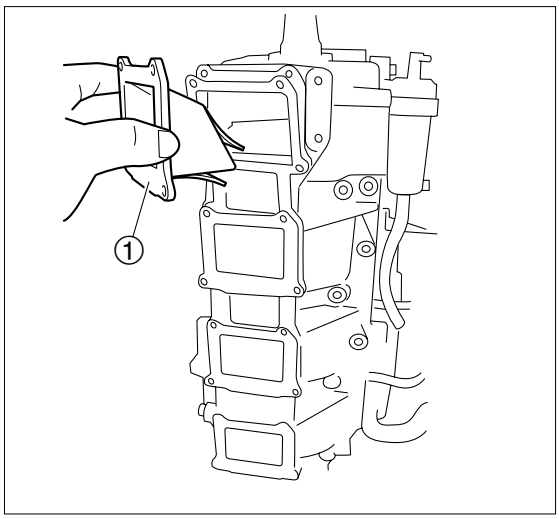
Do not move adjust screw located on the upper part of throttle body.

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



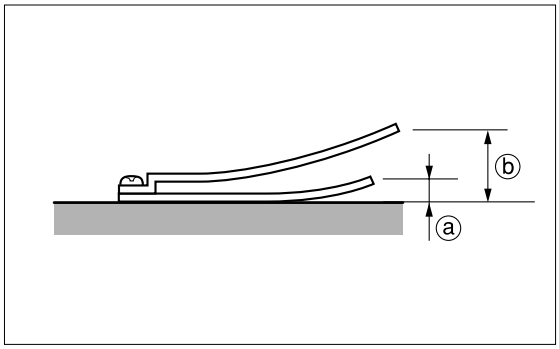


3. Remove air chamber and remove reed valve ass'y ①.



4. 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 ⓑ :
9.2 - 9.4 mm (0.362 - 0.370 in)
Reed Valve Bend ⓐ :
0.2 mm (0.008 in)



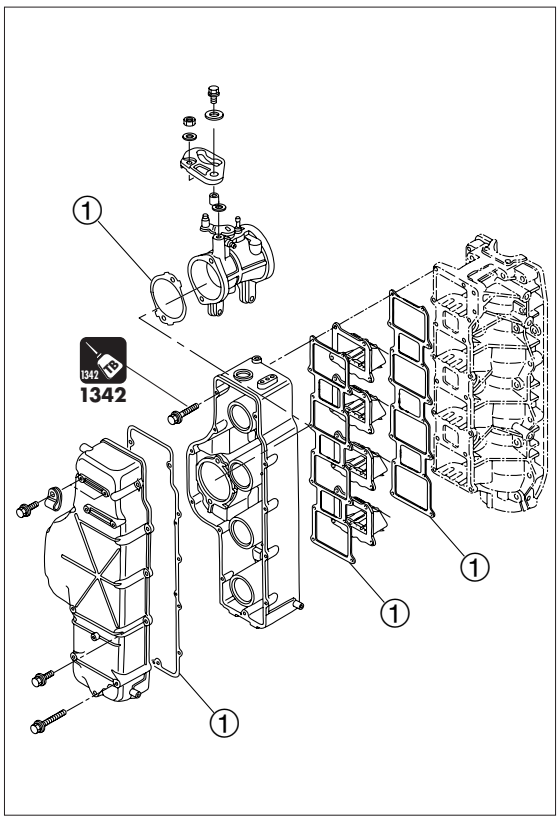
5. Assembling Air Box
   Assemble air box by reversing removal steps.

   1) When assembling, replace all gaskets with new ones.

   2) Replace mounting bolts with new ones, or when reusing mounting bolts, apply ThreeBond's thread lock #1342 to them.

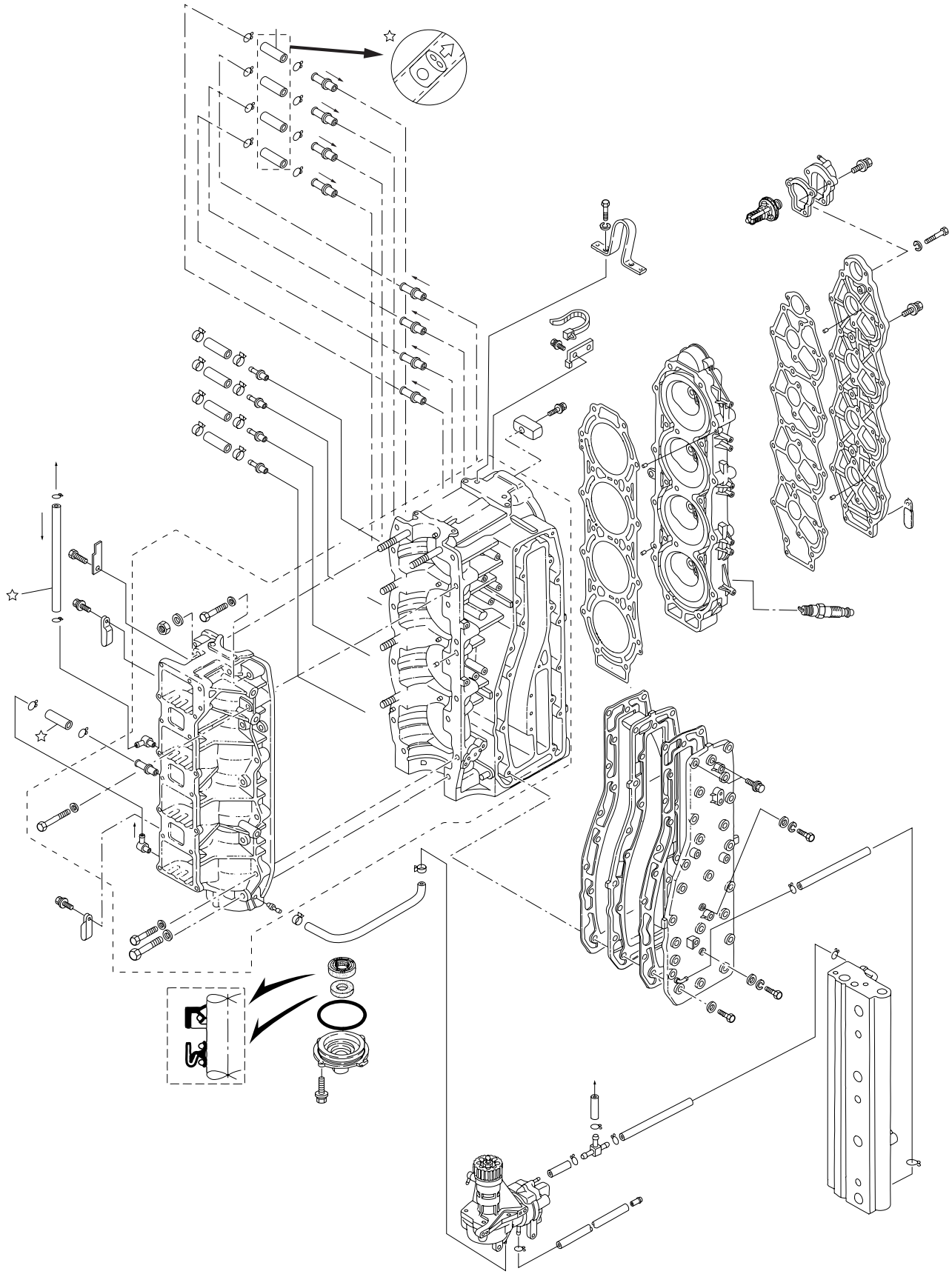
Air Chamber Cover Mounting Bolts :
9 N · m (7 lb · ft) [0.9 kgf · m]

Throttle Body Mounting Bolts :
15 N · m (11 lb · ft) [1.5 kgf · m]

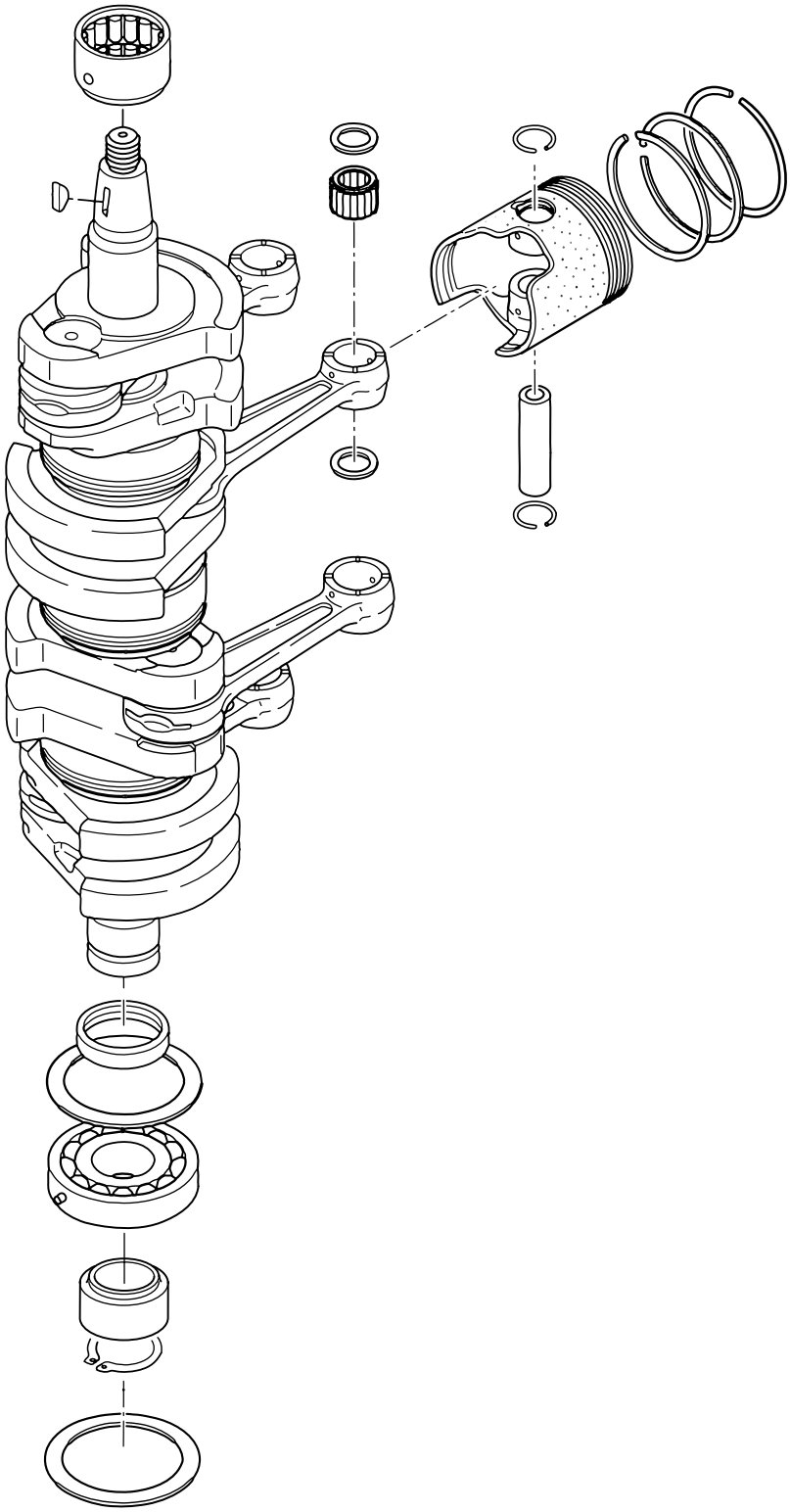


① Gasket **Do not reuse.**

Exploded Diagram of Short Block

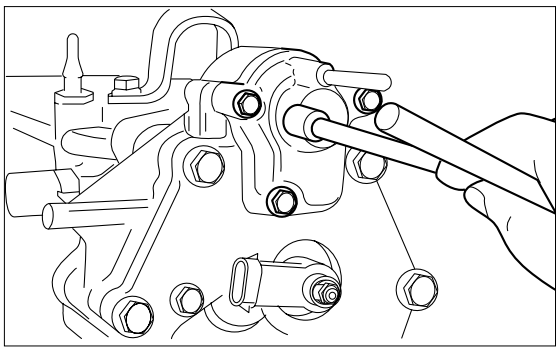


Exploded Diagram of Piston-Crank Shaft Assembly

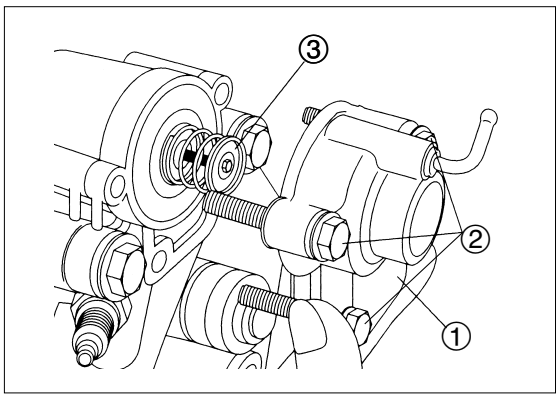


8) Removing Thermostat

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



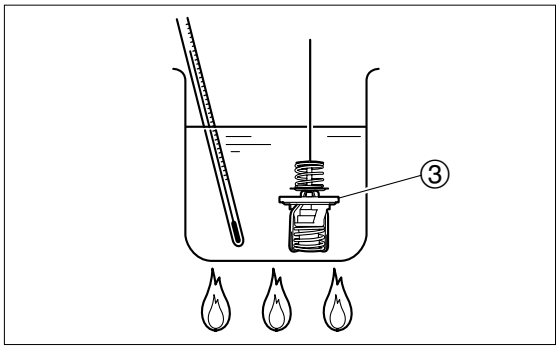
If thermostat cap is seized, tap lightly using a plastic hammer and then remove.



Inspection of Thermostat

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

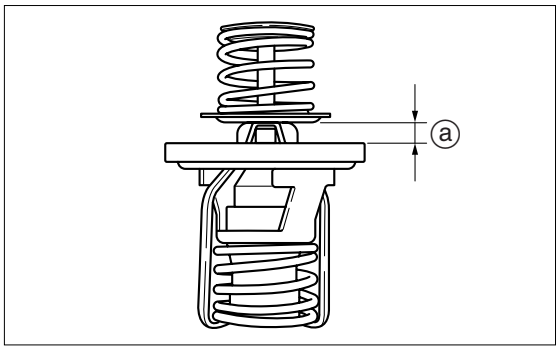
Valve Opening Temperature :
58.5 - 61.5˚C (136.5 - 143.5˚F)
Valve Full Open Temperature :
73.5 - 76.5˚C (163.5 - 170.5˚F)



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

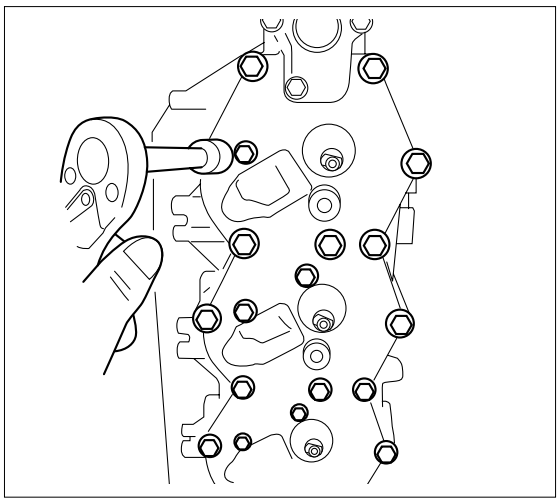
2. Measure valve lift of thermostat when prescribed temperature has been reached. Replace if the length is less than specified value.

Water Temperature	Valve Lift ⓐ
75˚C (167˚F)	4.5mm (0.177in) or over



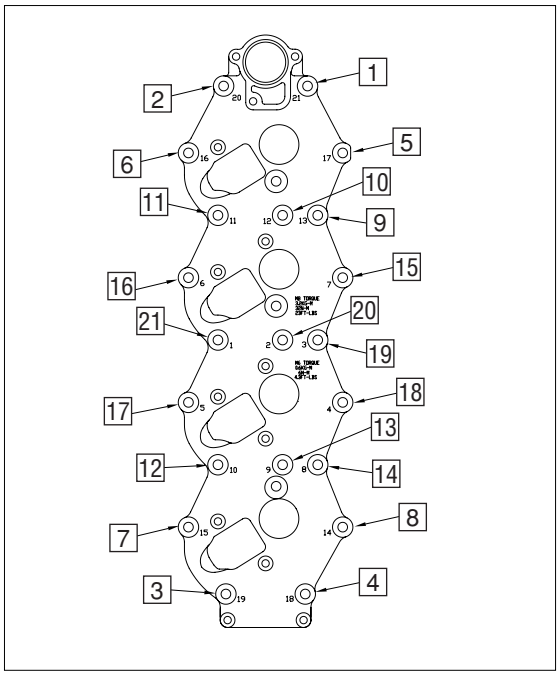
9) Removing Cylinder Head / Head Cover

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

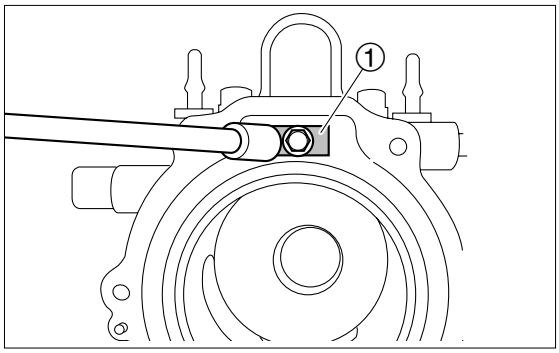


When loosening M8 bolts, loosen in descending order of the numbers shown embossed on the head cover.

Handle cylinder head / head cover taking care not to scratch their mating surfaces.



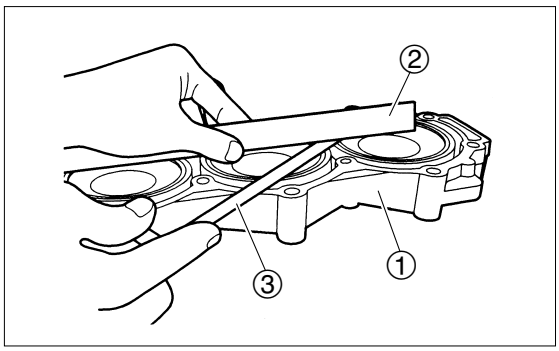
2. Remove engine anode ① and check it.



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

10) Inspection of Cylinder Head

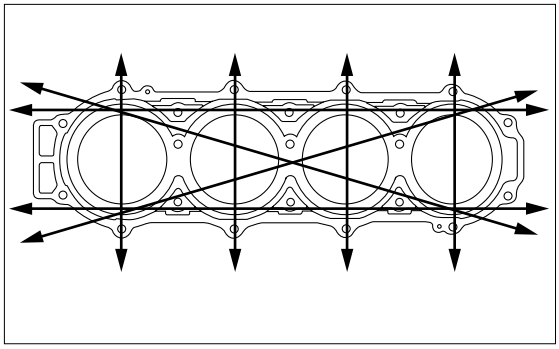
1. Remove carbon deposit in the combustion chamber of cylinder head, and check the interior for degradation, damage and other defects.



2. 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.

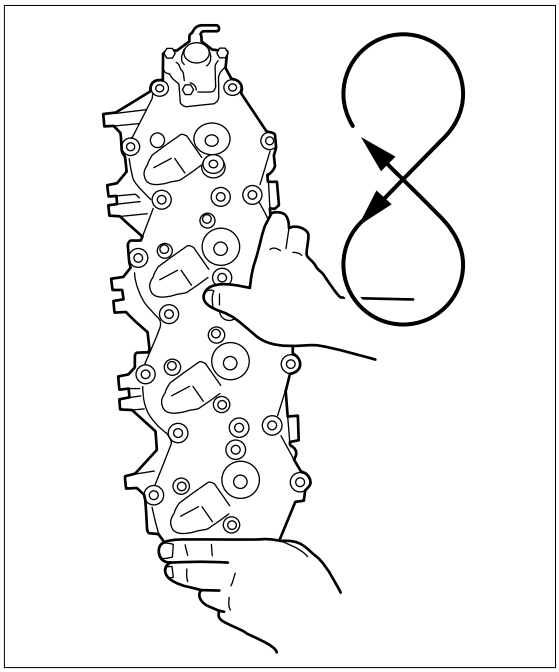
3. Use straight edge ② and thickness gauge ③ to check distortion of cylinder head 1 in the directions shown. Repair or replace if the distortion is over the specified limit.



Thickness Gauge :
Commercially Available Item

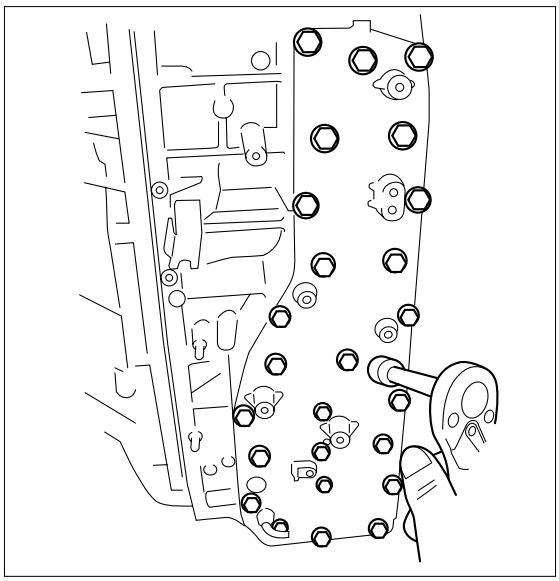
Functional Limit :
0.10 mm (0.004 in)

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 place glass and moving it on the paper drawing the letter “8" on it. Finish by using sand paper #600.

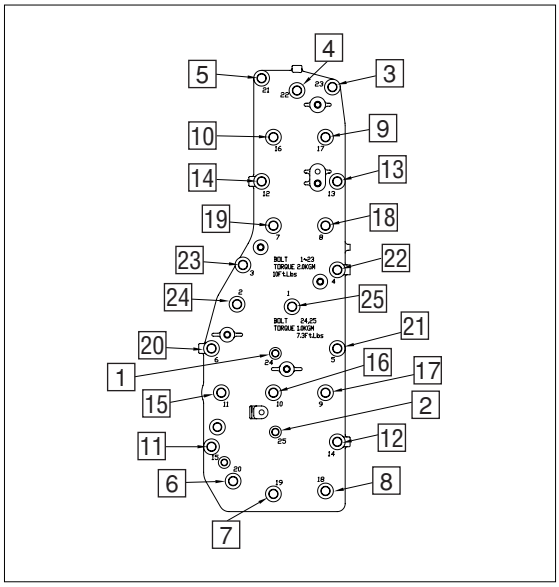


11) Removing Exhaust Cover

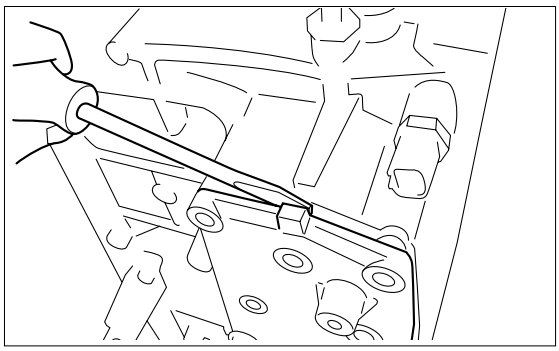
1. Loosen exhaust cover mounting bolts in the order shown, remove them, and remove exhaust cover.



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



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.



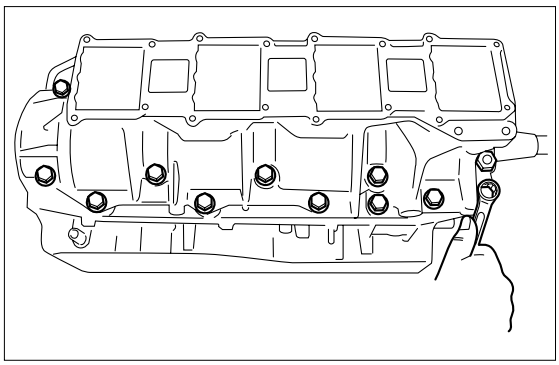
12) Inspection of Exhaust Cover

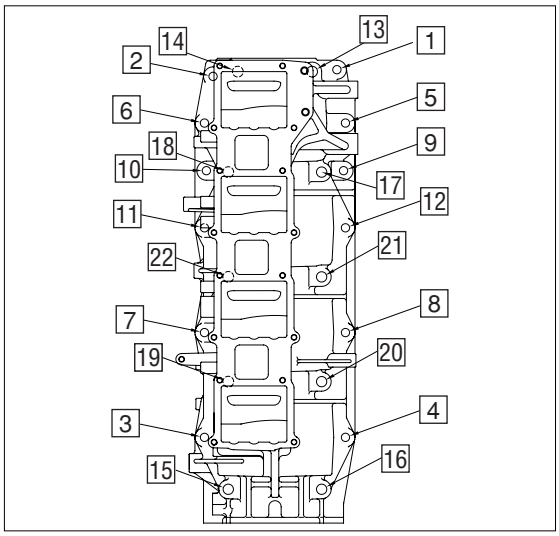
1. Check the removed outer exhaust cover and inner exhaust cover for damages such as distortion or scratches on their mating surface

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

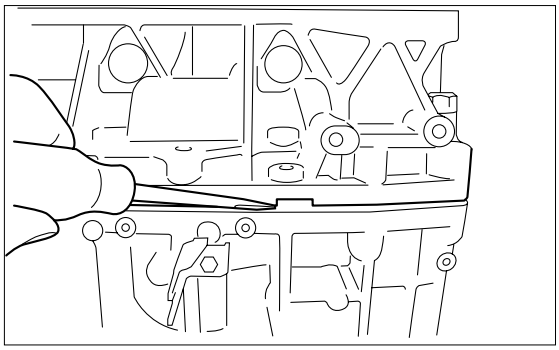
13) Removing Crank Case

1. Loosen crank case mounting bolts in the order shown, remove them, and remove crank case.



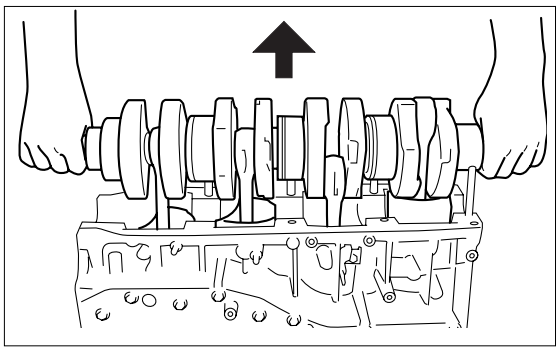


When removing crank case, pry the gap at the groove of crank case by using a bladed screw driver.



Note that there are two knock pins on the mating surface of crank case.

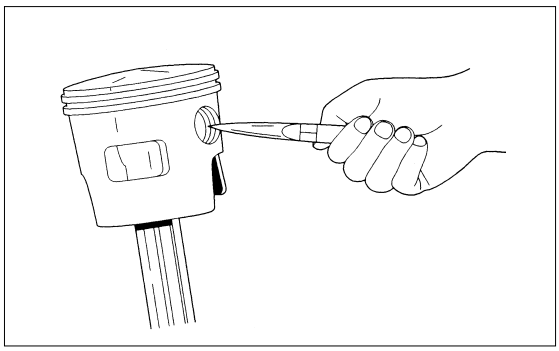
2. Remove crank shaft ass'y.
   Put a pipe of ø19mm (0.748 in) in the drive shaft side of crank shaft ass'y, hold the crank shaft ass'y using both hands, lift it in parallel with the cylinder block to remove taking care not to damage the piston rings.



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

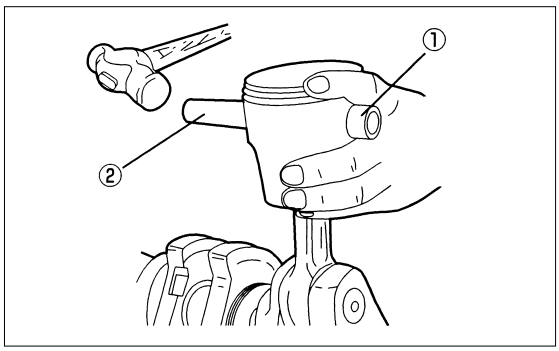
14) Removing Pistons

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



Remove another piston pin clip. Be careful not to damage the piston pin hole.

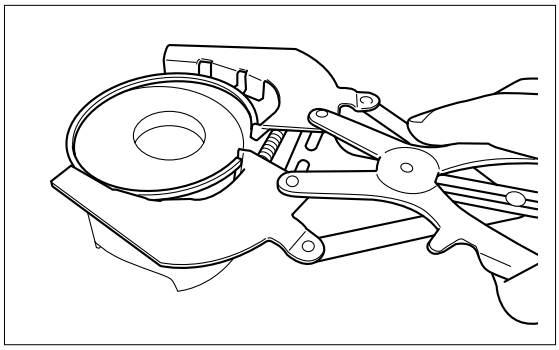
2. Remove piston pin ①.



Use piston pin tool if the pin cannot be removed with the pliers. Put the piston pin tool on the piston pin and tap is lightly taking care not to apply force to the connecting rod. Do not tap small end washer.

Piston Pin Tool ② :
P/N. 3T1-72215-0

3. Remove piston rings.
Use piston ring remover.



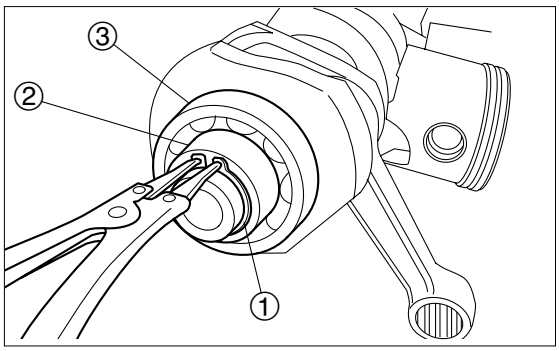
Piston Ring Tool :
P/N. 353-72249-0

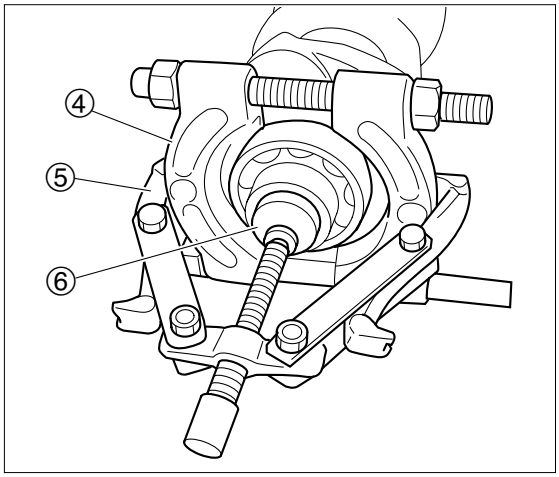
5

15) Disassembly of Crank Shaft

1. 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 :

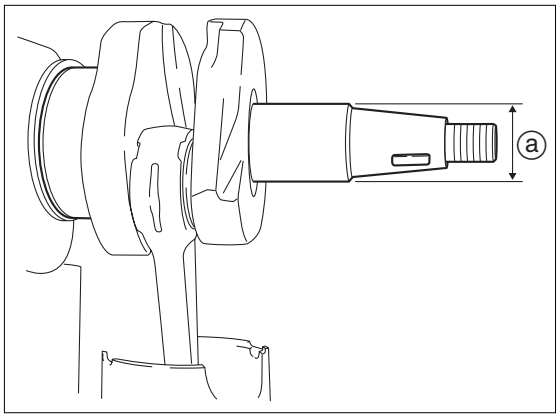


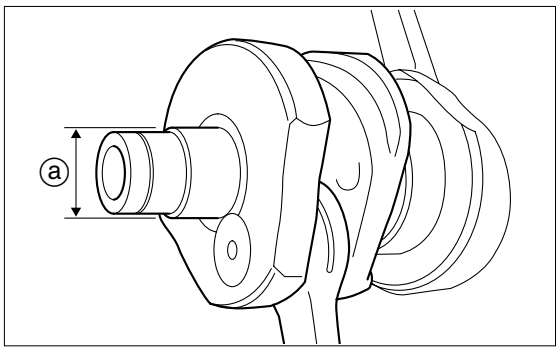


16) Inspection of Crank Shaft

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 ⓐ :
#1, Top ø40.0 mm (1.574 in)
#4, Bottom ø40.0 mm (1.574 in)



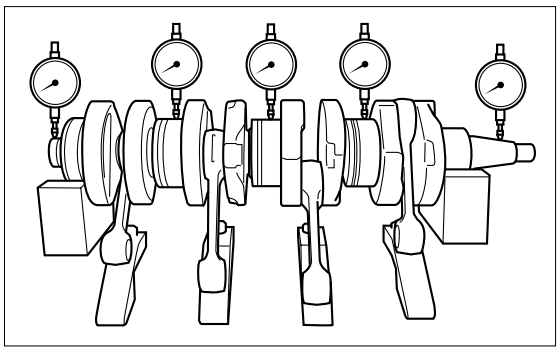


2. · Check if that main bearing rotates smoothly. Replace crank shaft ass'y if necessary.

· Measure crank shaft deflection. Replace crank shaft if the deflection is over the specified value.

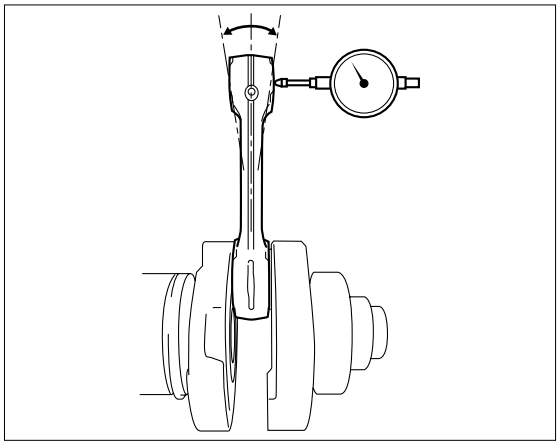
Dial Gauge ① : Commercially Available Item
V Block ② : Commercially Available Item

Crank Shaft Deflection Limit :
0.05 mm (0.0020 in)



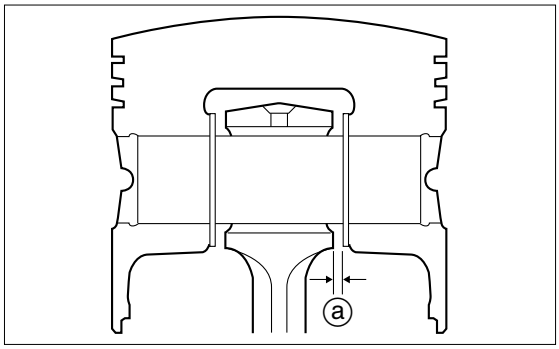
3. Replace crank shaft ass'y if the deflection is over the standard value.

Connecting Rod Deflection Limit :
2.0 mm (0.0800 in)



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

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



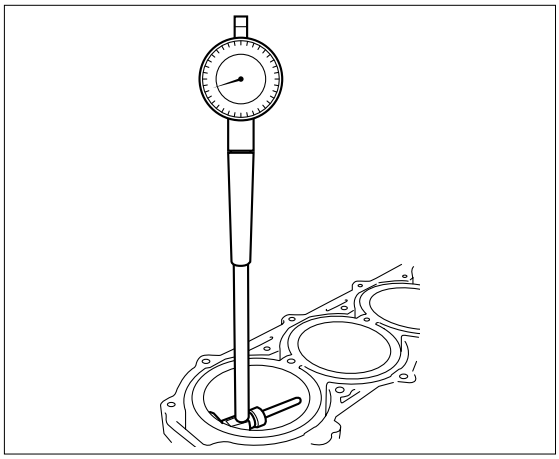
17) Inspection of Engine Parts

1. Inspection of Cylinder

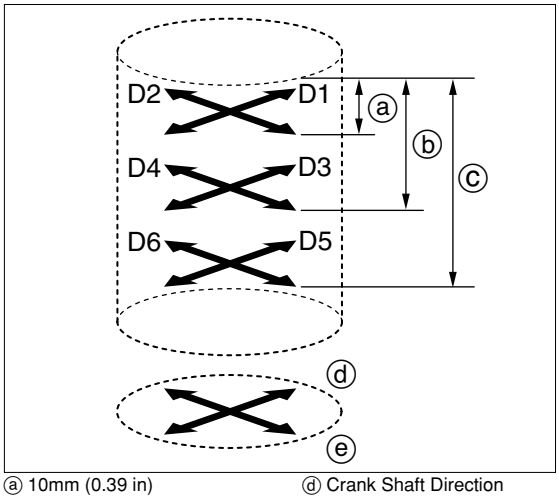
1) Measure cylinder inner diameters (D_1 - D_6) at ⓐ, ⓑ and ⓒ.
If any of the diameter is over the limit, replace the cylinder or bore the liner to make it compatible with an oversize piston.

Cylinder Inner Diameters (D_1 - D_6) : Standard Value
88.02 mm (3.4654 in)
Oversize Piston :
88.52 mm (3.4850 in)

Functional Limit :
88.08 mm (3.4677 in)
Oversize Piston :
88.56 mm (3.4866 in)



- Measure at the area of the largest wear. The measurement heights ⓑ and ⓒ represent location 5 mm above and below exhaust port. ⓓ represents diameter in crank shaft direction, ⓔ 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.

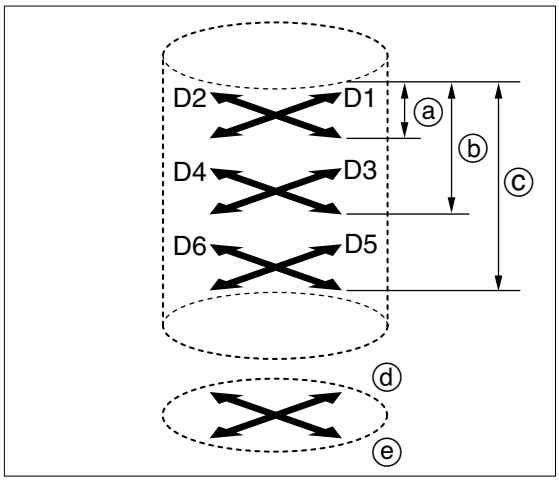


ⓐ 10mm (0.39 in)
ⓑ 30mm (1.18 in)
ⓒ 80mm (3.15 in)
ⓓ Crank Shaft Direction
ⓔ Crank Web Direction

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 :
D_1-D_5 (Measurement Point) ⓐ
D_2-D_6 (Measurement Point) ⓒ

Functional Limit of taper :
0.08 mm (0.0032 in)



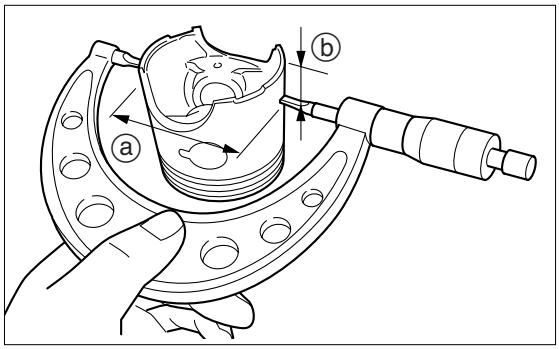
ⓐ 10mm (0.39 in)
ⓑ 30mm (1.18 in)
ⓒ 80mm (3.15 in)
ⓓ Crank Shaft Direction
ⓔ Crank Web Direction

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
(D_2-D_1)
(D_4-D_3)
(D_6-D_5)

Functional Limit of out-of-roundness :
0.05 mm (0.0020 in)

18) 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 ⓑ :
11.5 mm (0.45 in) above bottom end of piston skirt. approximately 90 degrees from pin hole.
Standard Value ⓐ :
Standard Piston : 87.86 mm (3.4590 in)
Oversized Piston : 88.36 mm (3.4787 in)

Functional Limit ⓐ :
Standard Piston : 87.78 mm (3.4559 in)
Oversized Piston : 88.28 mm (3.4756 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 : 0.15 - 0.21 mm (0.0059 - 0.0083 in)

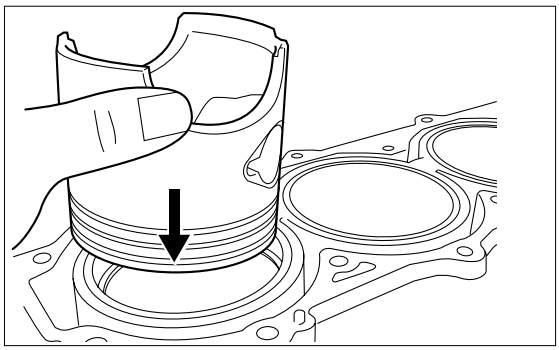
Functional Limit :
0.30 mm (0.0118 in)

Calculation of Piston Clearance :
Cylinder Inner Diameter - Piston Outer Diameter

Use the maximum value of the cylinder inner diameter measured.

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.

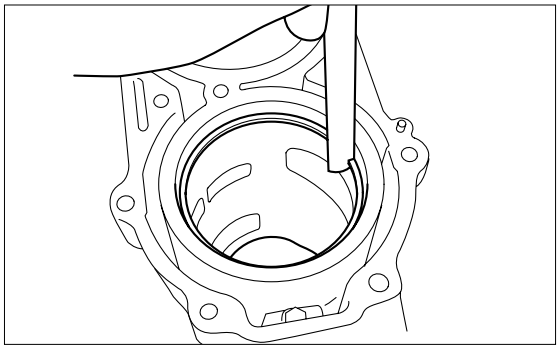
Thickness Gauge :
Commercially Available Item

Piston Ring End Gap : Standard Value

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

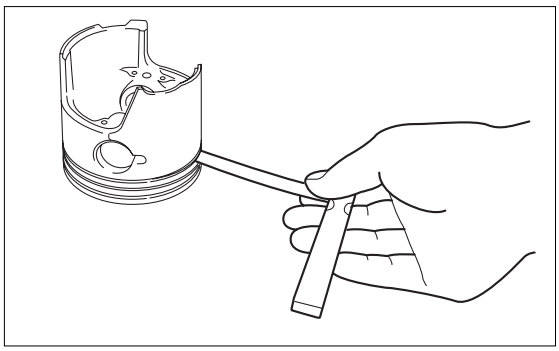
Functional Limit :

ⓐ Top Ring ⓑ Second Ring ⓒ Third Ring	0.8 mm (0.0315 in)



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.



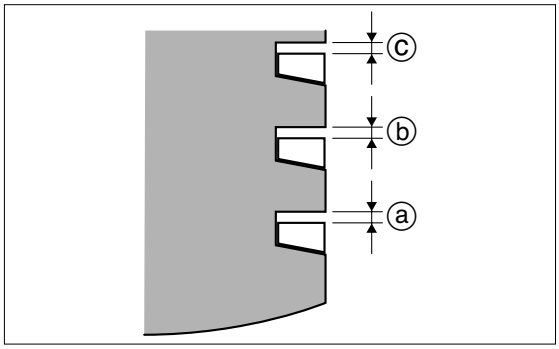
Piston Ring Tool :
P/N. 353-72249-0

Piston Ring Side Clearance :
Standard Value :

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

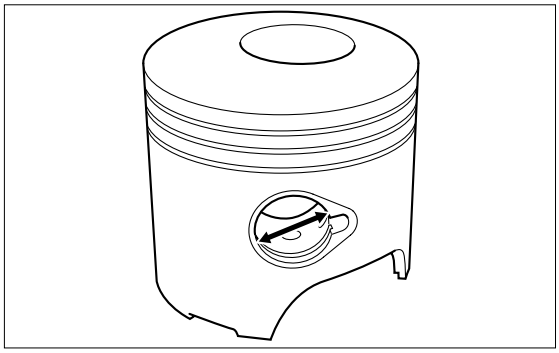
Functional Limit :

ⓐ Top Ring ⓑ Second Ring ⓒ Third Ring	0.10 mm (0.0039 in)



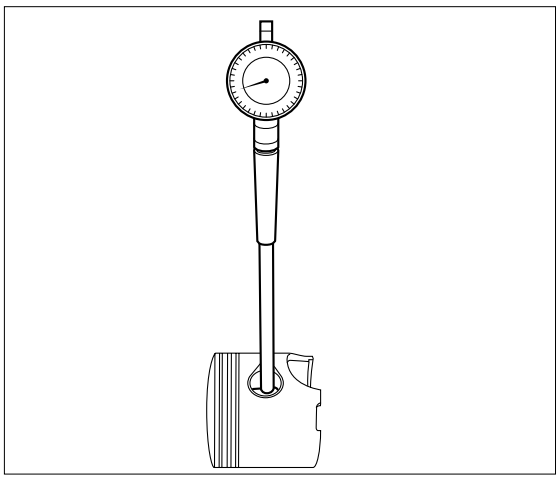
5. Inspection of Piston Pin Hole

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



Piston Pin Hole : Standard Value
23.02 mm (0.9063 in)

Functional Limit :
23.03 mm (0.9067 in)



6. Inspection of Piston Pins

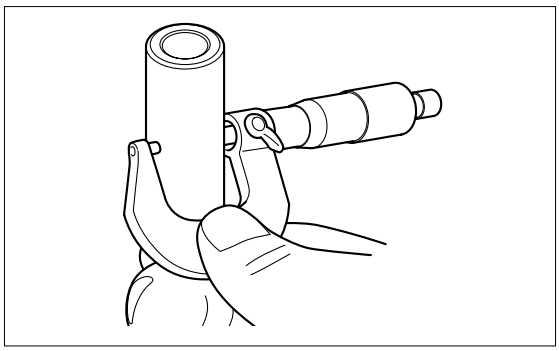
Measure piston pin outer diameter, and replace piston pin if the outer diameter is over the limit.

Piston Pin Outer Diameter : Standard Value
23.00 mm (0.9056 in)

Functional Limit :
22.97 mm (0.9045 in)

Measuring Locations :

D_1 and D_3	10 mm (0.394 in) from top end and bottom end respectively
D_2	35 mm (1.378 in) from the end



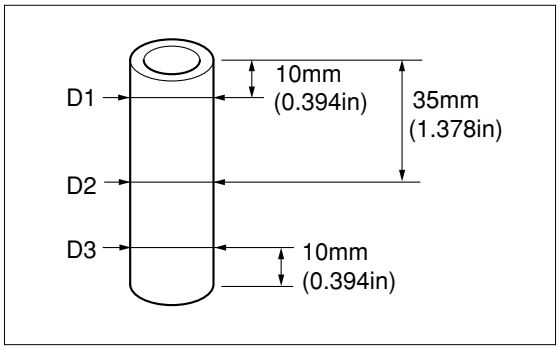
7. Inspection of Piston Pin Clearance

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

Calculation of Piston Pin Clearance :
Piston Pin Hole Inner Diameter - Piston Pin Outer Diameter

Standard Value :
0.015 - 0.025 mm (0.00059 - 0.00098 in)

Functional Limit :
0.040mm (0.0016 in)

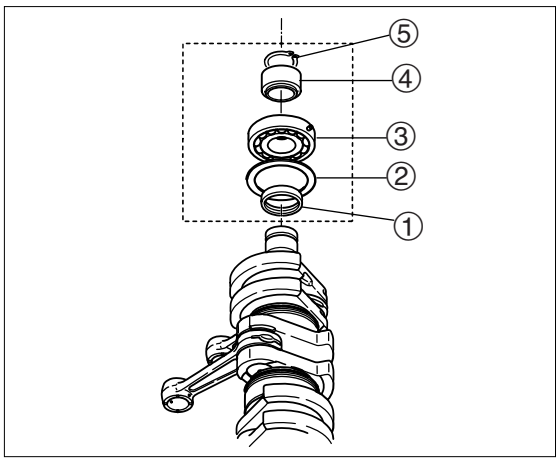


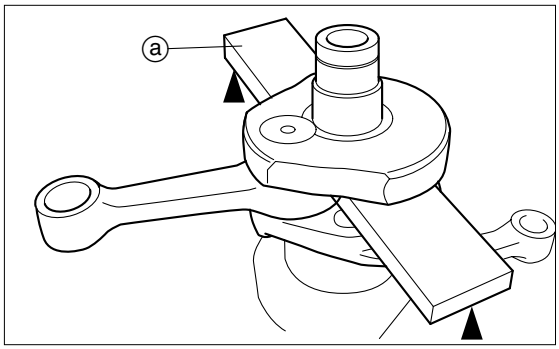
Use the maximum values of piston pin hole inner diameters and piston pin outer diameters measured respectively.

5

19) Assembling Crank Shaft

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

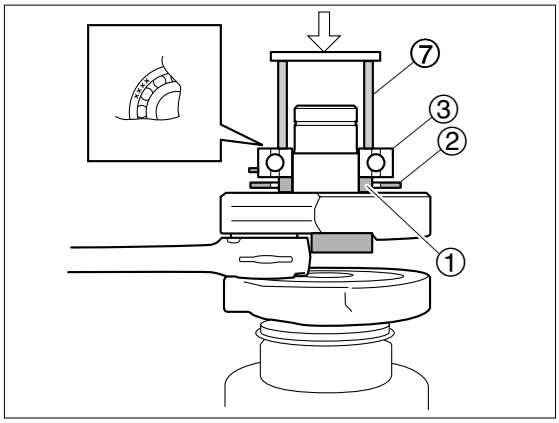




Attach spacer 40-52-7 ① and washer 66-85-2 ② and then press-fit bearing 6208 ③.

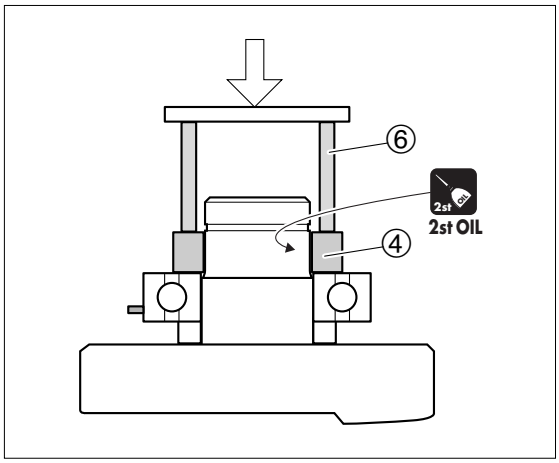
Bearing Press-Fitting Tool ⑦ :
Inner Diameter: ø45 mm (1.575 in)

Do not reuse removed bearing.



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

Spacer Press-Fitting Tool ⑥ :
Inner Diameter: ø36 mm (1.417 in)

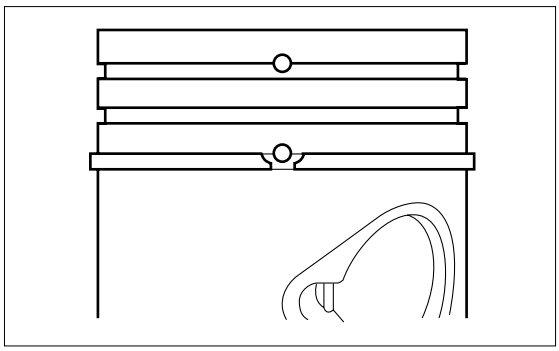


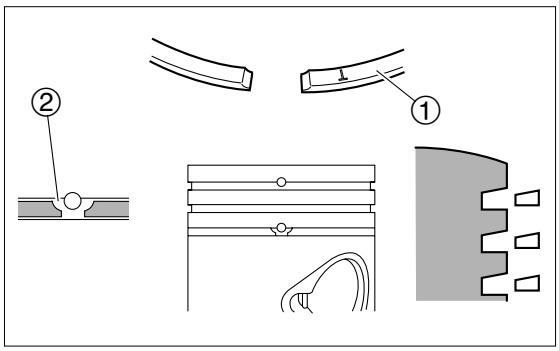
20) Installing Pistons

1. Installation of Piston Rings

   Complete 3rd piston 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.

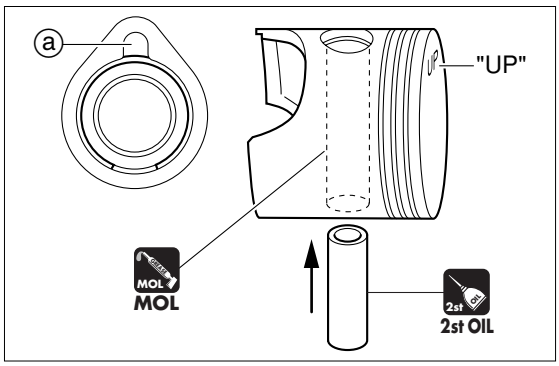




2. Installation of Piston Pin

   Attach piston to 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 ⓐ located in the piston pin clip groove.

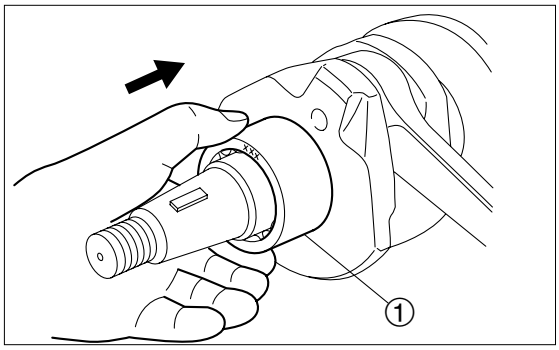


- When a new piston is used, apply molybdenum grease (Moly-paste 500) to piston pin hole and two-stroke engine oil to piston pin.

5

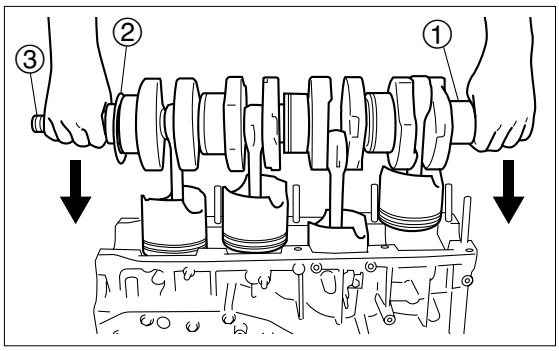
21) Assembling Power Unit Parts

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



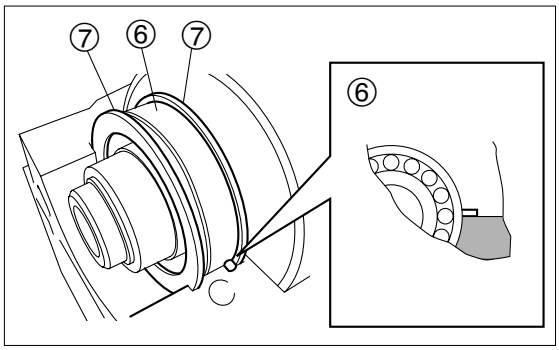
> Face the marking on the bearing to flywheel side.

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

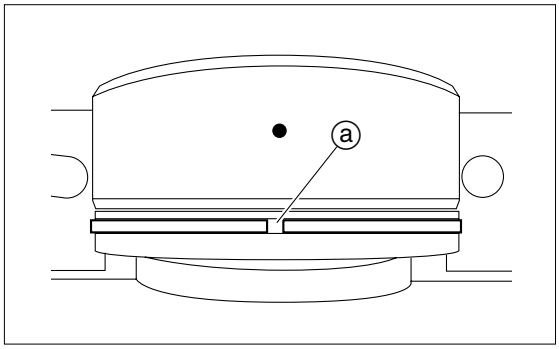


> · When installing crank shaft ass'y, lower the ass'y gradually so that crank shaft is held parallel with the cylinder face.
> · Insert pistons one by one while confirming that each piston enters vertically in the cylinder liner. Pistons can be inserted easier while moving them up and down a little.
> · Put a piece of round bar or pipe ③ of ø19 mm (0.75 in) in the drive shaft opening to make it easier to hold.

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



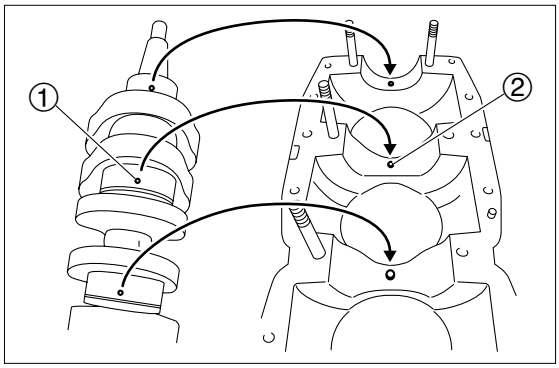
4. Bring seal ring gap ⓐ to crank case side center.



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

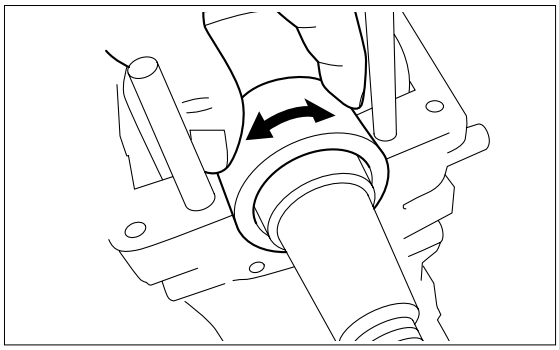
5. Repositioning Crank Shaft Ass'y

Reposition crank shaft ass'y attached to cylinder by bringing main bearing holes ① to cylinder dowel pins ②.

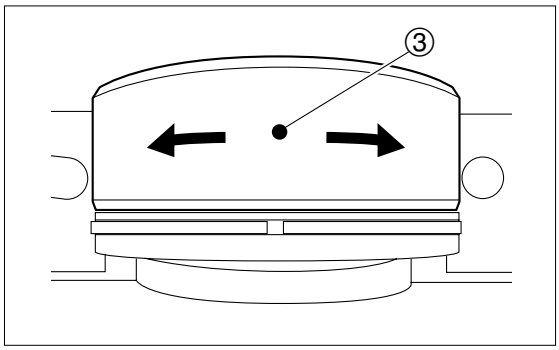


Attempt to move main bearing and upper bearing lightly to check that dowel pins are in the bearing holes snugly.

6. Positioning Upper Bearing and Main Bearing



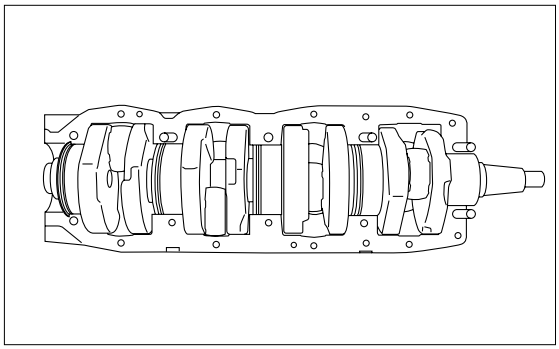
Bring knock hole of each bearing to dowel pin of cylinder's journal areas.
Attempt to move each bearing lightly to check if dowel pin is in the hole snugly.
Each bearing is provided with a black dot ③ on the opposite side of knock hole to check the location.



5

22) Assembling Crank Case Halves

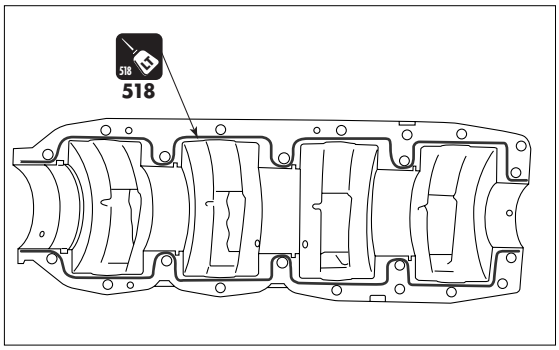
1. Degrease crank case and cylinder mating faces.



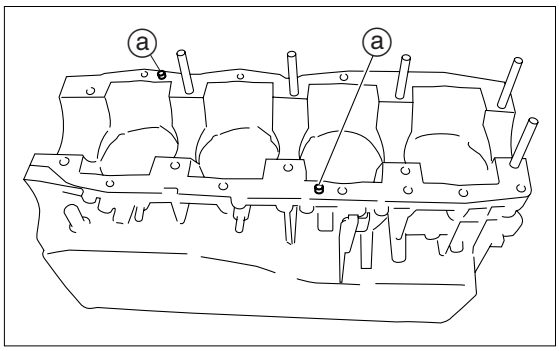
2. Apply sealing agent to crank case's mating surface.

Crank Case Mating Surface :
Loctite #518

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.

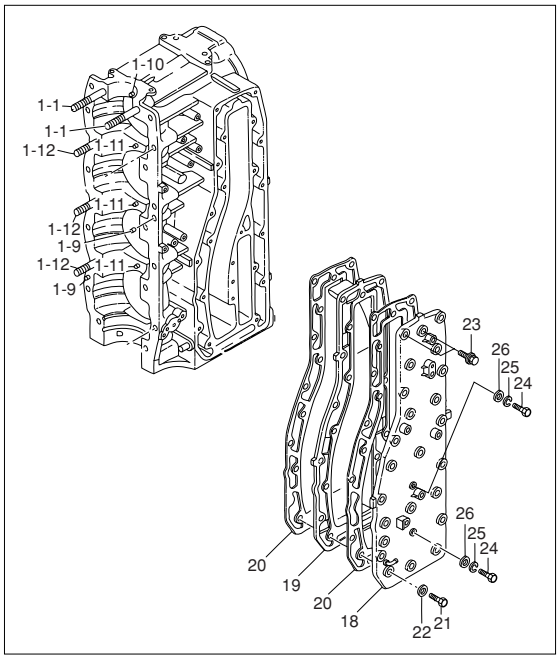


3. When installing crank case, check position of dowel pins ⓐ.



23) Assembling Exhaust Cover Parts

1. Assemble exhaust cover (inner), exhaust cover (outer) and gaskets.



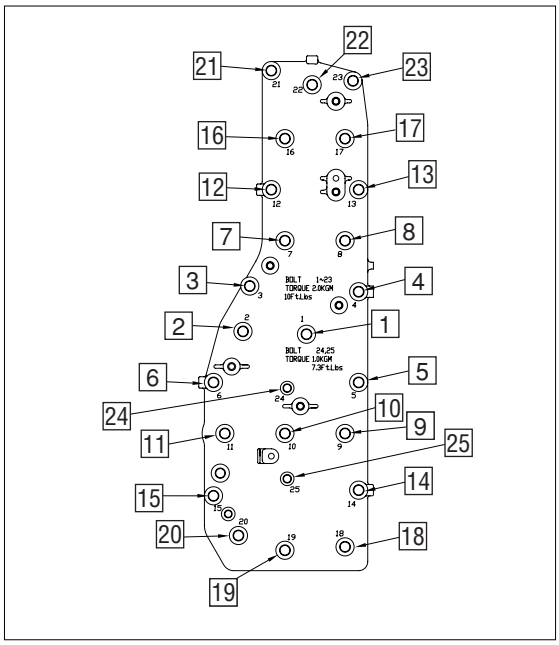
2. Attach exhaust cover securing bolts 1 to 23 and tighten them in the order of their numbers shown to specified torque in two steps.

Temporary Tightening :
12 N · m (9 lb · ft) [1.2 kgf · m]
Final Tightening :
20 N · m (14 lb · ft) [2.0 kgf · m]

Then, tighten bolts (M6) 24 and 25 to specified torque.

Bolts (M6) 24 and 25 :
10 N · m (7 lb · ft) [1.0 kgf · m]

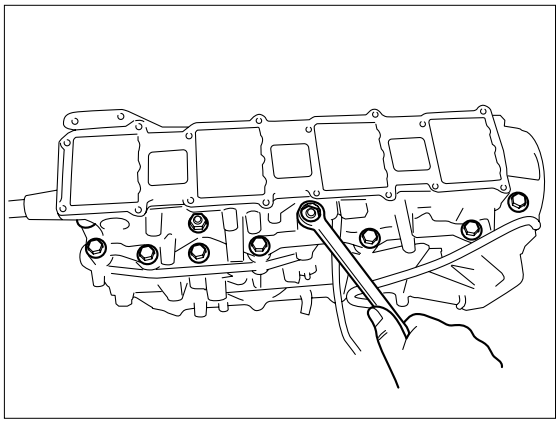
Tighten the bolts in the order of the numbers marked on the exhaust cover.



5

3. 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 surfaces even.

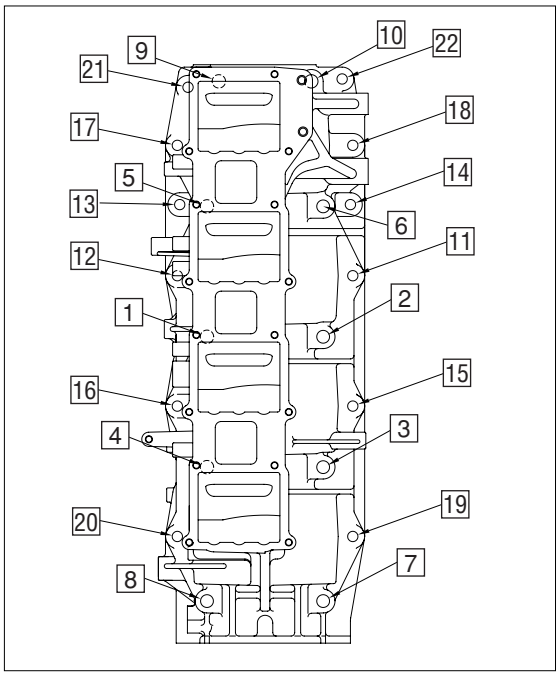


4. Tighten crank case securing bolts and nuts (M10) [1] to [10] in the order of the numbers shown.

Temporary Tightening :
20 N · m (15 lb · ft) [2.0 kgf · m]
Final Tightening :
40 N · m (30 lb · ft) [4.0 kgf · m]

Then, tighten bolts (M8) [11] to [22] in the order of the numbers shown.

Temporary Tightening :
12 N·m (9 lb · ft) [1.2 kgf · m]
Final Tightening :
25 N·m (18 lb · ft) [2.5 kgf · m]

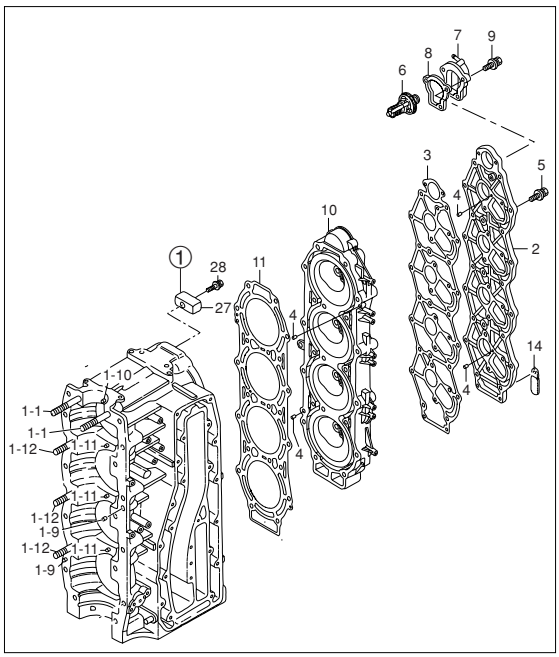


Make no forced assemblies, rotate crankshaft with flywheel after torquing crankcase bolts to ensure nothing binding.

Tighten crank case securing bolts and nuts in two steps to their specified torque.

24) Assembling Cylinder Head Parts

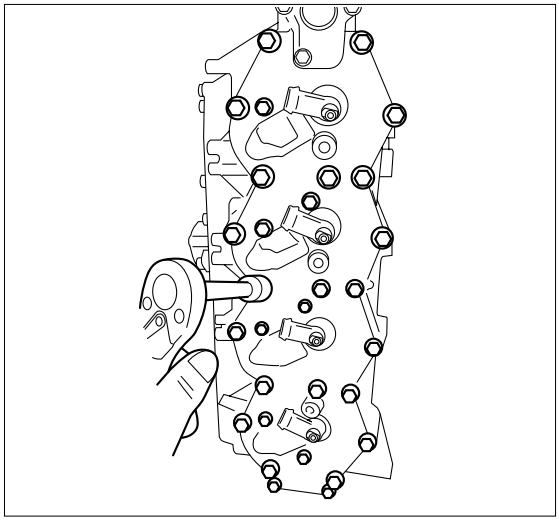
1. Attach anode ① to cylinder.



2. Attach dowel pins to cylinder head, and then attach gaskets and cylinder head cover.
   Tighten cylinder cover securing bolts (M6) ⚠1 to ⚠10 in the order of the numbers shown.

Temporary Tightening :
2.0 N · m (1.4 lb · ft) [0.20 kgf · m]

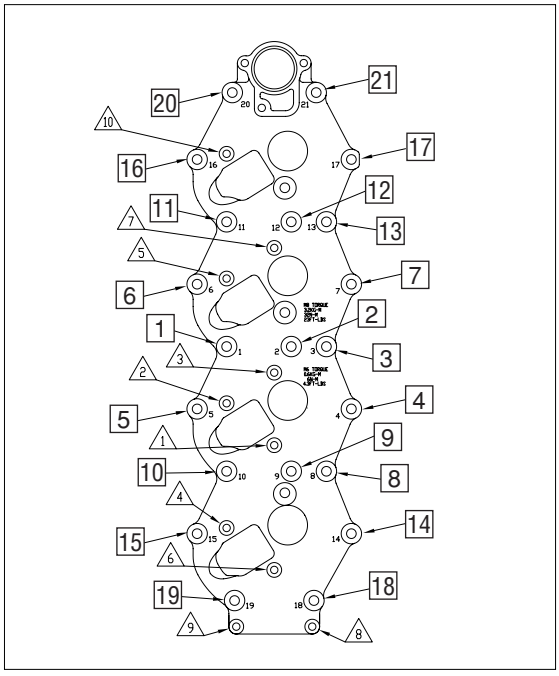
3. Attach cylinder head with head cover and cylinder head gasket to cylinder.
   Tighten cylinder head securing bolts (M8) 1 to 21 in the order of the numbers shown.



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. Tighten bolts (M6) ⚠1 to ⚠10 to specified final torque.



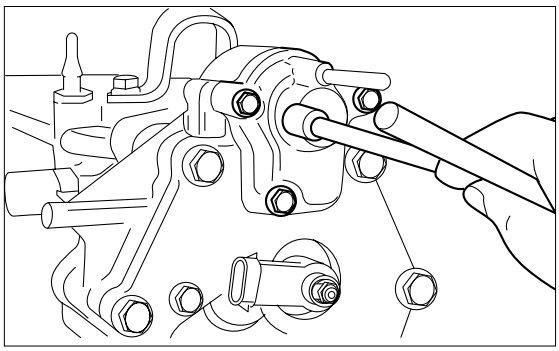
Tighten head cover bolts M6 after tightening bolts M8. Never tighten bolts M6 before tightening bolts M8.

5

5. Install thermostat, thermo-cap and gasket.

Final Tightening :
6 N · m (4 lb · ft) [0.6 kgf · m]

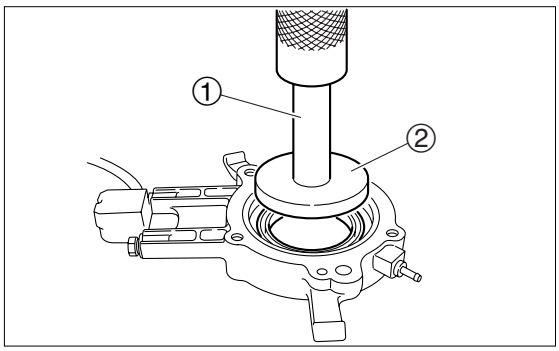
Tighten head cover bolts M6 after tightening bolts M8. Never tighten bolts M6 before tightening bolts M8.

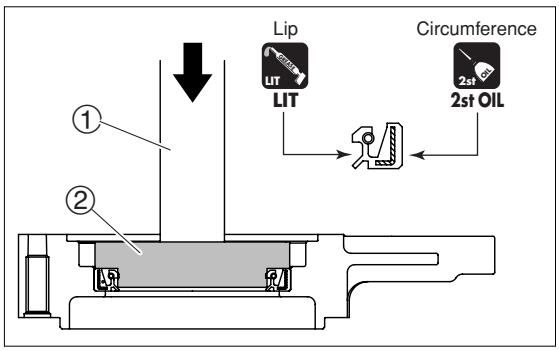


25) Assembling Coil Bracket Parts

1. Apply grease and oil to oil seal and press-fit it to coil bracket.

Driver Rod ① :
P/N. 3AC-99702-0
Oil Seal Attachment ② :
P/N. 3U1-99820-0





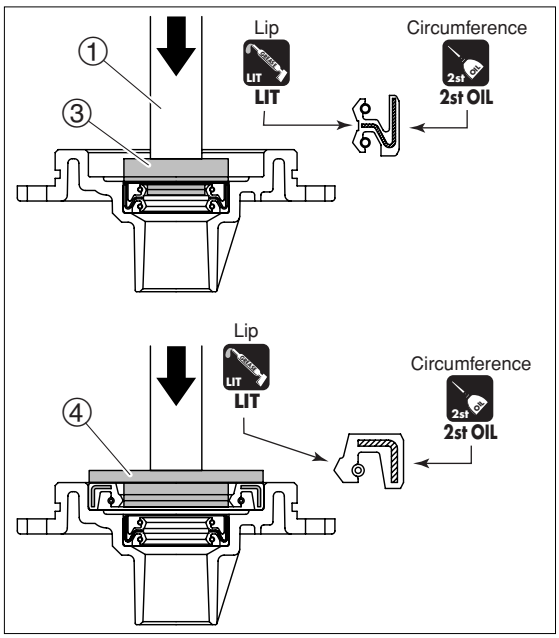
26) Assembling Crank Case Head Parts

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



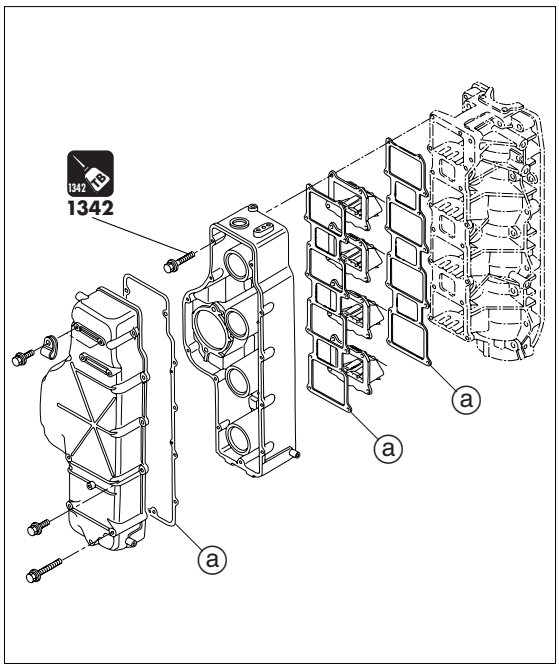
27) Installing Air Chamber

1. Attach reed valve, air chamber and gaskets to crank case. Attach and tighten securing bolts (M6) [1] to [16] to specified torque in the order of the numbers shown.

Bolts (M6) [1] - [16] :
9 N · m (7 lb · ft) [0.9 kgf · m]

Use new gaskets.

When reusing bolts, apply screw lock #1342.

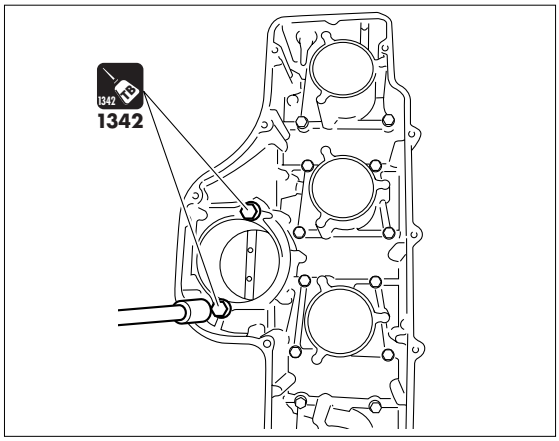


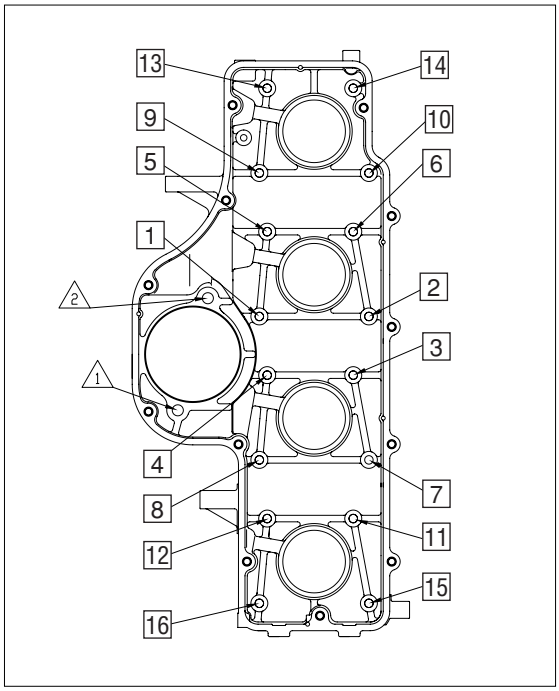
① Gasket **Do not reuse.**

2. Install throttle body. Tighten bolts (M8) △1 and △2 to specified torque.

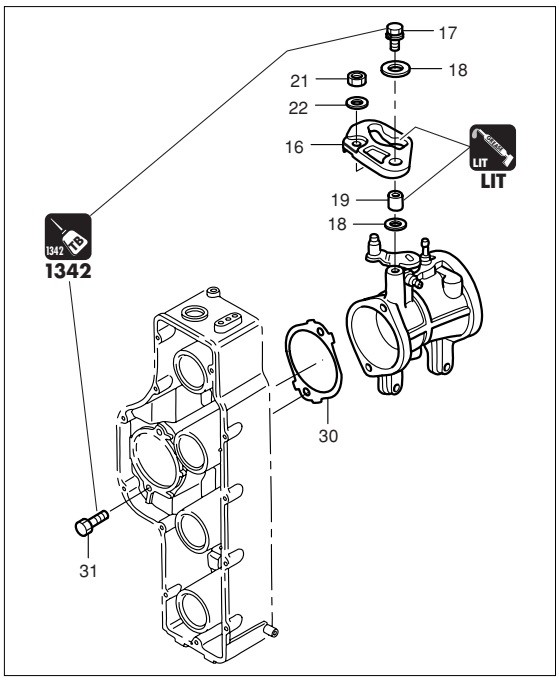
Bolts (M8) △1 - △2 :
15 N · m (11 lb · ft) [1.5 kgf · m]

When reusing bolts, apply screw lock #1342.



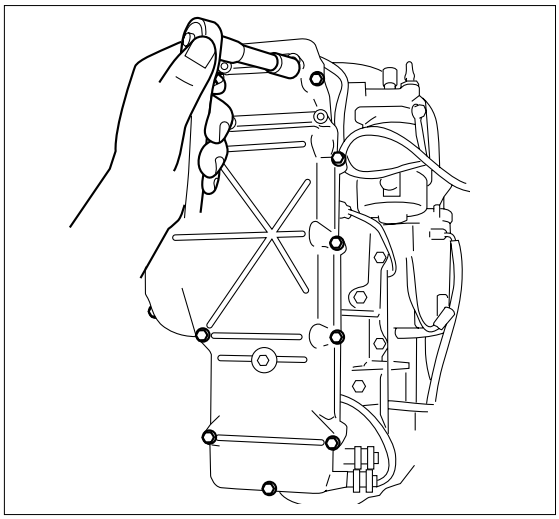


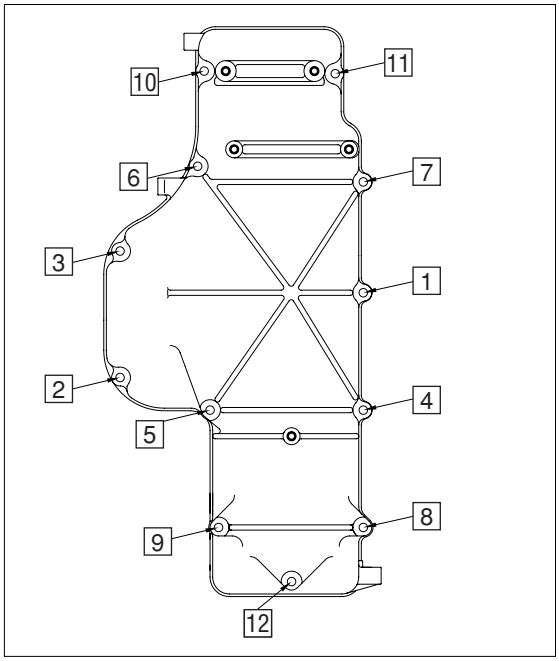
· Apply LIT grease to sliding faces of throttle cam and roller.
· Apply ThreeBond 1342 to throttle body securing bolts.



3. Attach air chamber cover and gasket. Attach and tighten air chamber securing bolts (M6) 1 to 12 to specified torque in the order of the numbers shown.

Air Chamber Bolts :
6 N · m (4 lb · ft) [0.6 kgf · m]



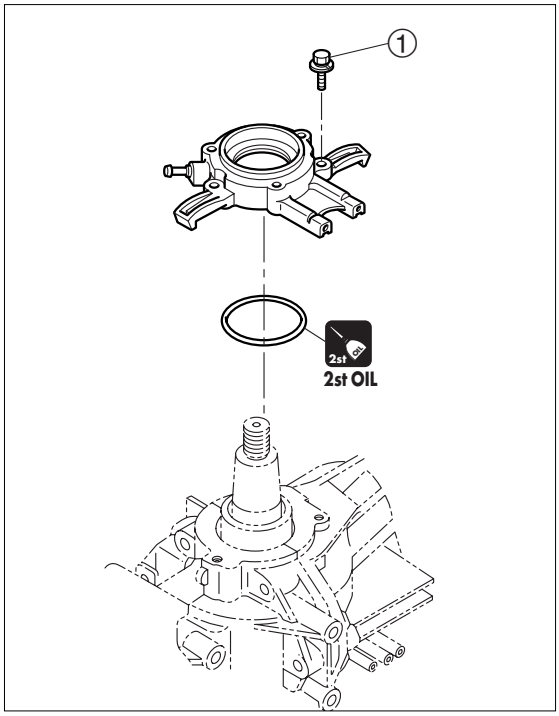


28) Attaching Coil Bracket

1. Attach O ring and coil bracket to cylinder ass'y and secure them with bolts.

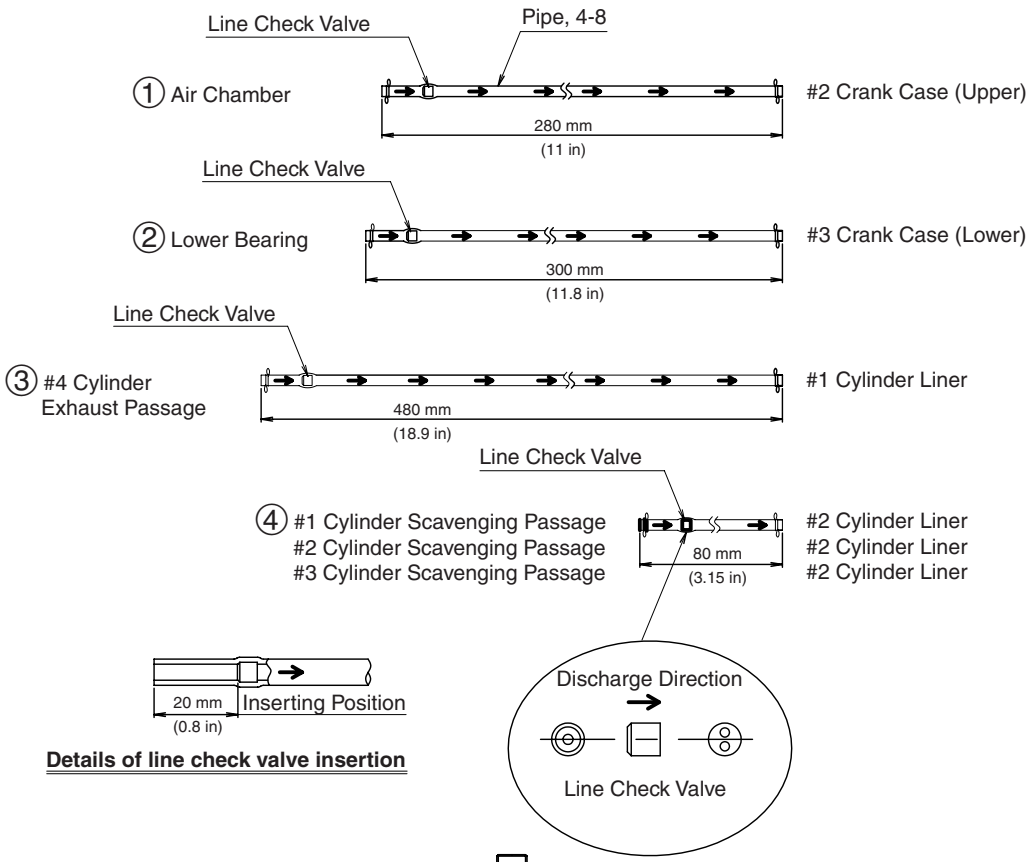
Coil Bracket Bolt ① :
6 N · m (4 lb · ft) [0.6 kgf · m]

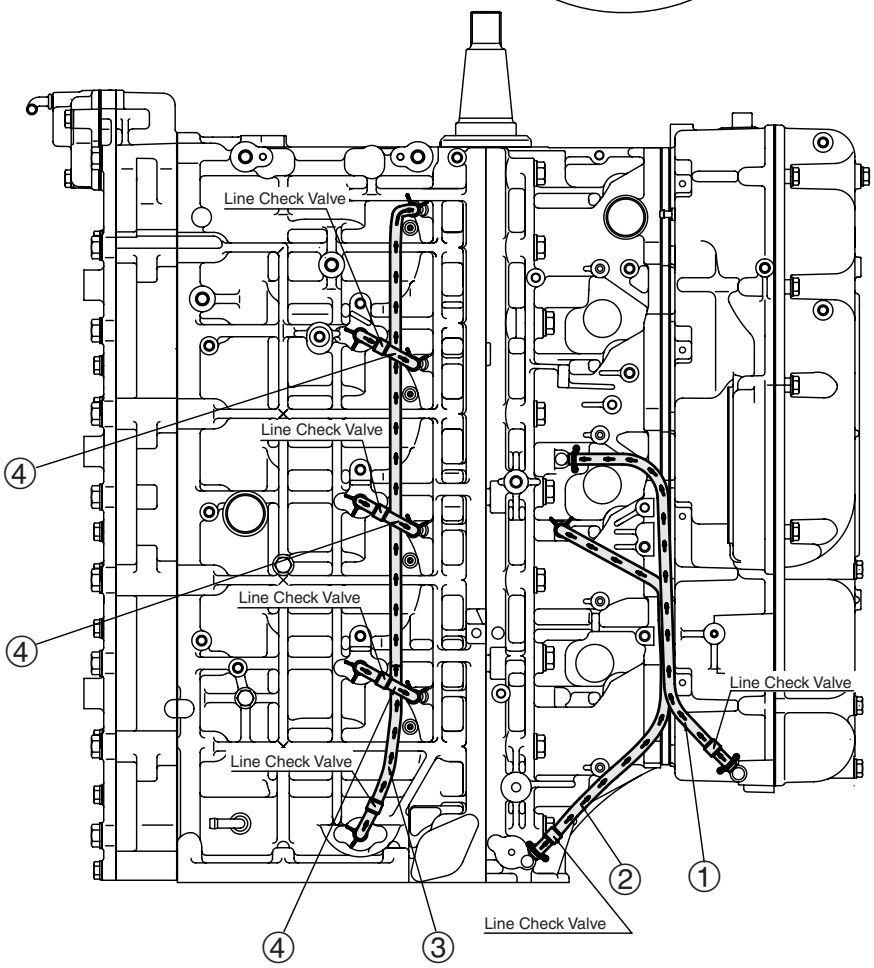
Be sure to check that O ring is set properly.



5

29) Attaching Recirculation Hoses

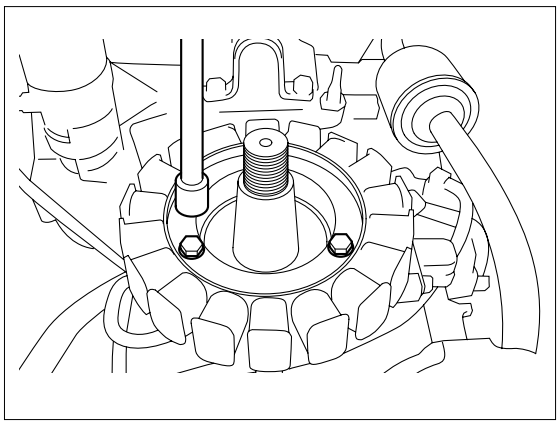




30) Installing Alternator

1. Tighten alternator securing bolts to specified torque.

Alternator Securing Bolts :
6 N · m (4 lb · ft) [0.6 kgf · m]



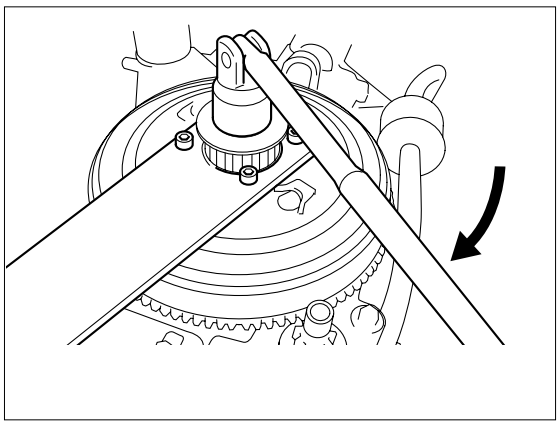
31) Installing Flywheel

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 Nut :
260 N · m (190 lb · ft) [26 kgf · m]

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

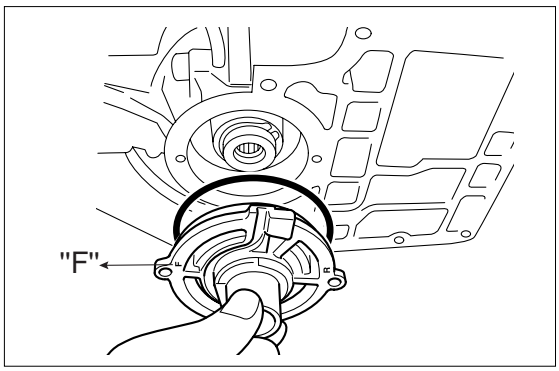


5

32) Installing 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.



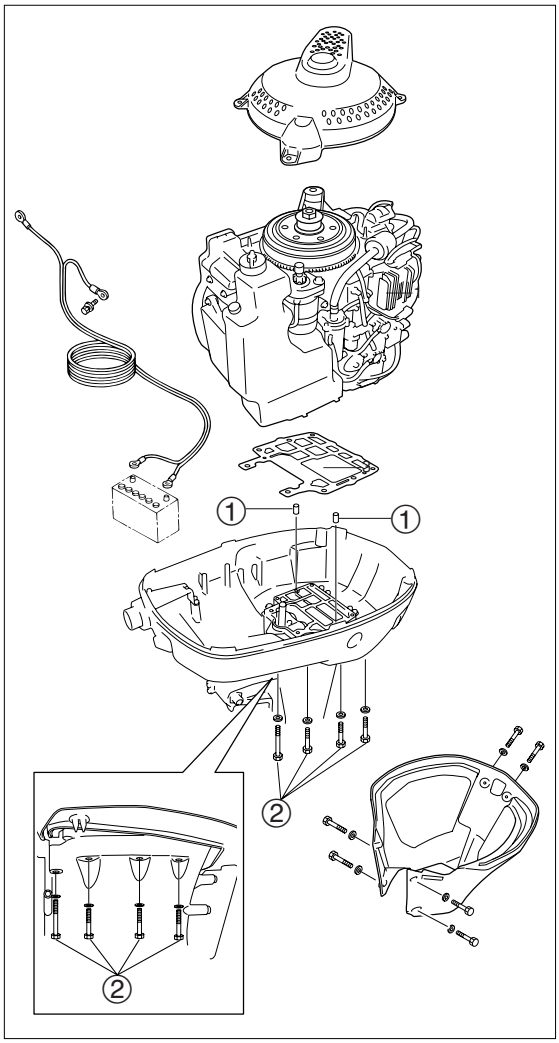
> Install crank case head so that the mark "F" is at front side (crank case side) of engine.

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 :**
> 40 N · m (29 lb · ft) [4.0 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.

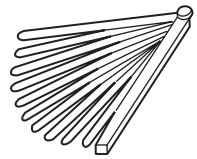
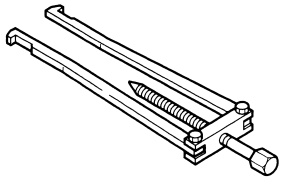
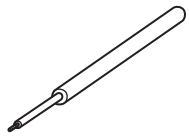
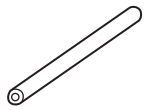
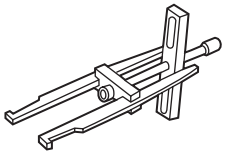
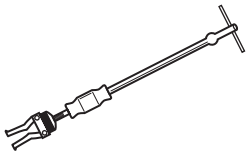
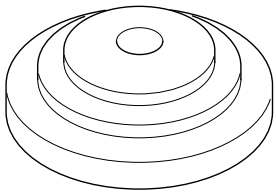
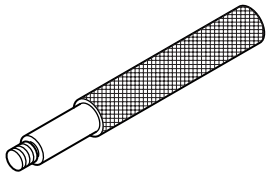
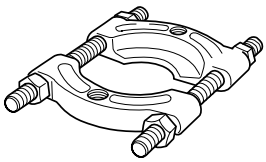
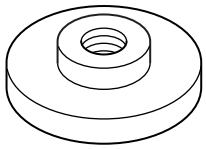
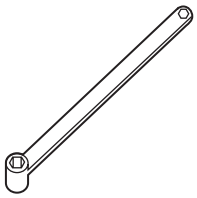
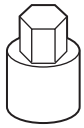
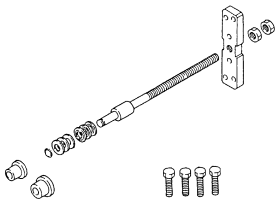
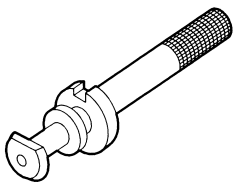
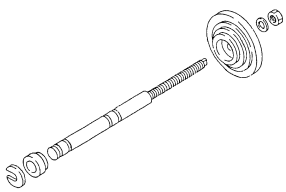
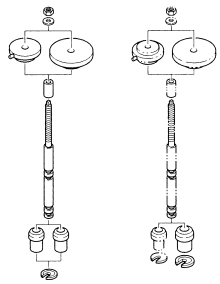
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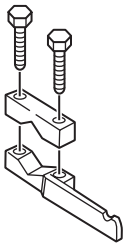
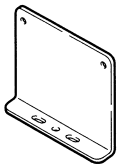
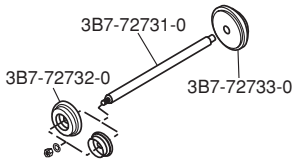
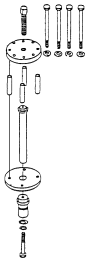
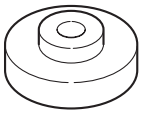
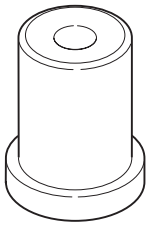
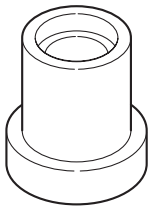
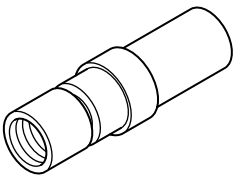
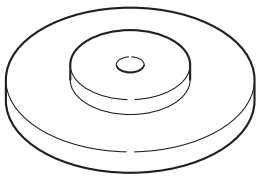
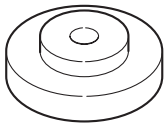
Lower Unit



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1. Special tools

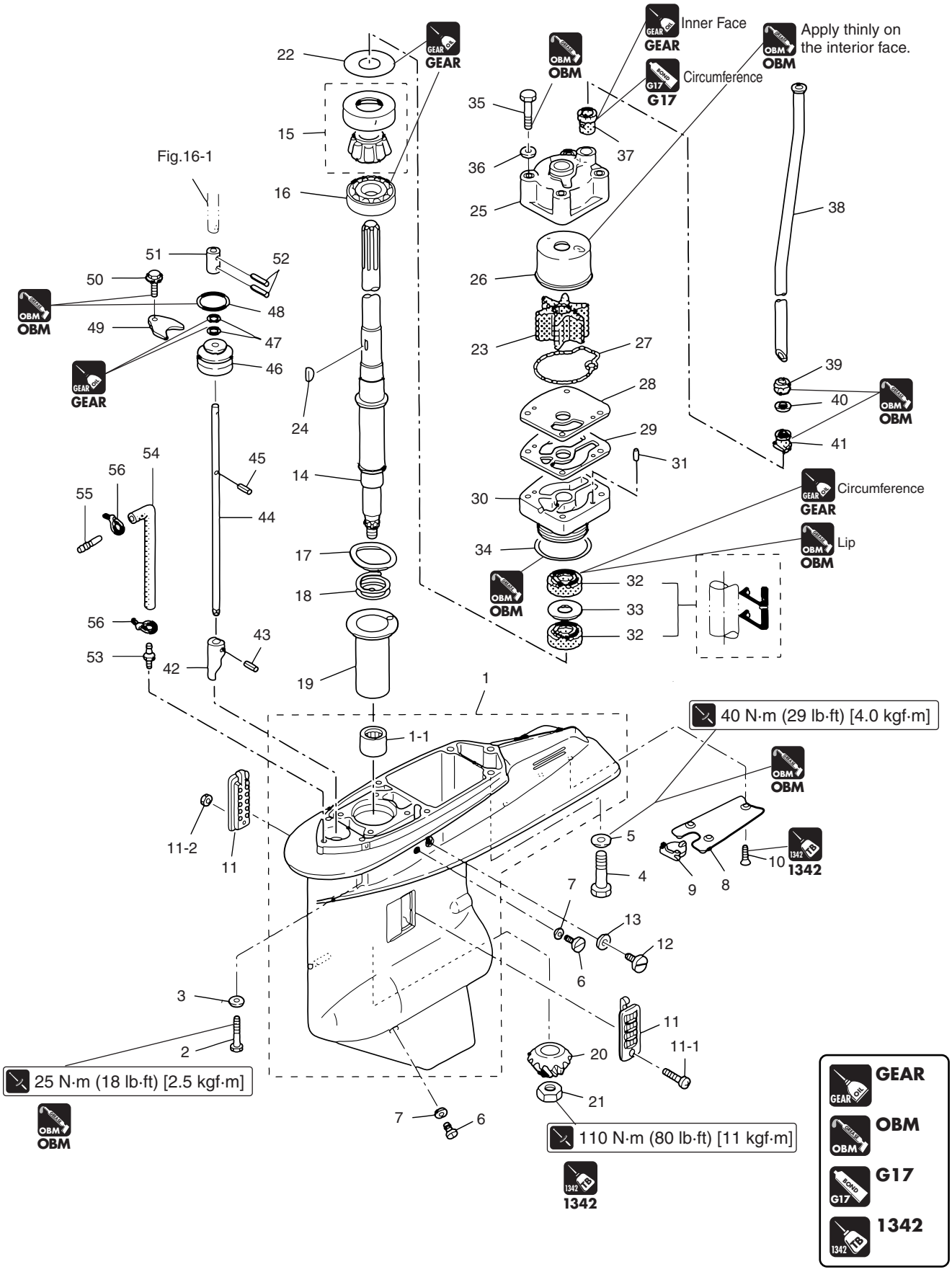
			
Thickness Gauge P/N. 353-72251-0	Propeller Shaft Housing Puller Ass'y P/N. 353-72252-0	Spring Pin Tool A P/N. 369-72217-0	Spring Pin Tool B P/N. 369-72218-0
Measuring gaps	Removing propeller shaft housing	Removing spring pin	Installing spring pin
		ø100 x ø79.5 x ø51.5 x ø61.5 	
Bevel Gear Bearing Puller 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 place and various attachments
	ø51.5 x ø24.5 		
Universal Puller Plate P/N. 3AC-99750-0	Bearing Attachment P/N. 3AC-99905-0	Bevel Gear B Nut Wrench P/N. 3B7-72231-0	Drive Shaft Socket P/N. 3B7-72232-0
Removing reverse (C) gear bearing	Used in combination with driver rod Attaching reverse (C) gear bearing	Removing or attaching pinion (B) gear nut	Removing or attaching pinion (B) gear nut
			
Backlash Measuring Tool A Kit P/N. 3B7-72234-0	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
Measuring backlash between forward (A) gear and pinion (B) gear	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

			
Bevel Gear Bearing Install Tool P/N. 3B7-72719-0	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
Installing forward (A) gear bearing	Measuring backlash	Used to attach dial gauge when measuring backlash	Attaching forward (A) gear bearing outer race
	ø 41.5 x ø21.5 	ø31.5 x ø25.0 	ø79.5 x ø39.5 
Needle Bearing Press Kit P/N. 3C7-72900-1	Oil Seal Attachment P/N. 3J6-99820-0	Needle Bearing Attachment P/N. 3T1-99710-0	Bearing install Tool P/N. 3T1-99900-0
Removing or attaching gear case needle bearing	Attaching pump case (lower) oil seal	Used to press-fit forward (A) gear needle bearing	Attaching drive shaft bearing
ø31.5 x ø25 x H32 	ø79.5 x ø39.5 	ø49.5 x ø29.5 	
Needle Bearing Attachment P/N. 3U1-99710-0	Bearing Attachment P/N. 3U1-99905-0	Oil Seal Attachment P/N. 3Y9-99820-0	
Used in combination with driver rod and center plate Attaching propeller shaft housing needle bearing	Attaching propeller shaft housing bearing	Used in combination with driver rod Attaching propeller shaft housing oil seal	

2. Parts Layout

P/L Fig. 14

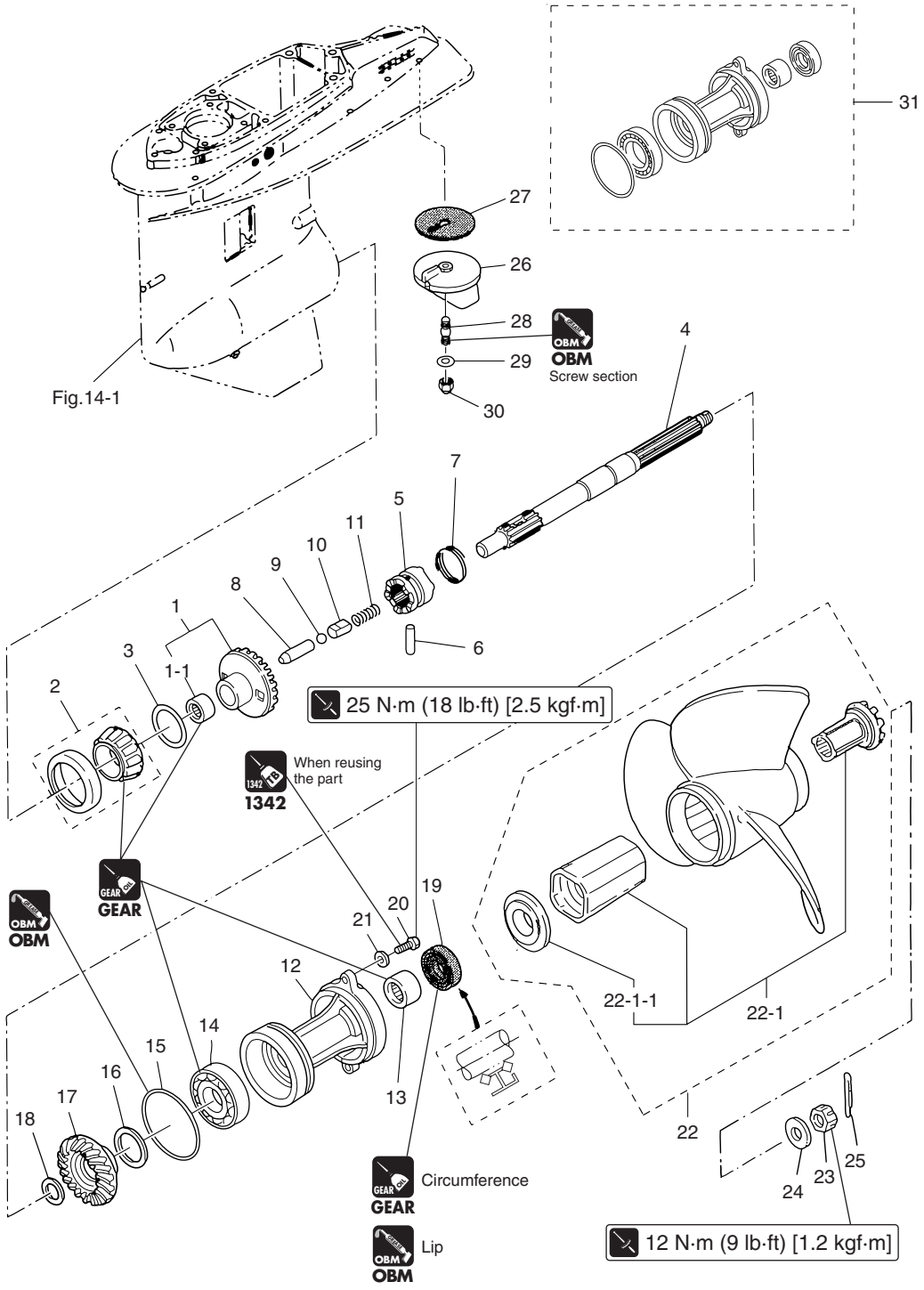
Gear Case (Drive Shaft)



Ref. No.	Description	Q'ty	Remarks
1	Gear Case	1	
1-1	Needle Bearing, 28.6-38.1-31.8	1	Do not reuse.
2	Bolt	4	M8 L=35mm
3	Washer	4	M8
4	Bolt, 10-40	3	M10 L=40mm
5	Washer	3	M10 L=40mm
6	Oil Plug	2	
7	Gasket, 8.1-15-1	2	Do not reuse.
8	Gear Case Plate	1	
9	Gear Case Plate Plug	1	
10	Screw	3	M6 L=14mm
11	Water Strainer Set	set	
11-1	Screw	1	M4 L=45mm
11-2	Nylon Nut, 4-P0.7	1	M4
12	Water Plug	1	
13	Gasket, 10.1-15-1	1	Do not reuse.
14	Drive Shaft "L"	1	for Transom "L"
	Drive Shaft "UL"	1	for Transom "UL"
15	Bearing, 0506	1	Do not reuse.
16	Bearing, 16007	1	Do not reuse.
17	Wave Washer, d=47.2	1	
18	Drive Shaft Spring	1	
19	Drive Shaft Spring Guide	1	
20	Pinion Gear (B Gear)	1	
21	Pinion Gear Nut (B Gear Nut)	1	
22	Shim, 52-60.5-0.3	AR	Selection if necessary
	Shim, 52-60.5-0.15	AR	
	Shim, 52-60.5-0.1	AR	
23	Water Pump Impeller	1	
24	Water Pump Impeller Key	1	
25	Pump Case (Upper)	1	
26	Pump Case Liner	1	
27	Pump Case Seal	1	Do not reuse.
28	Water Pump Guide Plate	1	
29	Pump Guide Plate Gasket	1	Do not reuse.
30	Pump Case (Lower)	1	
31	Dowel Pin, 4-10	2	
32	Oil Seal, 22-42-7	2	Do not reuse.
33	Shim, 35-41.9-0.5	1	
34	O-Ring, 3.1-54.4	1	Do not reuse.
35	Bolt	4	M8 L=85mm
36	Washer	4	M8
37	Water Pipe Seal (Lower)	1	
38	Water Pipe "L"	1	for Transom "L"
	Water Pipe "UL"	1	for Transom "UL"
39	Water Pipe Seal (Upper)	1	
40	Collar, 18-20-4.5	1	
41	Water Pipe Auxiliary Mount	1	Water Pipe Locking Rubber
42	Clutch Cam	1	
43	Spring Pin, 3.5-16	1	Do not reuse.
44	Cam Rod "L"	1	for Transom "L"
	Cam Rod "UL"	1	for Transom "UL"
45	Spring Pin, 3.5-10	1	Do not reuse.
46	Cam Rod Bushing	1	
47	O-Ring, 1.9-6.8	2	Do not reuse.
48	O-Ring, 3.5-27.7	1	Do not reuse.
49	Stopper	1	
50	Bolt	1	M6 L=12mm W/SW
51	Shift Rod Joint	1	
52	Spring Pin, 3.5-16	2	Do not reuse.
53	Nipple, 6-1/8	1	for Speedometer Option
54	Speedometer Pipe "L"	1	for Transom "L" Option
	Speedometer Pipe "UL"	1	for Transom "UL" Option
55	Nipple, 6-6	1	Option
56	Lead Wire Band, 100	2	Option

Gear Case (Propeller Shaft)

P/L Fig. 15



G17
1342
OBM
GEAR

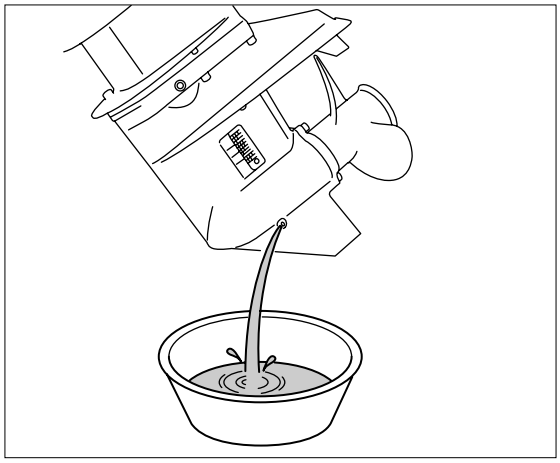
Ref. No.	Description	Q'ty	Remarks
1	Forward Gear (A gear)	1	
1-1	Needle Bearing, 25-32-26	1	Do not reuse.
2	Bearing, 30209	1	Do not reuse.
3	Shim, 47-57-0.15 Shim, 47-57-0.1	AR AR	Selection if necessary
4	Propeller Shaft	1	
5	Clutch	1	
6	Clutch Pin	1	
7	Clutch Pin Snap	1	Do not reuse.
8	Clutch Push Rod	1	
9	Steel Ball, 9/16	1	
10	Clutch Spring Retainer	1	
11	Clutch Spring	1	
12	Propeller Shaft Housing	1	
13	Needle Bearing, 30-40-30	1	Do not reuse.
14	Ball Bearing, 6208	1	Do not reuse.
15	O-Ring, 3.1-94.4	1	Do not reuse.
16	Shim, 42-50-0.15 Shim, 42-50-0.1	AR AR	Selection if necessary
17	Reverse Gear (C Gear)	1	
18	Washer, t=3.2 Washer, t=3.0 Washer, t=2.8	AR AR AR	Selection if necessary
19	Oil Seal, 30-50-12	1	Do not reuse.
20	Bolt, 8-30 Pre-coated	2	M8 L=30mm
21	Washer	2	M8
22	Propeller M-11 (3 x 14.0 x 11.0) Propeller M-13 (3 x 14.0 x 13.0) Propeller M-15 (3 x 13.75 x 15.0) Propeller M-16 (3 x 13.25 x 16.0) Propeller M-17 (3 x 13.25 x 17.0) Propeller M-19 (3 x 13.0 x 19.0) Propeller M-21 (3 x 12.75 x 21.0)	1 1 1 1 1 1 1	Old Part No. 3E0W64176-0 Old Part No. 3E0W64181-0 Old Part No. 3E0W64185-0 Old Part No. 3E0W64187-0 Old Part No. 3E0W64189-0 Old Part No. 3E0W64194-0 Old Part No. 3E0W64196-0
22-1	Propeller Hub Kit	set	Old Part No. 3E0-64238-0
22-1-1	Forward Thrust Washer	1	
23	Propeller Nut	1	
24	Washer, 17-32-3	1	
25	Split Pin, 3-25	1	Do not reuse.
26	Trim Tab	1	
27	Trim Tab Gasket	1	
28	Stud Bolt	1	M8 L=25mm
29	Washer	1	M8
30	Nylon Nut, 8-P1.25	1	M8
31	Propeller Shaft Housing Ass'y	1	

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.

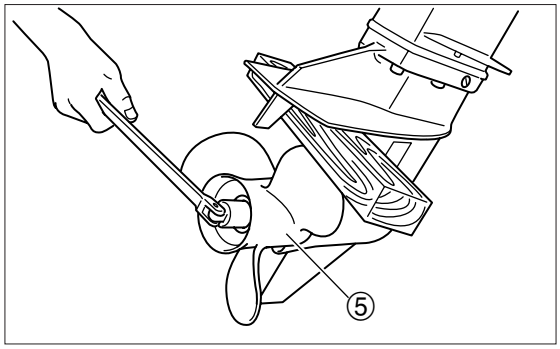


2) Removing Propeller

1. Disconnect battery cables from the battery and remove lock plate from stop switch.

2. Shift gear into forward (F).

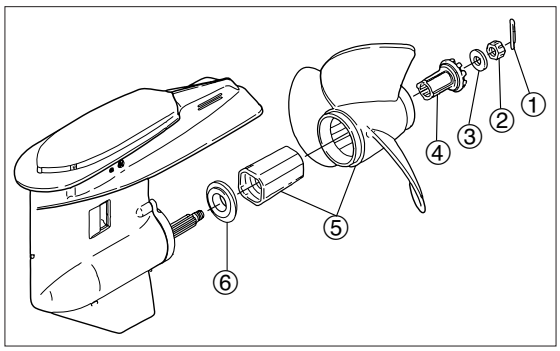
3. Put a piece wood between anti-cavitation plate and propeller ⑤ to prevent the propeller ⑤ from accidental rotation. Pull out split pin ①, loosen propeller nut ②, and then, propeller ⑤.



⚠ 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.**

When removing lower unit from outboard motor, tilting the outboard motor makes the work easier.

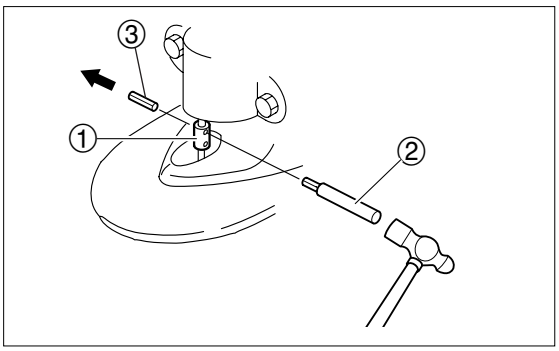


① Split Pin
② Propeller Nut
③ Washer
④ Propeller Hub Kit
⑤ Propeller and Drive Sleeve
⑥ Thrust Holder

3) Removing Lower Unit

1. Shift the gear into forward (F) to set shift rod to upper position.

2. Remove spring pin and disconnect shift rod.

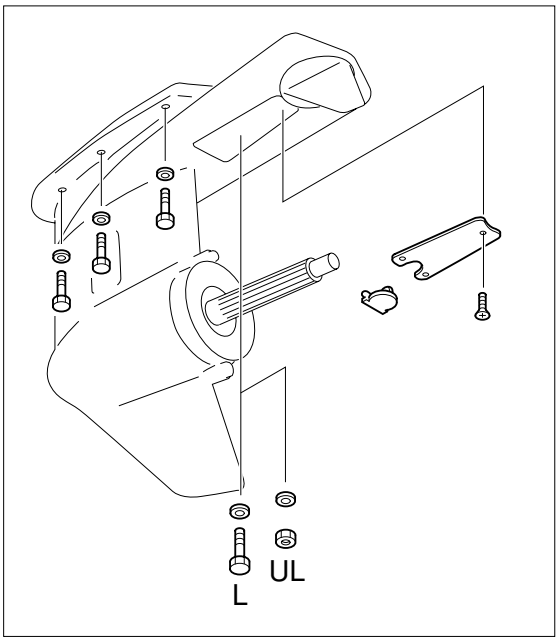


③ Spring Pin **Do not reuse.**

- 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.

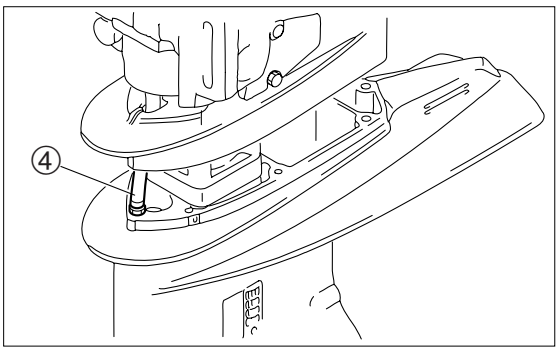
Spring Pin Tool A ② :
P/N. 369-72217-0

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



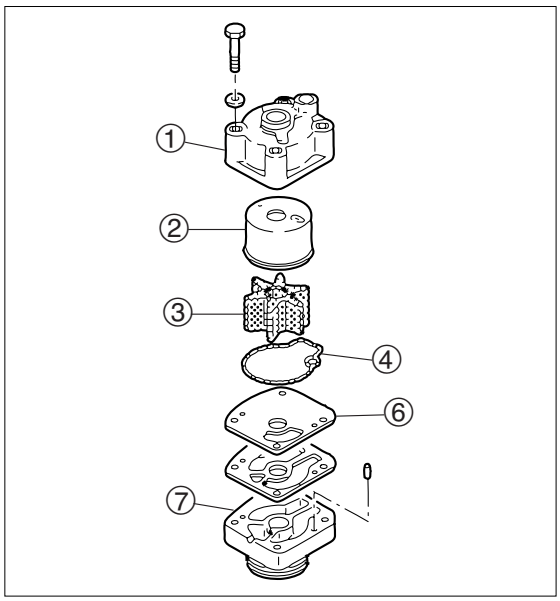
Hold lower unit while removing it to prevent it dropping on the floor.

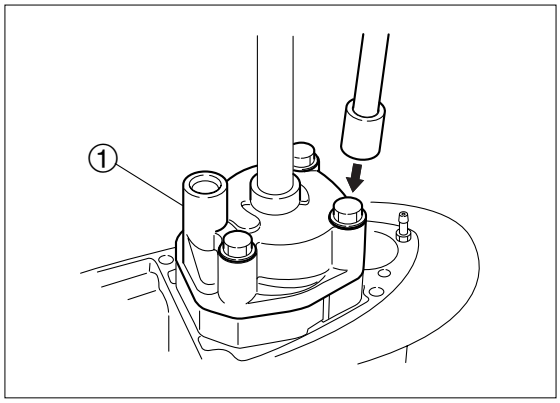
4. Disconnect speedometer pipe ④ from the nipple before separating lower unit from the driveshaft housing.



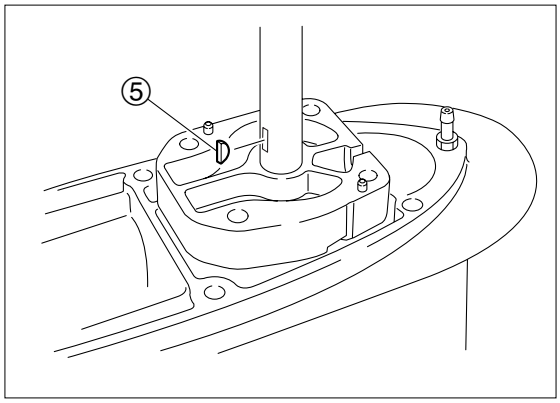
4) Removing Water Pump

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



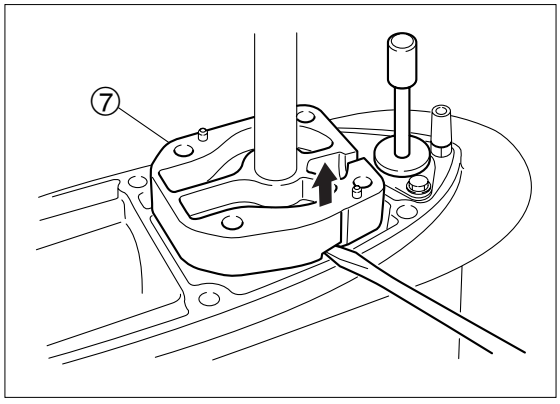


2. Remove water pump impeller key ⑤.



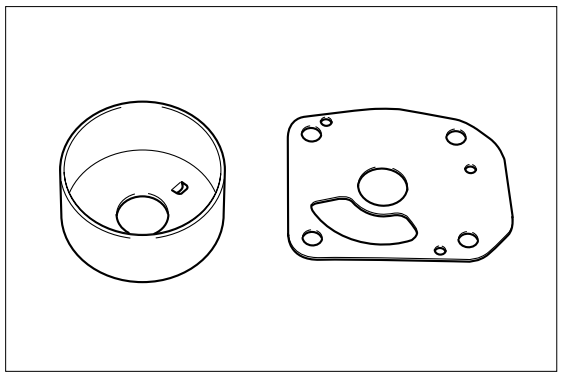
3. Remove guide plate ⑥ and pump case (lower) ⑦.

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

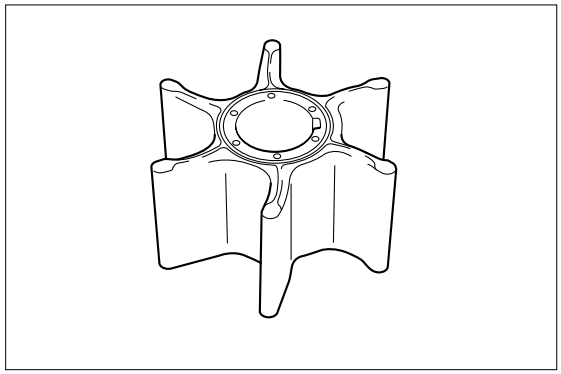


5) Inspection of Water Pump

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

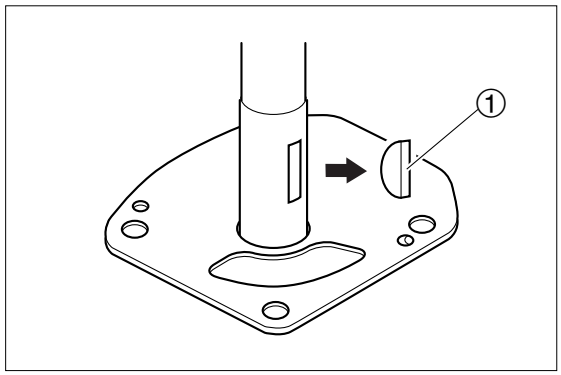


2. Check pump impeller for crack, damage and wear.
   Replace if necessary.

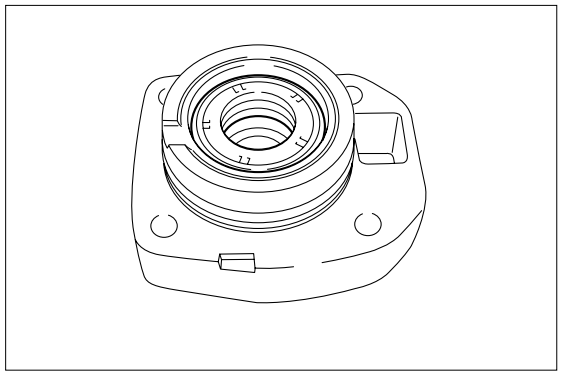


- The impeller may show gloss or have melted area if it is rotated with insufficient water.
- Even if impeller shows no abnormality on its surface, the blade(s) may be separated from the hub.
- Replace guide plate if a groove(s) of 0.5 mm or over is produced on it due to wear by impeller.

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

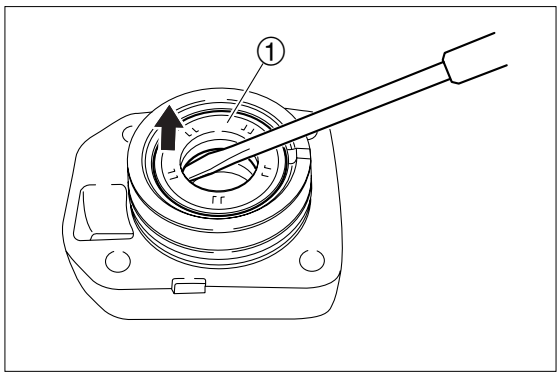


4. Check oil seal for wear and crack on the lip area.
   Replace if necessary.



6) Disassembly of Water Pump Case (Lower)

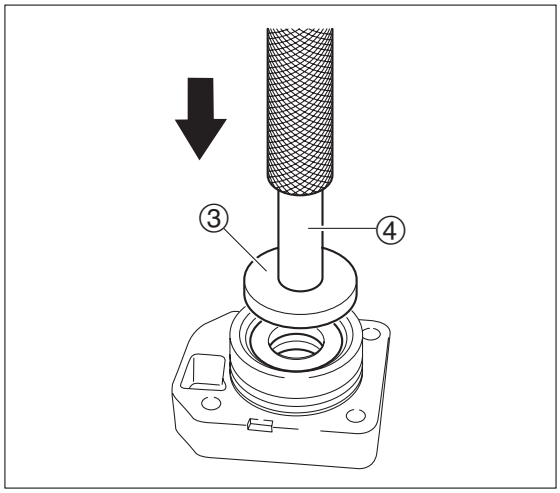
1. Use bladed screw driver or seal remover to remove oil seal ①.



Two oil seals are used. Note that there is a shim in between oil seals.

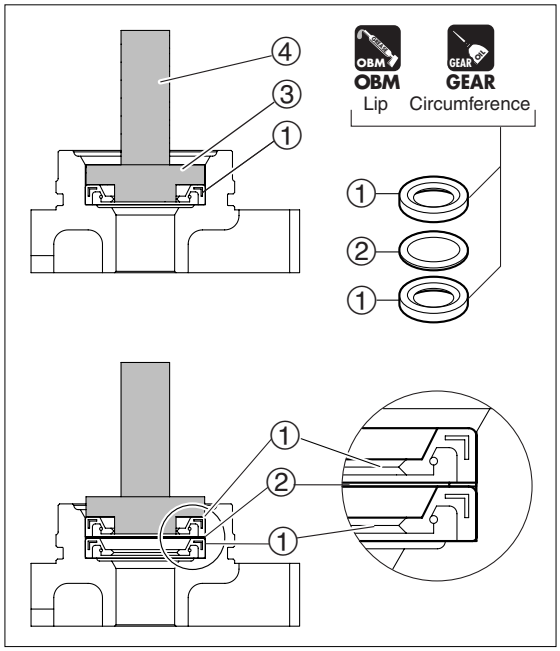
7) Assembly of Water Pump Case (Lower)

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



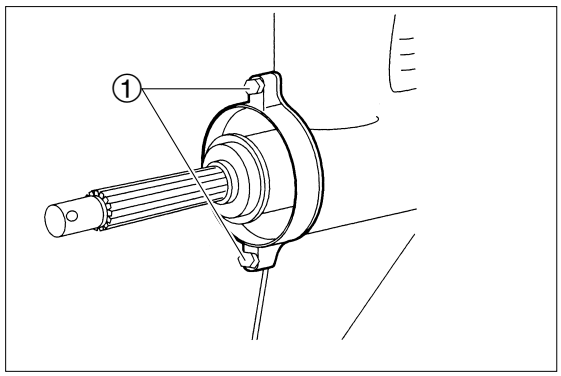
Oil Seal Attachment ③ :
P/N. 3J6-99820-0
Driver Rod ④ :
P/N. 3AC-99702-0

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



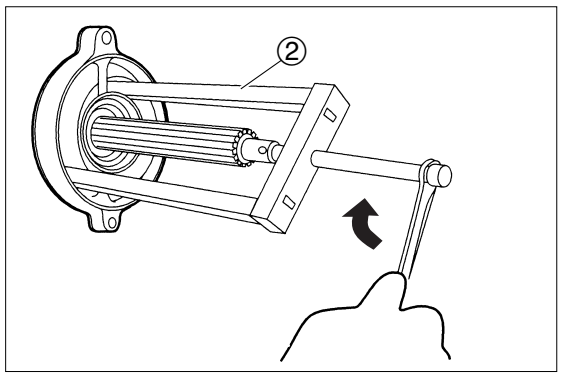
8) Removing Propeller Shaft Housing Ass'y

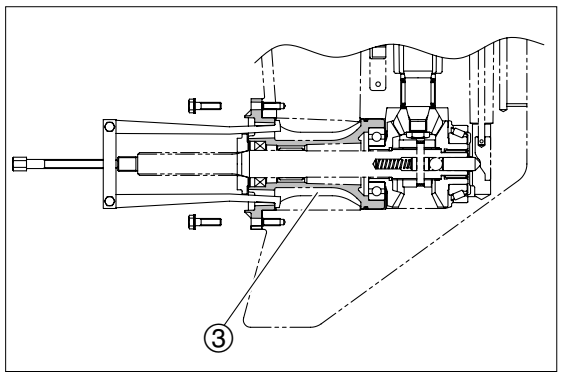
1. Loosen and remove bolts ①.



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

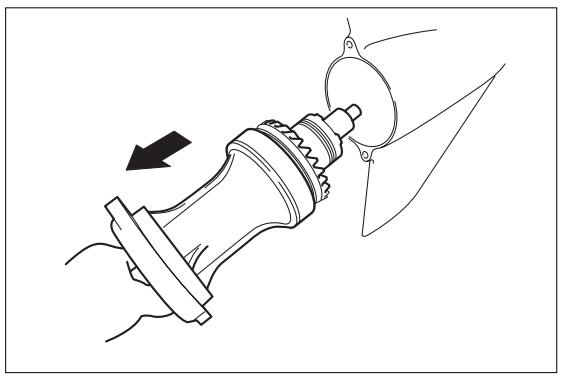




③ Propeller Shaft Housing Ass'y

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

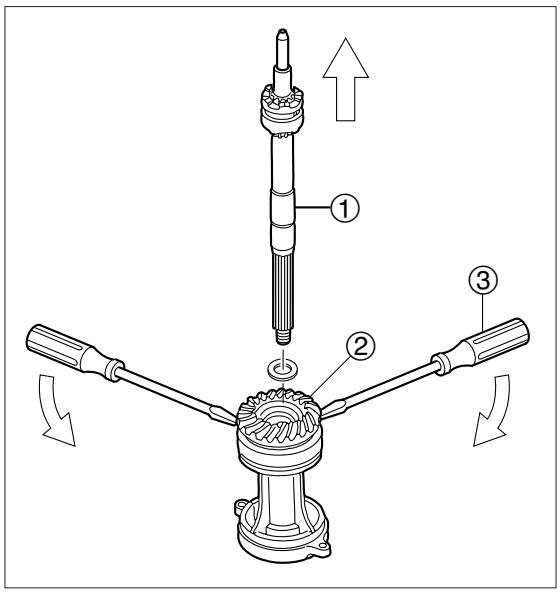
When pulling out propeller shaft housing ass'y, remove clutch push rod and steel balls together with the housing ass'y.



9) Disassembly of Propeller Shaft Housing Ass'y

1. Pull out propeller shaft ass'y ①.

2. Remove reverse (C) gear by using ⊖ screw drivers ③.



3. Remove bearing ④.

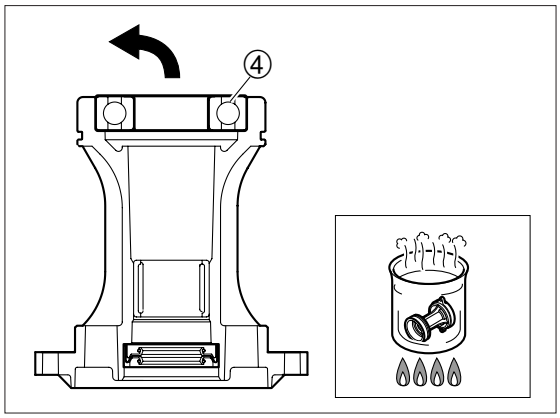
⚠ CAUTION

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 propshaft housing can also be made by using a heat gun or heat lamp.



④ Bearing **Do not reuse.**

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

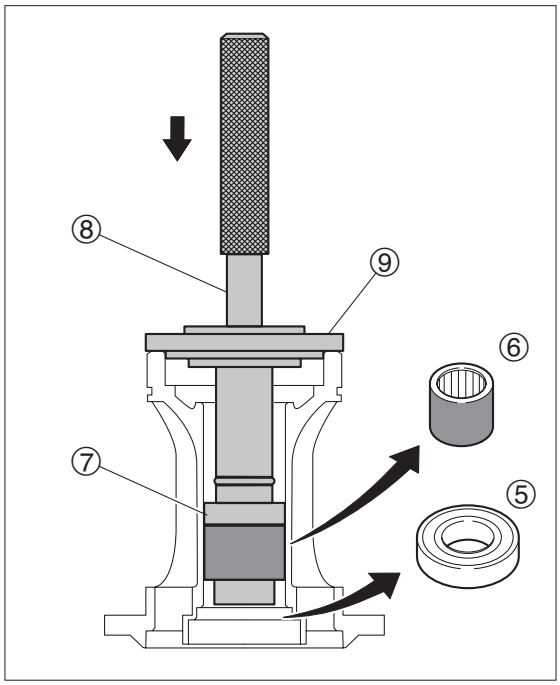
Before removing, check bearing for play or deflection. Replace if necessary.

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 ⑦ :
P/N. 3B7-72700-0

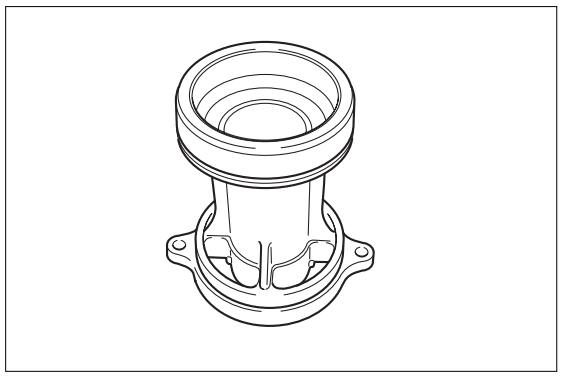
5. When removing only oil seal, use bladed screw driver to pry apart.



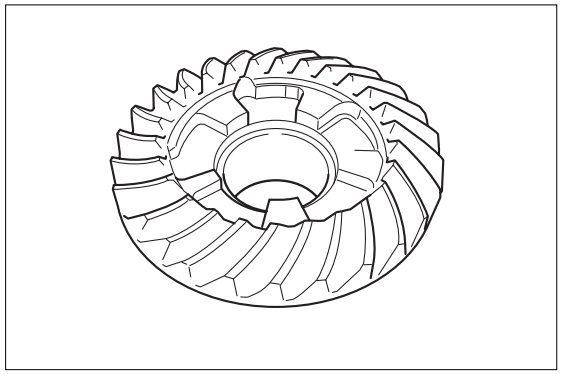
⑤ Oil Seal **Do not reuse.**
⑥ Needle Bearing **Do not reuse.**

10) Inspection of Propeller Shaft Housing

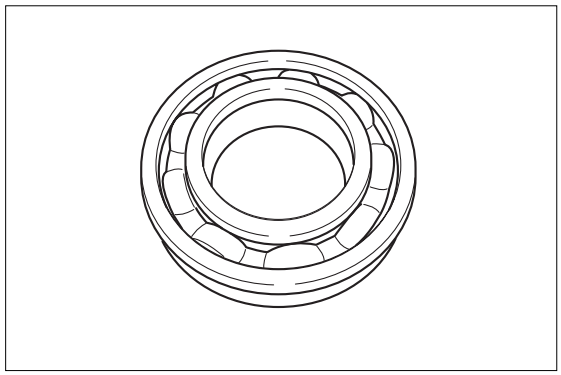
1. Clean the part by using a solvent and then check.
   Replace if necessary.



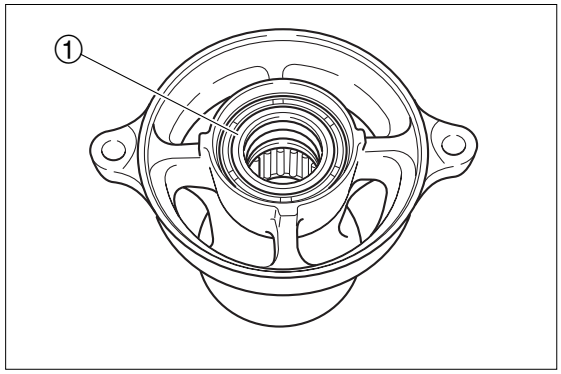
2. Check reverse (C) gear for crack or abnormal wear of the teeth and dog.
   Replace if necessary.



3. Check bearing for abnormality.
   Replace if necessary.



4. Check oil seal ① for wear and crack.
   Replace if necessary.



11) Assembly of Propeller Shaft Housing

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

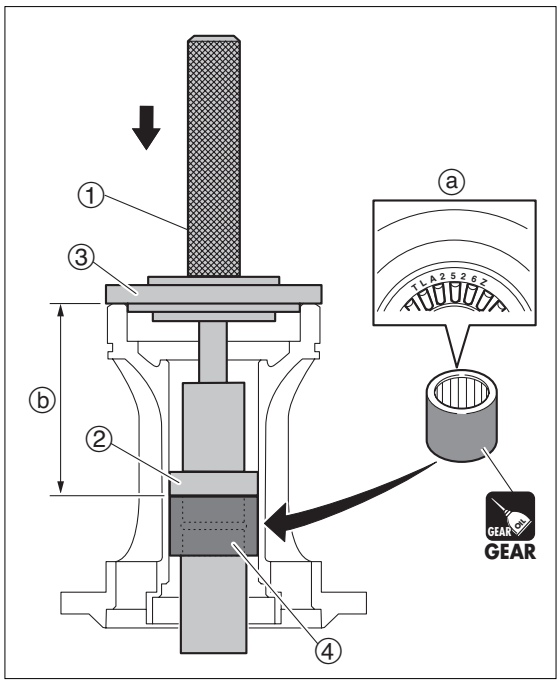
- Install needle bearing with the manufacturer's mark ⓐ facing the tool side.
- Screw in needle bearing attachment ② lightly by a hand so that no gap is made at driver rod ①.
- Clean needle bearing installation face and apply gear oil before installation.

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 ⓑ :
87.25 - 87.75 mm (3.435 - 3.455 in)

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

Needle Bearing Puller Kit ⑦ :
P/N. 3B7-72700-0

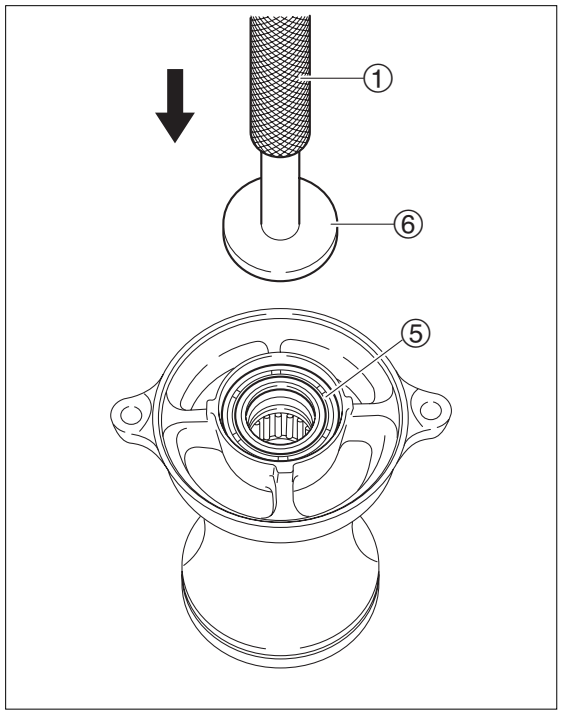


④ Needle Bearing **Do not reuse.**

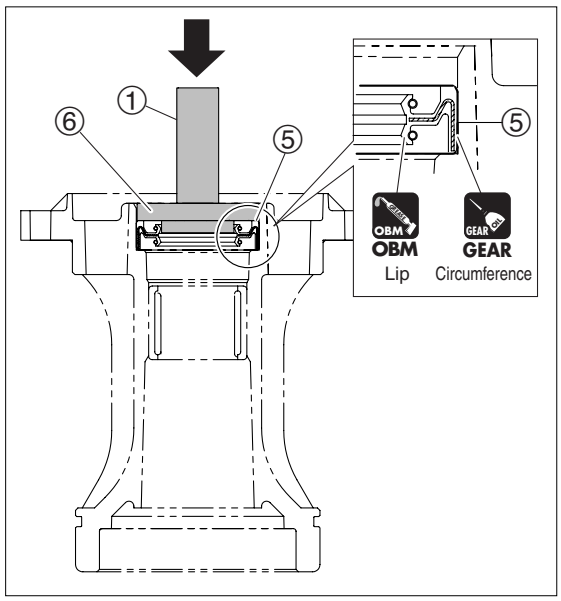
2. Install oil seal ⑤.
Use a press to install new oil seal to propeller shaft housing.

- 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



⑤ Needle Bearing **Do not reuse.**



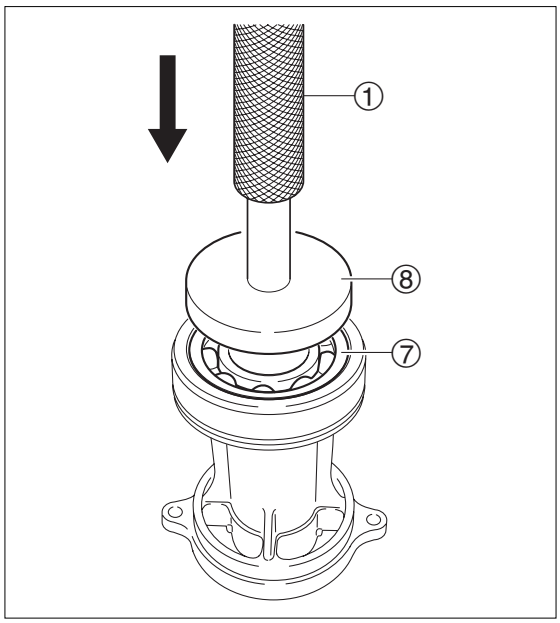
⑤ Oil Seal **Do not reuse.**

6

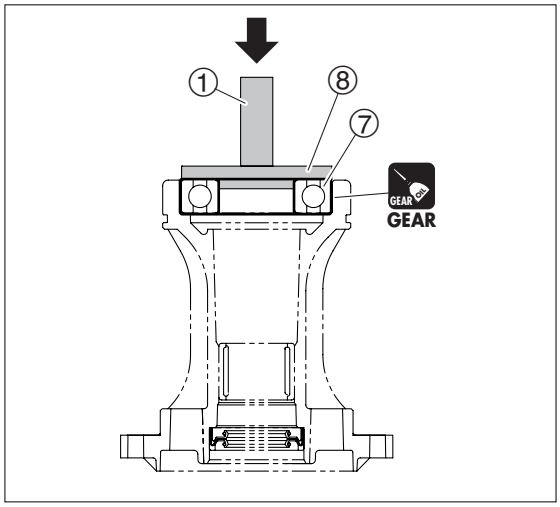
3. Install bearing ⑦.
   Use a press to install new bearing to propeller shaft housing.

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



⑦ Bearing **Do not reuse.**



⑦ Bearing **Do not reuse.**

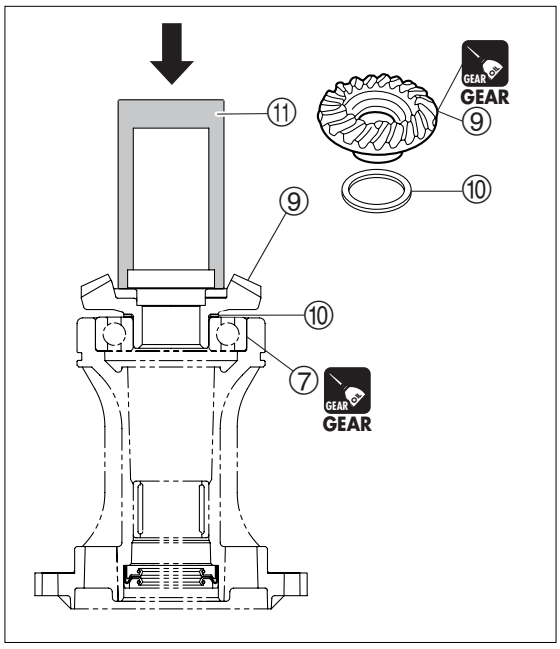
4. Attach shim ⑩ used on the reverse (C) gear ⑨ to the gear.
   Use press to install reverse (C) gear ⑨.

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

Bevel Gear Install Tool ⑪ :
P/N. 3B7-72719-0

⚠ CAUTION

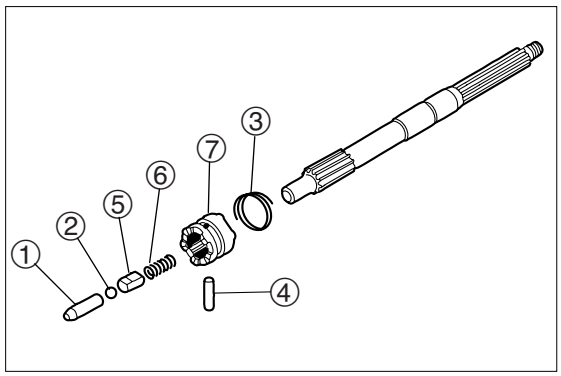
When gear case, propeller shaft, bearing, housing or reverse (C) gear is replaced, measure the backlash and perform shim adjustment.



⑦ Bearing **Do not reuse.**

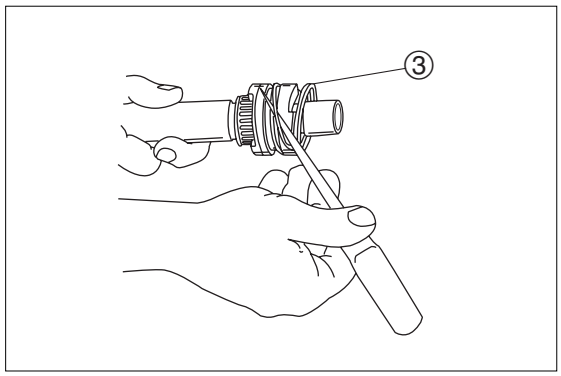
12) Disassembly of Propeller Shaft Ass'y

1. Remove push rod ① and steel ball ②.



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.

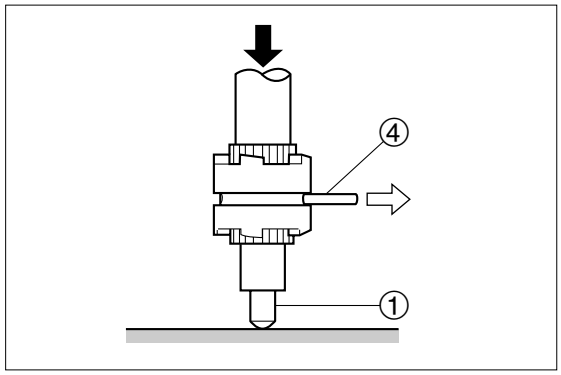


③ Clutch Pin Snap **Do not reuse.**

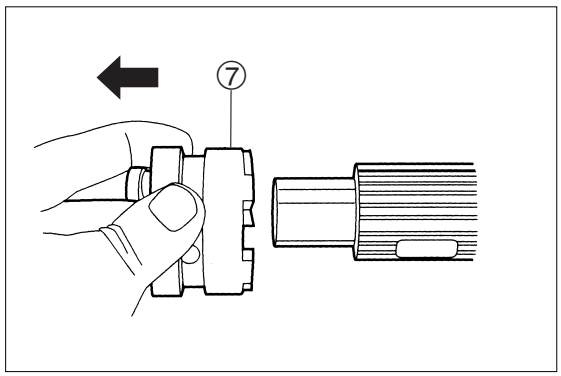
3. Pull out clutch pin ④, and remove clutch spring retainer ⑤, clutch spring ⑥, and clutch by referring to the figure.

⚠ 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.

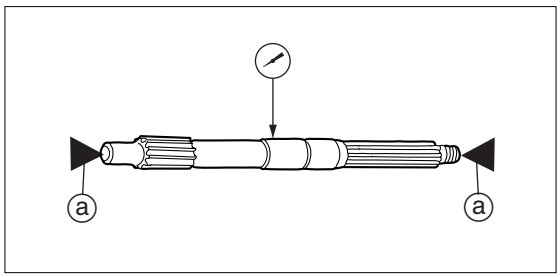


13) Inspection of Propeller Shaft Ass'y

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

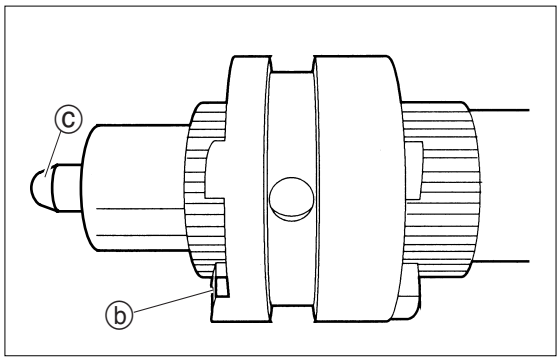
2. Measure propeller shaft runout.

Runout Limit :
0.05 mm (0.0020 in)



ⓐ Supporting Points

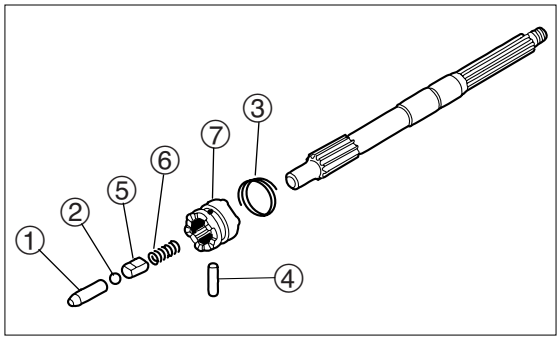
3. Check clutch dog ⓑ and push rod ⓒ for crack and wear. Replace if necessary.



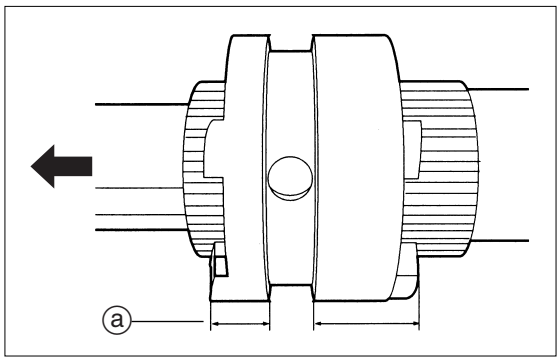
14) Assembly of Propeller Shaft Ass'y

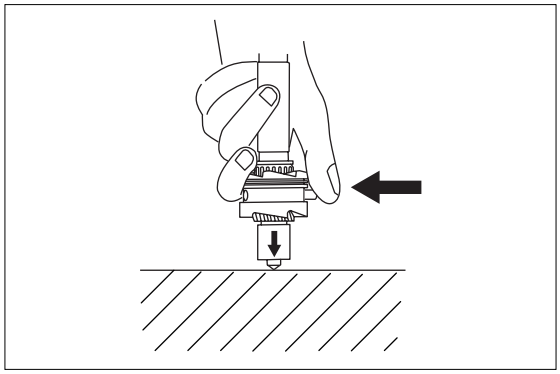
1. Attach spring ⑥, spring retainer ⑤, ball ②, push rod ①, clutch ⑦ and clutch pin ④ to propeller shaft.

- When attaching clutch, face the narrower claw ⓐ to push rod side.
- Install clutch pin while applying preload to push rod.
- Be careful not to allow ball to fly out by spring tension.



③ Clutch Pin Snap **Do not reuse.**



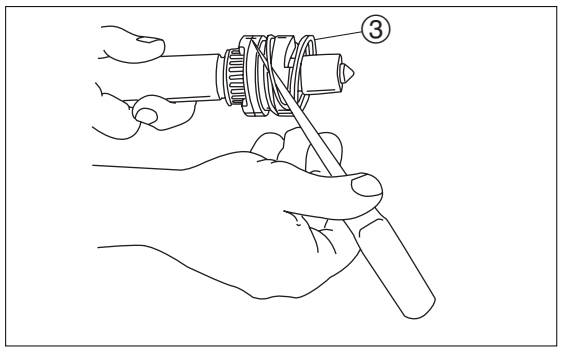


2. Attach new clutch pin snap ③ by using a bladed screw driver to turn the snap.

⚠ 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.

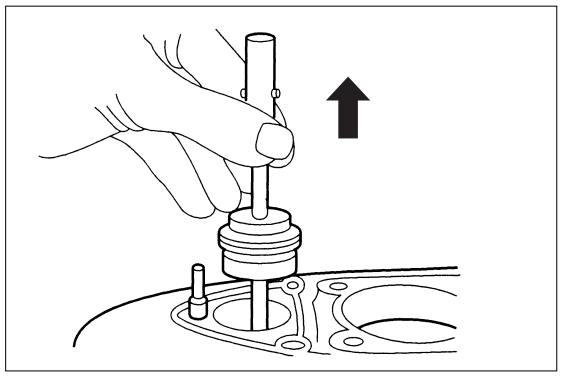


③ Clutch Pin Snap **Do not reuse.**

15) Disassembly of Cam Rod

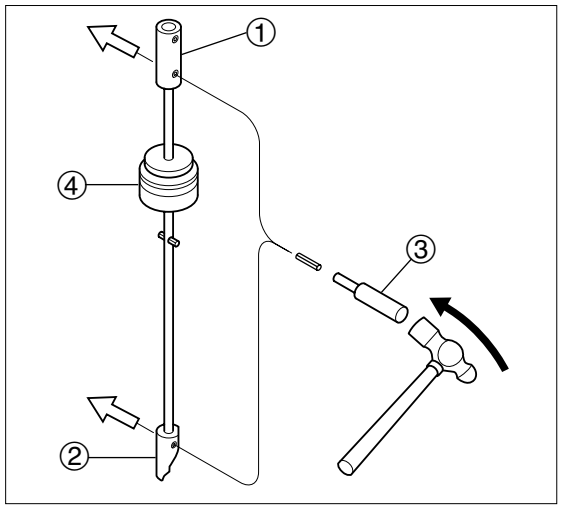
1. Remove stopper, pull out cam rod bushing, and take out cam rod from gear case.

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

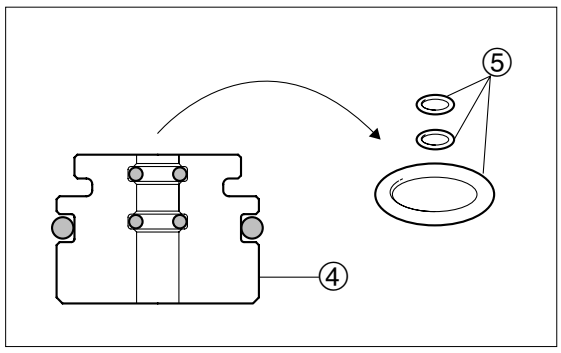


2. Remove shift rod joint ① and clutch cam ②.

Spring Pin Tool A ③ :
P/N. 369-72217-0



3. Remove O ring ⑤ from cam rod bushing ④.

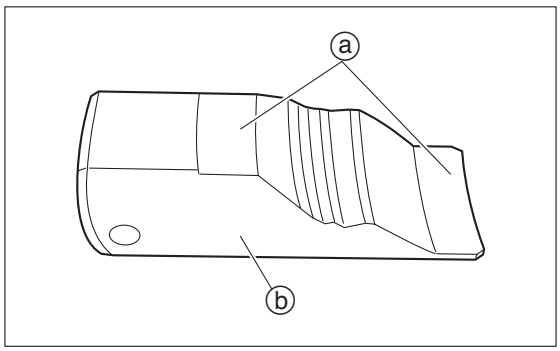


⑤ O Ring **Do not reuse.**

16) Inspection of Clutch Cam

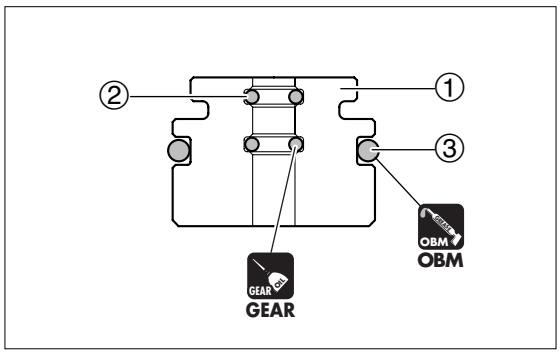
1. Check the part for wear and damage.
   Replace if necessary.

> Check especially for wear on the face ⓐ that scrapes against push rod and flaws on the circumference ⓑ.



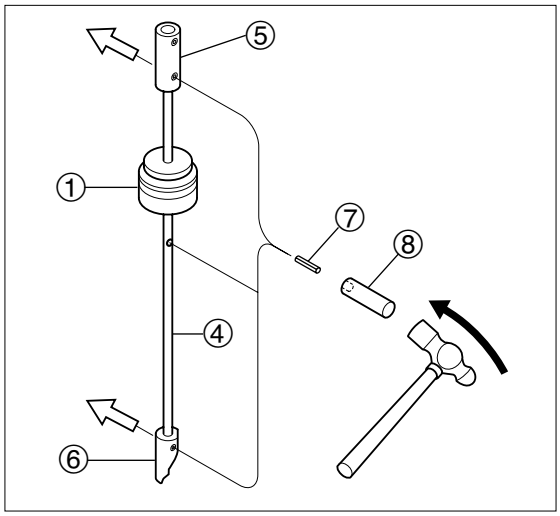
17) Assembly of Clutch Cam Parts

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



②③ O Rings **Do not reuse.**

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

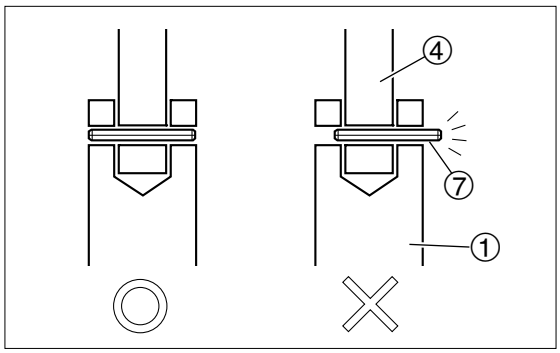


⑦ Spring Pin **Do not reuse.**

3. Drive spring pin ⑦.

> **Spring Pin Tool B ⑧ :**
> P/N. 369-72218-0

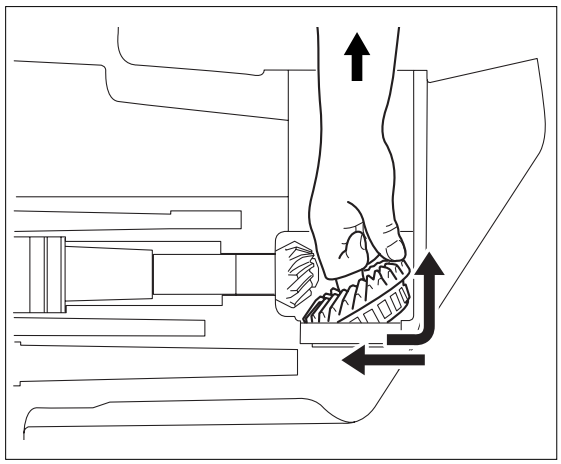
> **⚠ CAUTION**
>
> **Drive spring pin ⑦ so that it is flush with clutch cam surface as shown.**

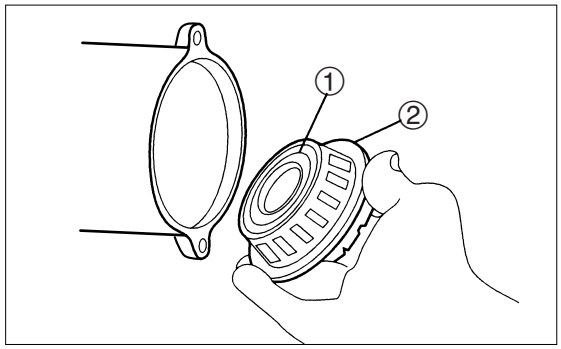


18) Removing Forward (A) Gear Ass'y

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

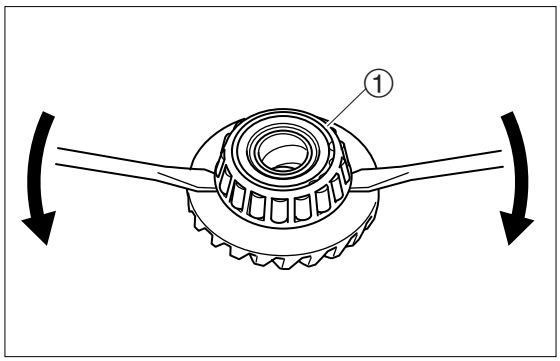
· Put mid finger into forward (A) gear hole and take it between the finger and the first finger (thumb), and lift the thumb side of the gear to remove it.
· Take forward (A) gear out taking care not to hit pinion (B) gear.





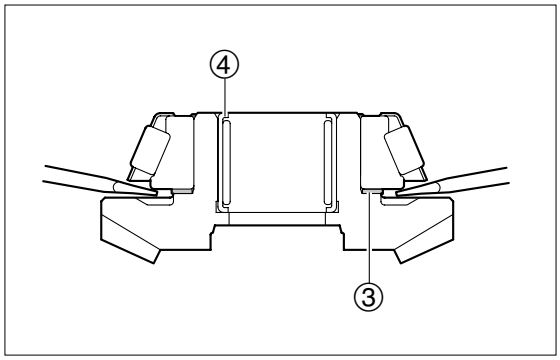
19) Disassembly of Forward Gear (A) Gear

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.

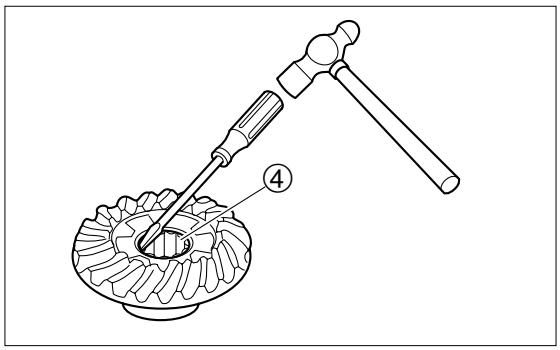


⚠ CAUTION

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.



④ Needle Bearing **Do not reuse.**

⚠ CAUTION

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

⚠ CAUTION

Do not reuse removed needle bearing.

20) Inspection of Forward (A) Gear

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

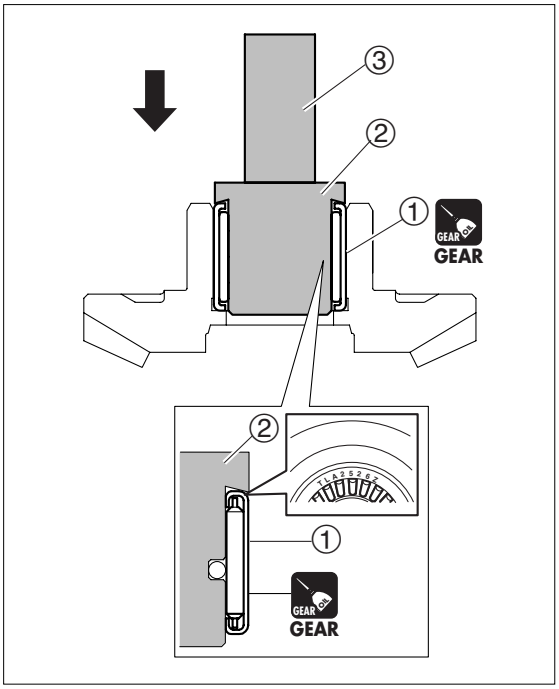
21) Assembly of Forward (A) Gear Parts

1. Install needle bearing ①.
   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

⚠ CAUTION

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



① Needle Bearing **Do not reuse.**

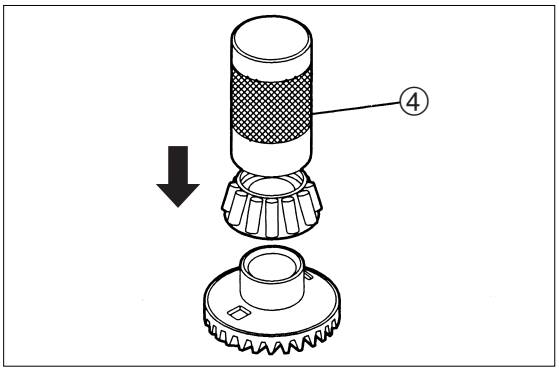
2. Attach shim ⑤ used before disassembly to taper roller bearing ②, and press-fit the part.

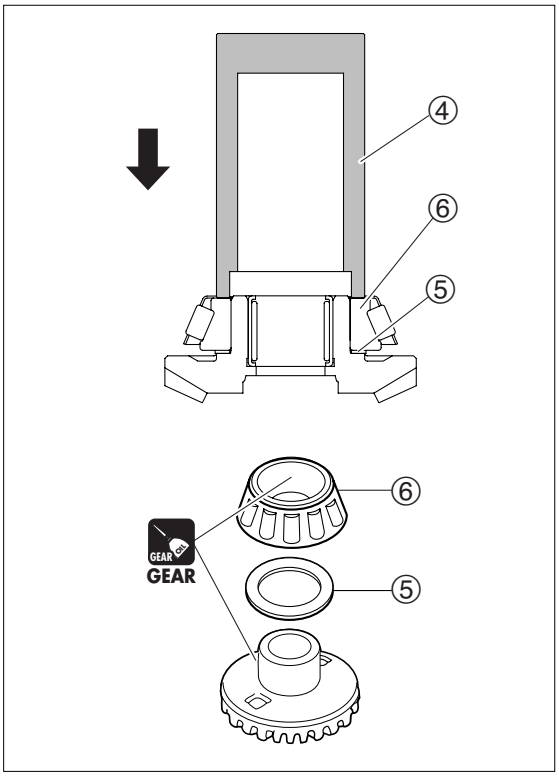
Bevel Gear Bearing Install Tool ④ :
P/N. 3B7-72719-0

⚠ CAUTION

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

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

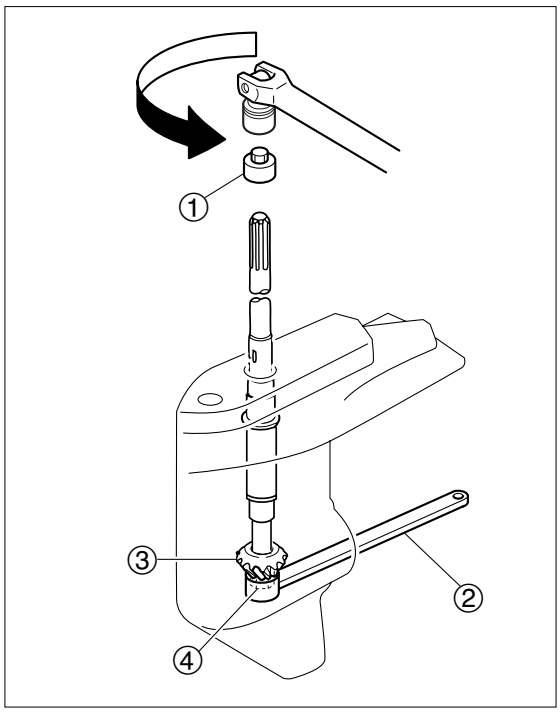




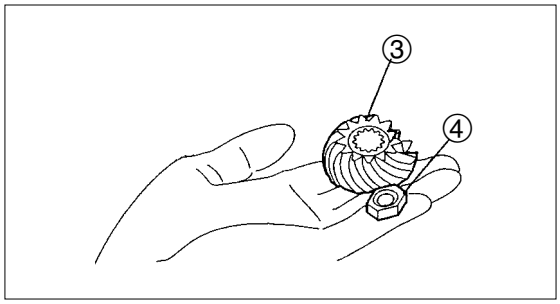
22) Removing Drive Shaft Ass'y

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

Drive Shaft Socket ① :
P/N. 3B7-72232-0
Bevel Gear B Nut Wrench ② :
P/N. 3B7-72231-0

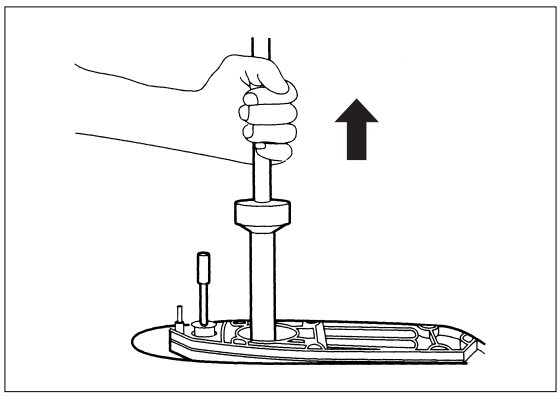


- Degrease pinion (B) gear nut completely so that the nut wrench does not slip on the nut.
- Loosen and remove the nut by using a drive shaft socket and a wrench and turning the wrench counterclockwise. Cover the wrench ② with rag to prevent it from hitting the case directly.
- This work can be made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

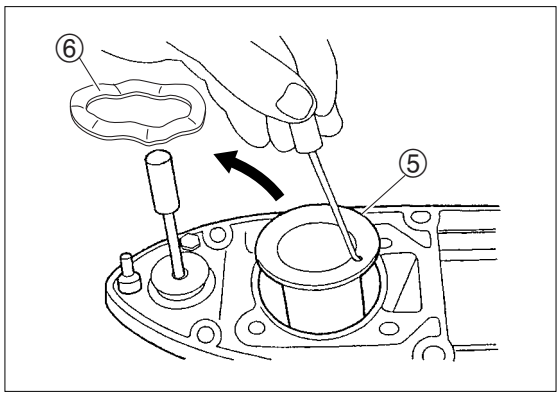


2. Pull out drive shaft from gear case.

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.



23) Disassembly of Drive Shaft Ass'y

1. Remove outer race ① and shim ②.

2. Remove drive shaft spring ③.

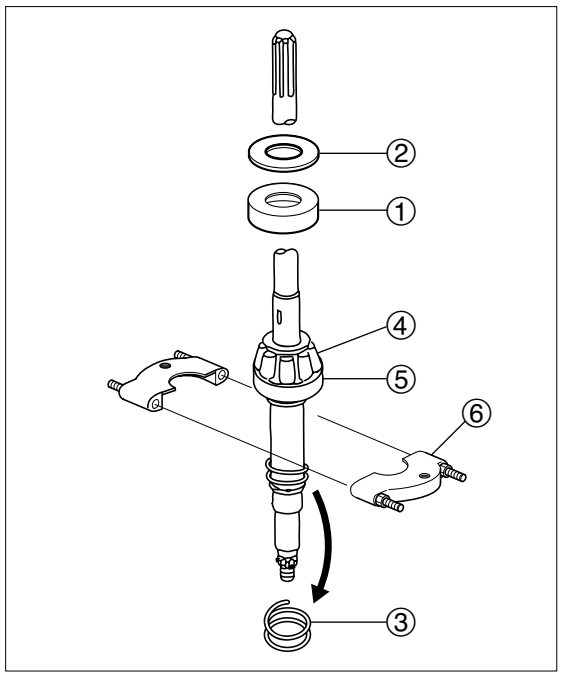
3. Remove taper roller bearings ④ and ⑤ by using press and universal puller ⑥.

· 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.

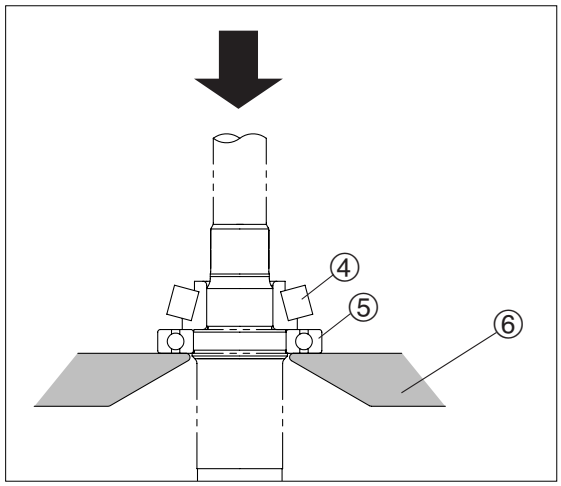
⚠ CAUTION

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

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



④⑤ Bearings **Do not reuse.**



④⑤ Bearings **Do not reuse.**

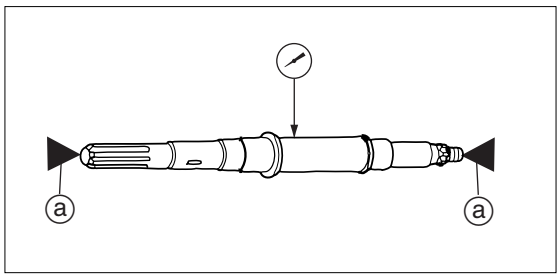
6

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)



ⓐ Supporting Points

25) Assembly of Drive Shaft Parts

1. Attach pinion (B) gear nut ① to drive shaft temporarily.

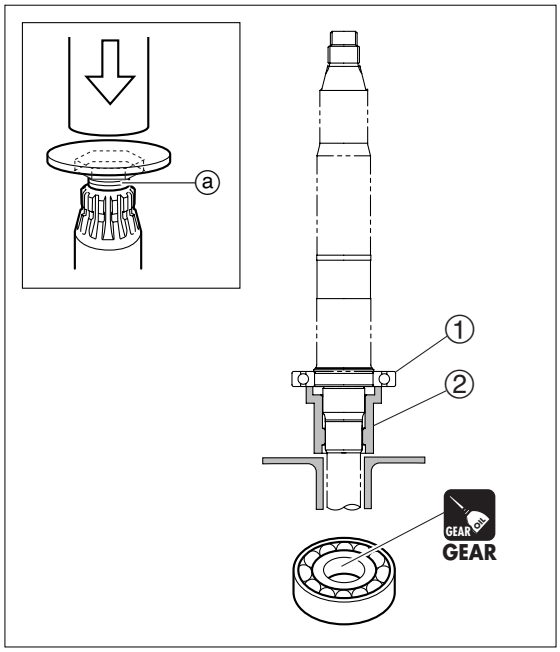
2. Install bearing ① by using press.
   Before installing bearing, be sure to clean drive shaft installation face and apply gear oil.

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

⚠ CAUTION

Do not press drive shaft thread ⓐ directly.
Put a piece of protector (steel plate) on the tip of the shaft.
Refer to "Chapter 6 Shim Adjustment".

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



① Bearing **Do not reuse.**

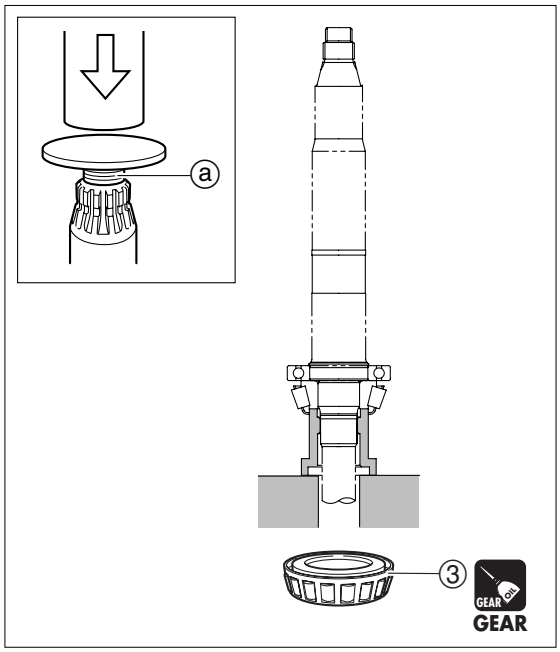
3. Install taper roller bearing ③ by using press.

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

⚠ CAUTION

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

Before installing taper roller bearing, be sure to clean drive shaft installation face and apply gear oil.

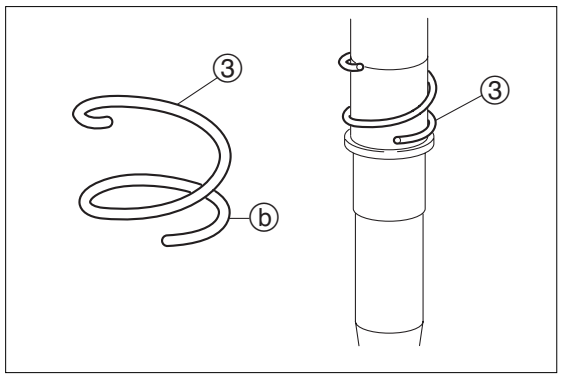


③ Taper Roller Bearing **Do not reuse.**

4. Attach drive shaft spring ③.

⚠ CAUTION

When attaching the spring, face the side ⓑ toward pinion (B) gear side.
Refer to "Chapter 6 Shim Adjustment".



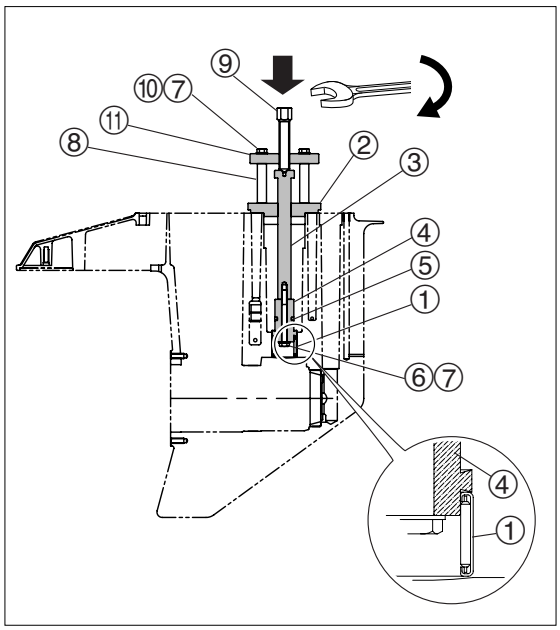
26) Disassembly of Gear Case

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

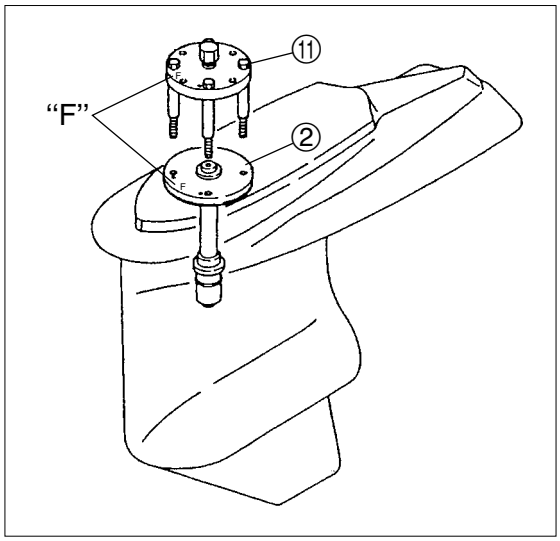
Needle Bearing Press Kit :
P/N. 3C7-72900-1
Bearing Outer Press Guide ② :
P/N. 3C7-72765-0
Needle Bearing Press Rod ③ :
P/N. 3C7-72767-0
Needle Bearing Press ④ :
P/N. 3C7-72770-0
O Ring ⑤ :
P/N. 3B2-62415-0
Bolt M8-80 ⑥ :
P/N. 910194-0880
Washer M8 ⑦ :
P/N. 940191-0800
Needle Bearing Press Collar ⑧ :
P/N. 3C7-72768-0
Needle Bearing Press Bolt ⑨ :
P/N. 3C7-72766-0
Bolt M8-110 ⑩ :
P/N. 3C7-72773-0
Needle Bearing Press Flange ⑪ :
P/N. 3C7-72901-0

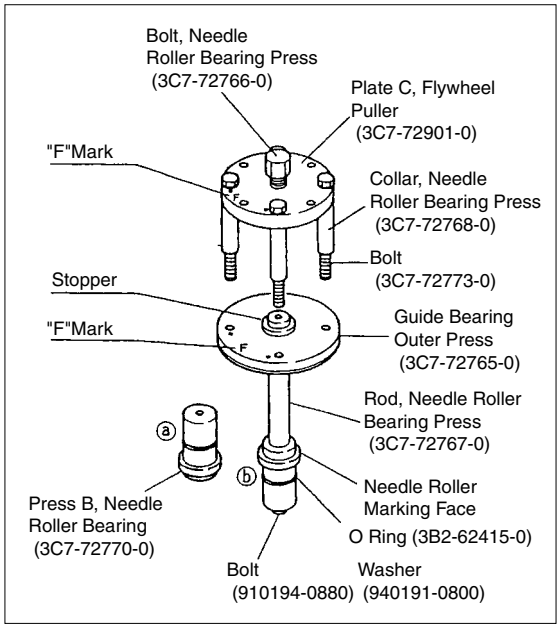
⚠ CAUTION

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



Needle ① Bearing **Do not reuse.**





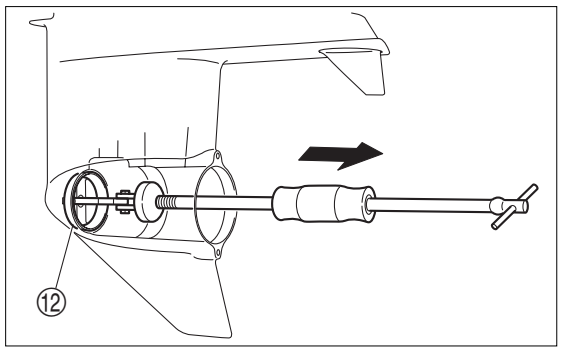
2. Remove taper roller bearing outer race ⑫.
   Put the slide hammer in the gear case, hook claw of slide hammer on the outer race to fix it, and slide the hammer to pull out the outer race.

Slide Hammer Kit :
P/N. 3AC-99080-0

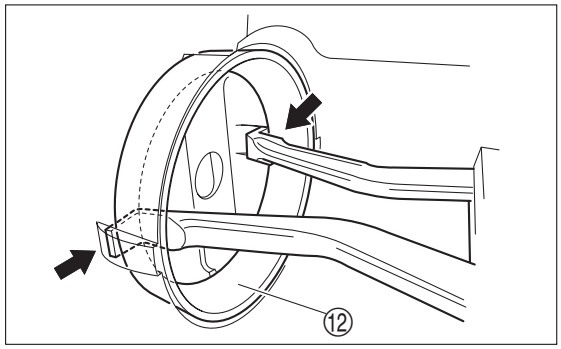
Confirm the position of insertion groove in the back of outer race, and put the claw of slide hammer in the groove.

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

Bevel Gear Bearing Puller Ass'y :
P/N. 3B7-72755-0

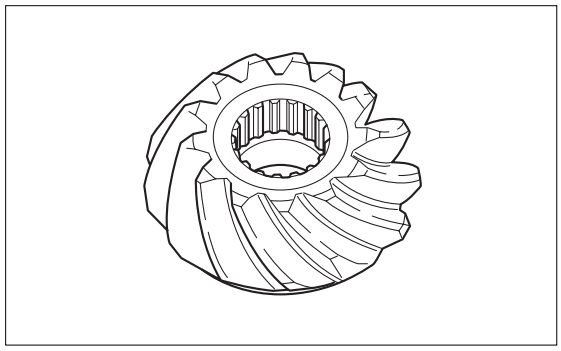


① Outer Race **Do not reuse.**



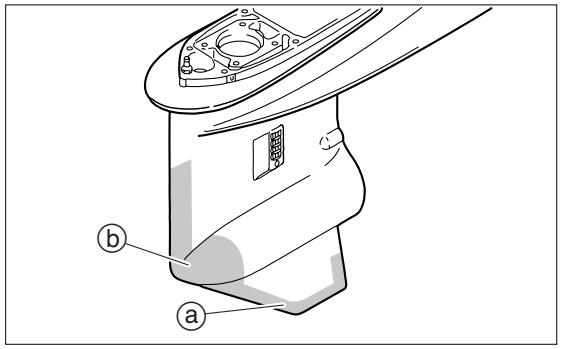
27) Inspection of Forward (A) Gear and Pinion (B) Gear

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



28) Inspection of Gear Case

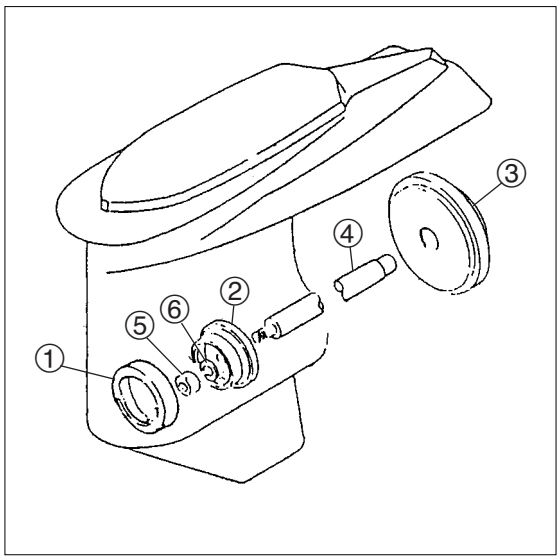
1. Also check skeg ⓐ and torpedo-like area ⓑ for crack and other damage.
   Replace if necessary.



29) Assembly of Gear Case Parts

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

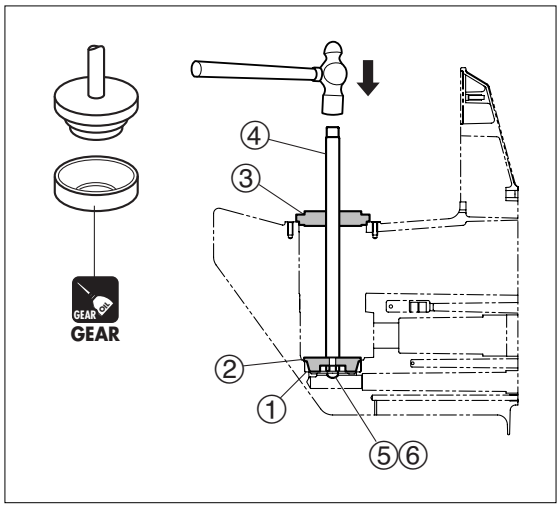
Bearing Outer Press Kit :
P/N. 3B7-72739-0
Bearing Outer Press Plate ② :
P/N. 3B7-72732-0
Bearing Outer Press Guide ③ :
P/N. 3B7-72733-0
Bearing Outer Press Rod ④ :
P/N. 3B7-72731-0
Nut M10 ⑤ :
P/N. 930191-1000
Spring Washer ⑥ :
P/N. 941392-1000



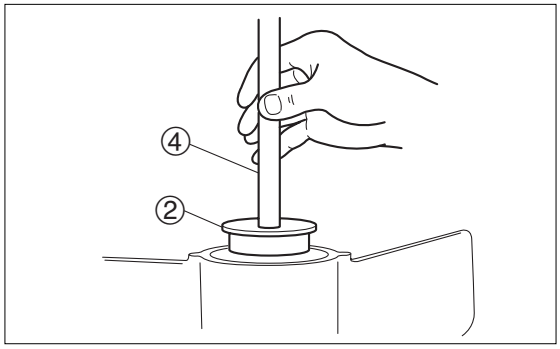
2. Fix gear case on a holder with its propeller shaft opening facing upward.

3. Clean outer race installation face in the gear case and apply gear oil.

3. 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.

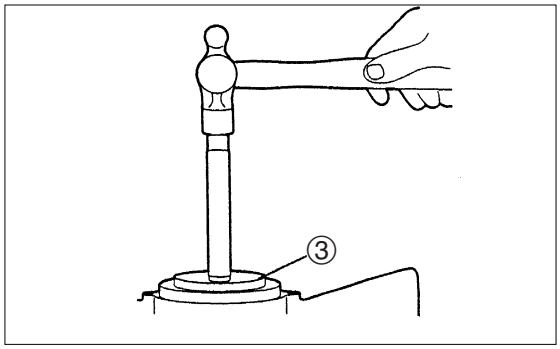


4. Put rod ass'y into gear case slowly so that plate ② contacts inside of the outer race, and put the guide on the rod and set it in the opening of the gear case.



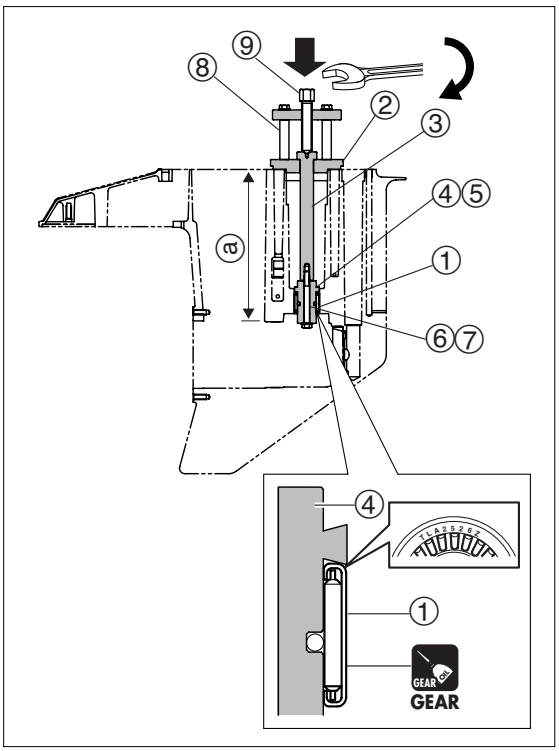
5. Tap the end of the rod with a hammer to press-fit the outer race in the housing securely.

The hammering sound changes when the outer race is set in the housing properly.



6. Install needle bearing by using the following tools.

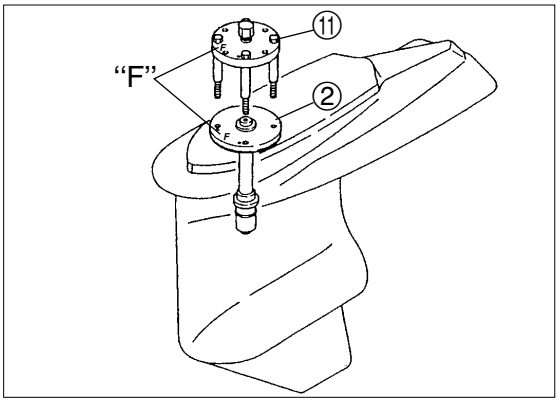
Needle Bearing Press Kit :
P/N. 3C7-72900-1
Bearing Outer Press Guide ② :
P/N. 3C7-72765-0
Needle Bearing Press Rod ③ :
P/N. 3C7-72767-0
Needle Bearing Press ④ :
P/N. 3C7-72770-0
O Ring ⑤ :
P/N. 3B2-62415-0
Bolt M8-80 ⑥ :
P/N. 910194-0880
Washer M8 ⑦ :
P/N. 940191-0800
Needle Bearing Press Collar ⑧ :
P/N. 3C7-72768-0
Needle Bearing Press Bolt ⑨ :
P/N. 3C7-72766-0
Bolt M8-110 ⑩ :
P/N. 3C7-72773-0
Needle Bearing Press Flange ⑪ :
P/N. 3C7-72901-0



① Needle Bearing **Do not reuse.**

⚠ 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 ⓐ :
189.45 - 190.05 mm (7.4587 - 7.4823 in)

6

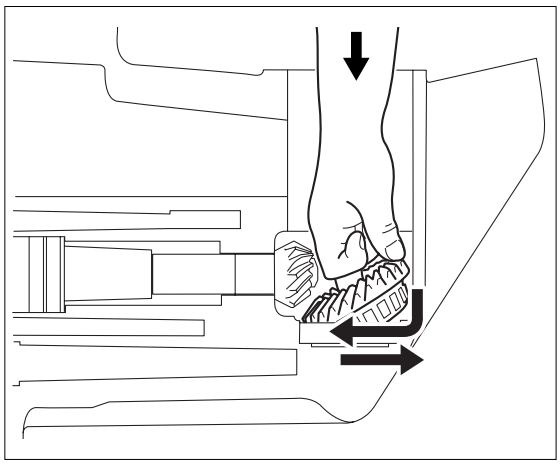
30) Assembly of Lower Unit Parts

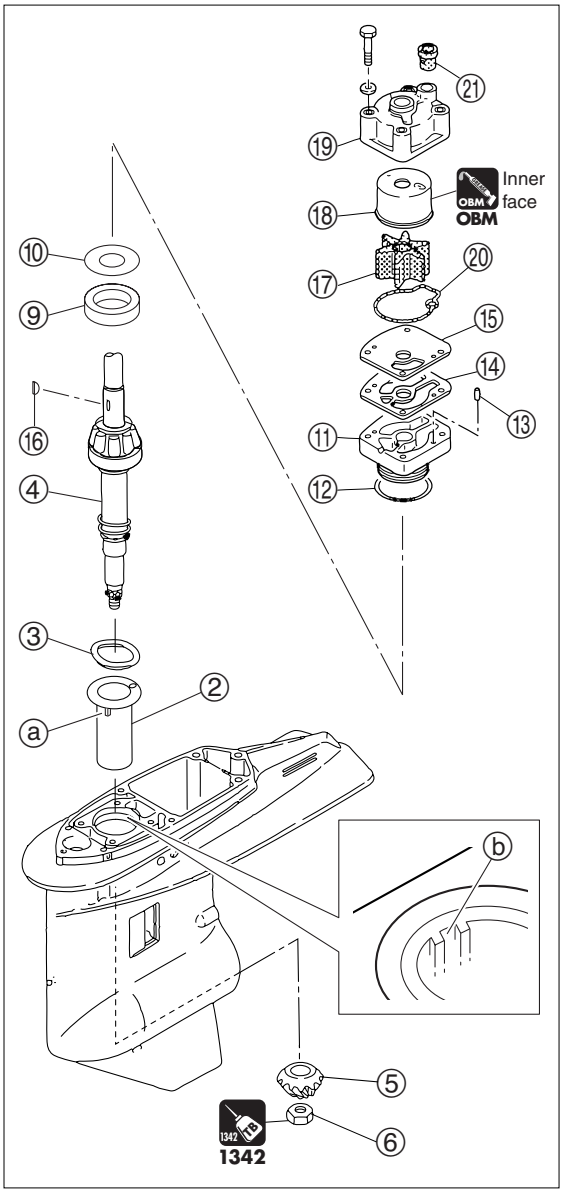
1. Install forward (A) gear ①.

2. Install drive shaft spring guide ②, wave washer ③ and drive shaft ④.

⚠ CAUTION

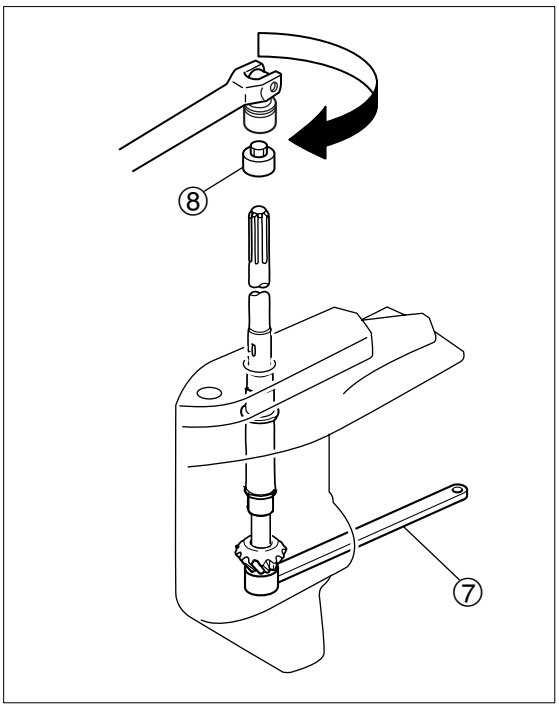
Align protrusion ⓐ of spring guide ② with gear case groove ⓑ.





⑫⑭⑳ **Do not reuse.**

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.

Pinion (B) Gear Nut ⑥ :
110N · m (80 lb · ft) [11kgf · m]

Bevel Gear B Nut Wrench ⑦ :
P/N. 3B7-72231-0
Drive Shaft Socket ⑧ :
P/N. 3B7-72232-0

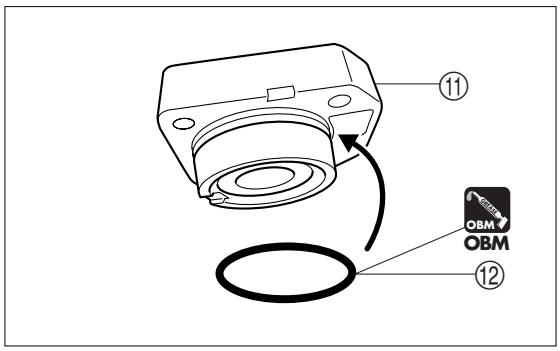
4. Attach shim ⑩ that is removed when disassembling taper roller bearing outer race ⑨.

⚠ CAUTION

When gear case, drive shaft or pump case (lower) is replaced, measure pinion (B) bear height and back lash between gears, and perform shim adjustment.
Refer to "Chapter 6 Shim Adjustment".

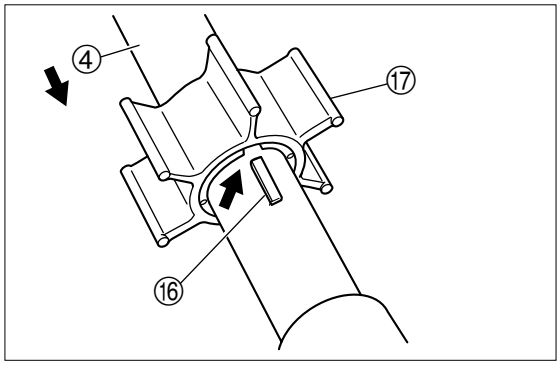
6. Attach O ring ⑫ to pump case (lower) ⑪ and install pump case (lower) to gear case.

Apply OBM grease to O ring.



7. Put dowel pin ⑬ on the pump case (lower) ⑪, and attach pump case guide plate gasket ⑭ and pump case guide plate ⑮.

8. 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.

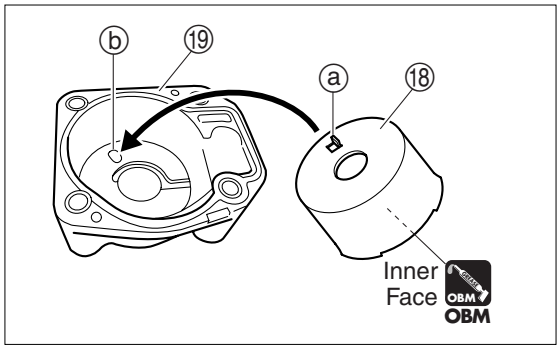


9. Attach water pump liner ⑱ to pump case (upper) ⑲.

Apply OBM grease to inside of water pump liner.

⚠ CAUTION

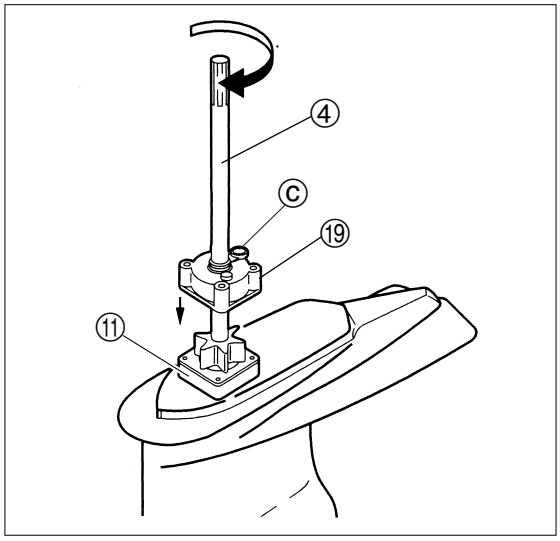
Align pump liner ⑱ protrusion ⓐ with pump case (upper) ⑲ concave ⓑ.



10. 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 direction.



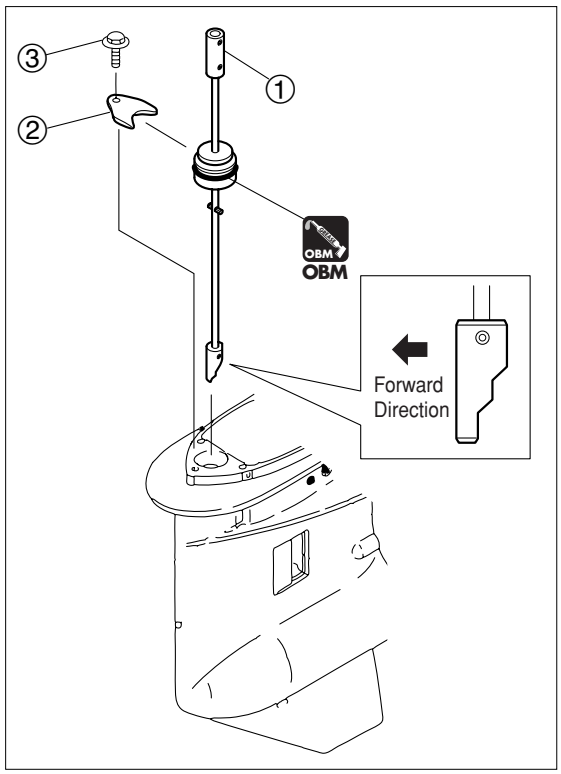
11. Attach water pipe seal ㉑ (RP).

Apply OBM grease thinly on the inside ⓒ of water pipe seal so that water pipe can be inserted smoothly.

31) Attaching Clutch Cam Ass'y

1. Install clutch cam ass'y ①.

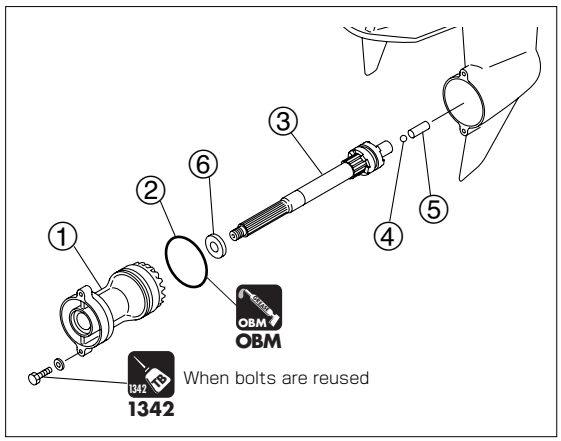
Apply OBM grease to O ring of clutch cam ass'y, and install the assembly by pushing cam rod bushing into gear case.
Be careful of direction of clutch cam.



2. Attach stopper ② and bolt ③.

3. Attach O ring ② to propeller shaft housing ①.

Apply OBM grease to O ring.



③ O Ring Do not reuse.

4. Attach steel ball 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 Chapter 6, Section 3. Page 6-48

5. Install propeller shaft ③ to propeller shaft housing ①, and install the assembly to gear case.

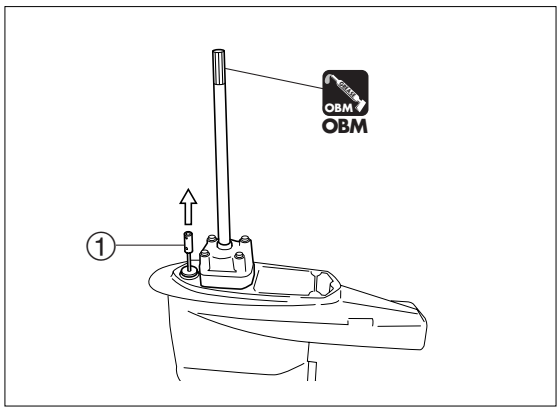
· Install propeller shaft housing to gear case securely, and tighten the securing bolts after confirming that O ring is set in the case properly.
· Apply ThreeBond 1342 to thread of propeller shaft housing installation bolts.

Propeller Shaft Housing Bolts :
25 N · m (18 lb · ft) [2.5 kgf · m]

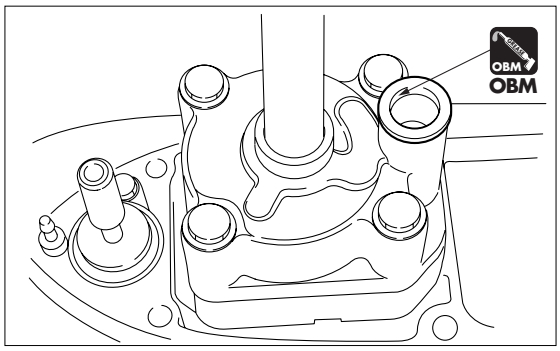
1342

32) Installation of Lower Unit

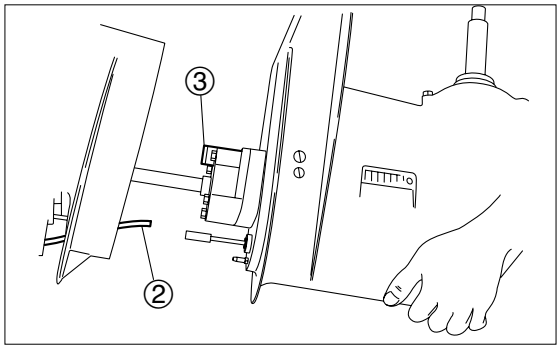
1. Set shift rod ① to up position.



- · 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.



2. 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.



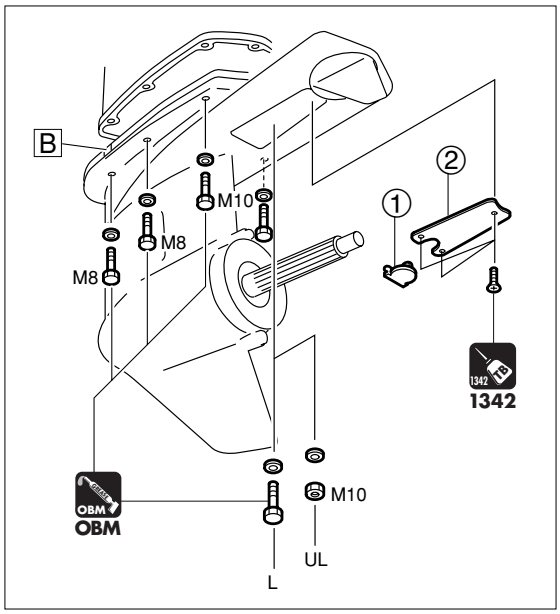
3. Tighten lower unit ass'y installation bolts and nut to specified torque.

4. Attach gear case plate plug ① and gear case plate ②.

⚠ 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.

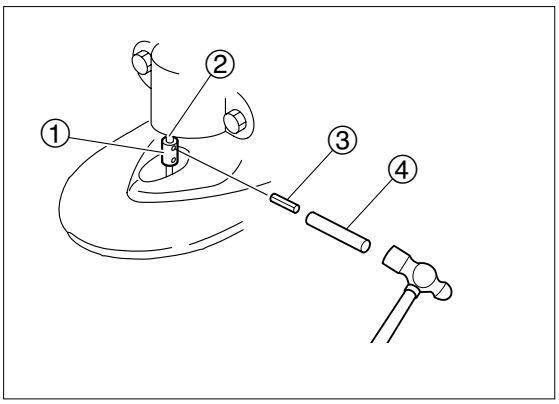
M8 :
25N · m (18 lb · ft) [2.5kgf · m]
M10 :
40N · m (29 lb · ft) [4.0kg · m]



5. Connect shift rod joint ① and shift rod ②, and drive in spring pin ③.

Spring Pin Tool B ④ :
P/N. 369-72218-0

Do not reuse spring pin.
Replace with new one when removed.



③ Spring Pin **Do not reuse.**

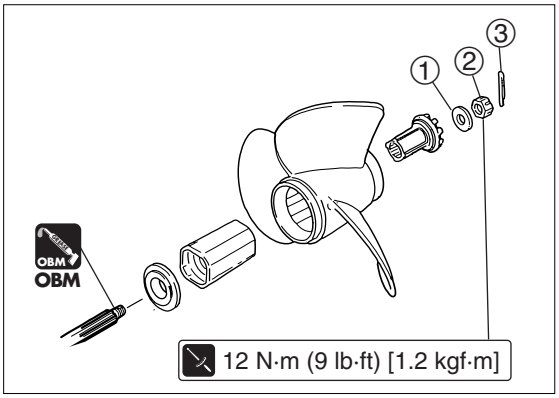
6. Attach propeller and tighten propeller nut ② to specified torque.

Propeller Nut ② :
12N · m (9 lb · ft) [1.2kgf · m]

7. Attach split pin ③.

⚠ CAUTION

If propeller shaft pin hole and propeller nut pin groove do not align, additionally tighten the nut until they align.



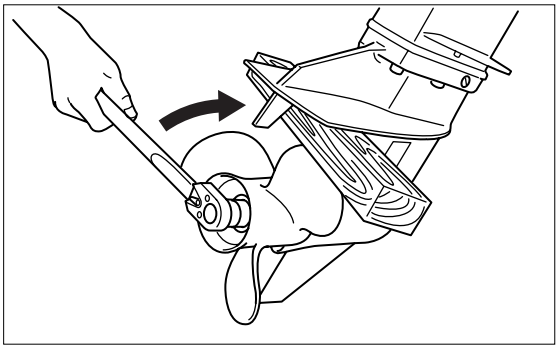
③ Split Pin **Do not reuse.**

8. 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.

⚠ CAUTION

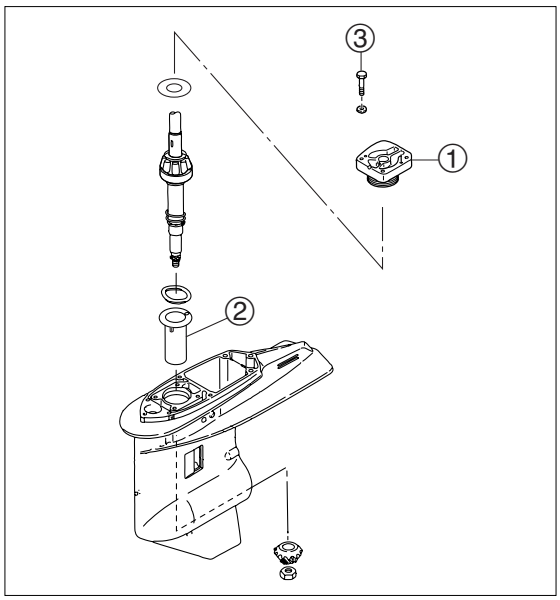
- **Before removing or installing propeller, be sure to disconnect battery cables from battery and remove stop switch lock plate.**
- **When removing or installing propeller, do not handle propeller with bare hands.**
- **Put a piece of wooden block between anti-ventilation plate and propeller to prevent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

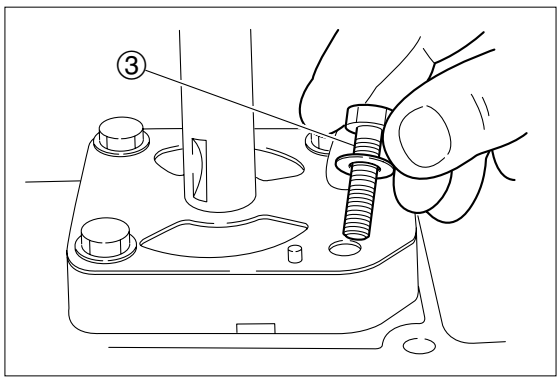


33) Measurement of Pinion (B) Gear Height and Shim Selection

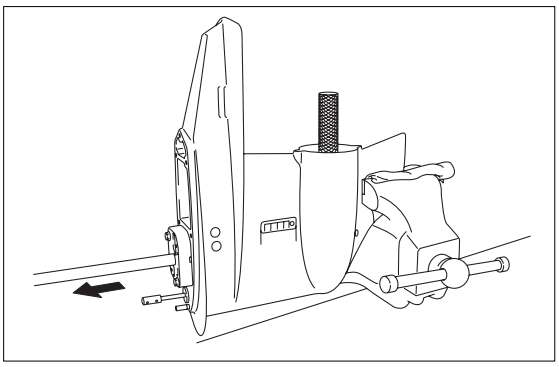
1. Before measuring back lash of each gear, measure drive shaft pinion (B) gear height and adjust the height to proper value if necessary.
   In accordance with procedure described in "Assembly of Lower Unit" in Chapter 6, install the parts up to pump case ①, and secure it by using M8 bolt (L=35mm) and flat washer ③.

M8 Bolt (L=35mm) + Flat Washer ③ :
13N · m (9.0 lb · ft) [1.3kgf · m]





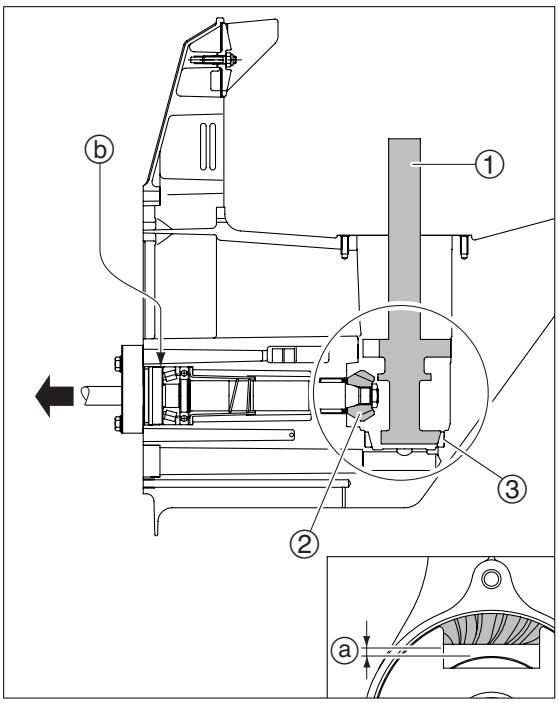
2. This work can be made easier when the opening of gear case of propeller shaft side is faced upward and fixed horizontally with a holder.
Put a shimming gauge ① into gear case, and measure gap ⓐ between shimming gauge ① and pinion (B) gear ②.



Thickness gauge measures the gap between shimming gauge ① and pinion (B) gear end.

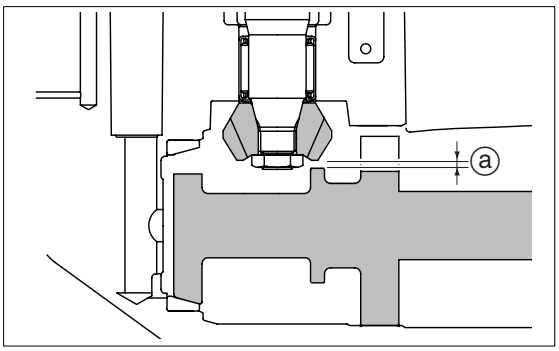
⚠ CAUTION

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



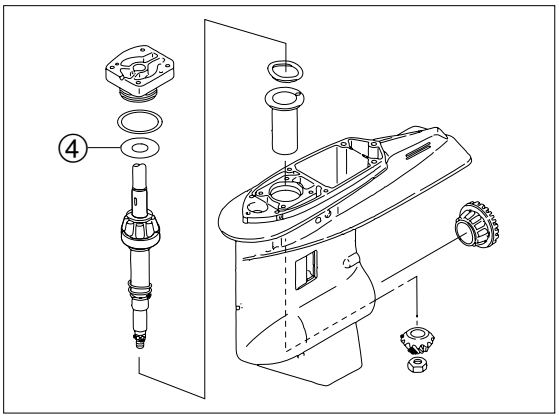
Shimming Gauge ① :
P/N. 3B7-72250-0
Thickness Gauge :
P/N. 353-72251-0

6. Add shim ④ to bottom of ⓑ pump case (lower) to adjust the gap ⓐ to specified value.



Pinion (B) Gear Height ⓐ :
0.60 - 0.64 mm (0.0236 - 0.0252 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



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

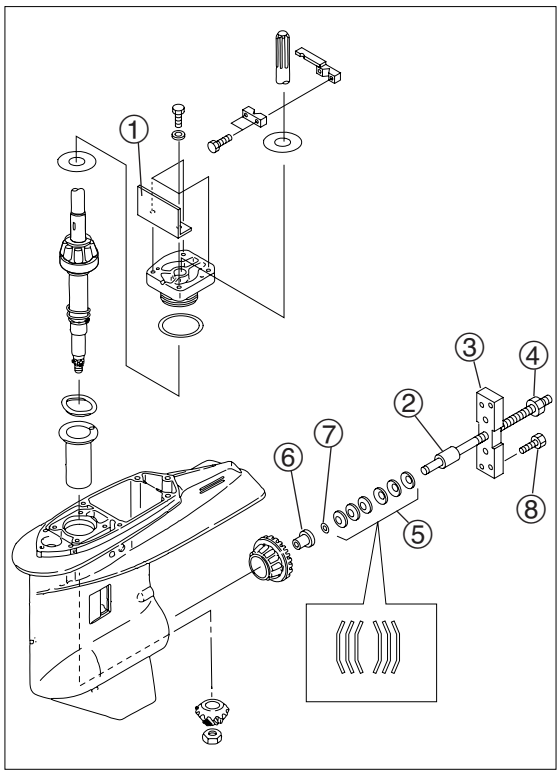
⚠ CAUTION

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.

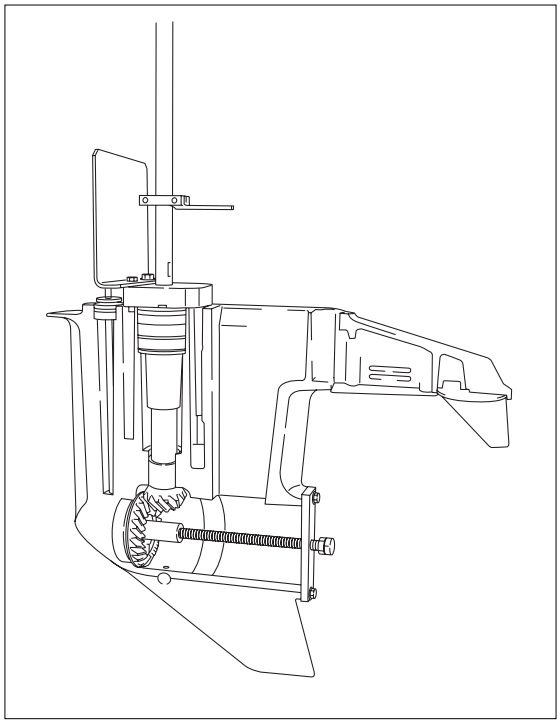
1. In accordance with procedure described in "Assembling Lower Unit" in Chapter 6, install parts up to pump case (lower).

2. Install dial gauge plate ① and secure it with bolt (M8-35) and flat washer.

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

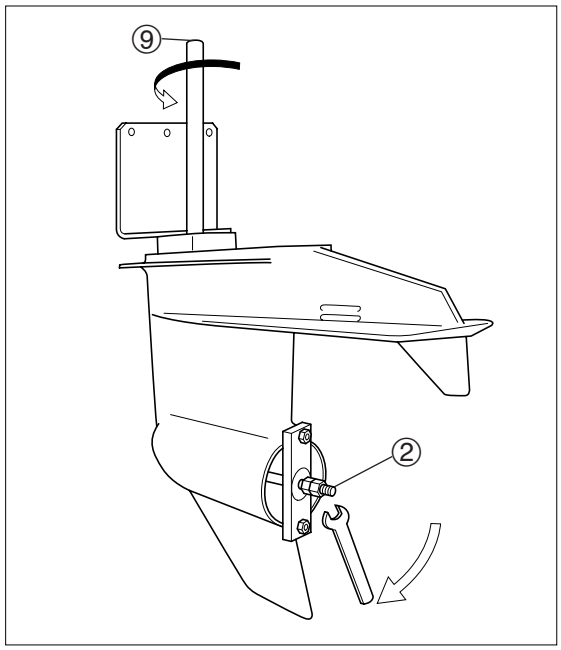


Dial Gauge Plate ① :
P/N. 3B7-72729-0
Backlash Measuring Tool Kit :
P/N. 3B7-72234-0
Backlash Measuring Tool Shaft ② :
P/N. 3B7-72723-0
Backlash Measuring Tool Plate ③ :
P/N. 3B7-72724-0
Nut M12P1.5 ④ :
P/N. 3B7-72735-0
Cone Disk Spring ⑤ :
P/N. 3B7-72734-0
Measuring Tool Set Piece ⑥ :
P/N. 3B7-72245-0
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.

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˚).
Tighten the nut to secure the plate so that the shaft ② will not move even if drive shaft is turned.

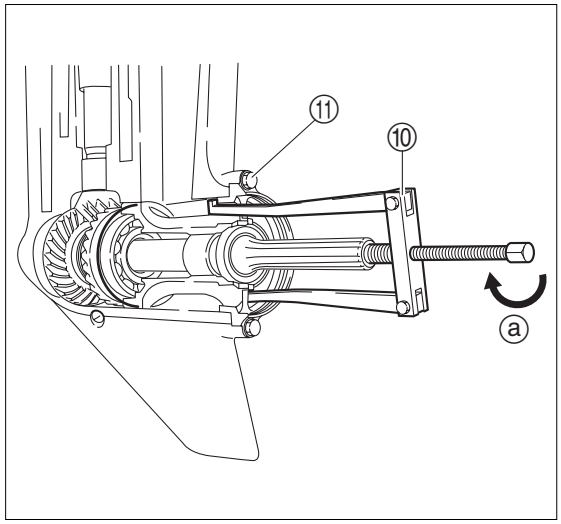


· As an alternative to the above measuring tool, a tool used for pulling out the following propeller shaft housing can be used to secure forward gear (A) gear.
· When performing the work, assemble propeller shaft ass'y and housing ass'y and bolts to tighten to specified torque.

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 ⓐ :
Tighten bolt gradually until propeller shaft stops to turn.



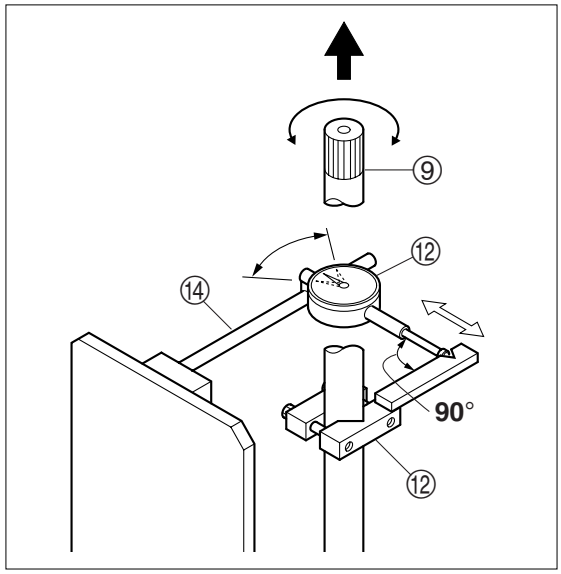
6

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



7. Select proper thickness of shim based on the backlash measured with dial gauge and on the table shown.

Proper Backlash :
0.24 - 0.48 mm (0.0094 - 0.0189 in)

- 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.

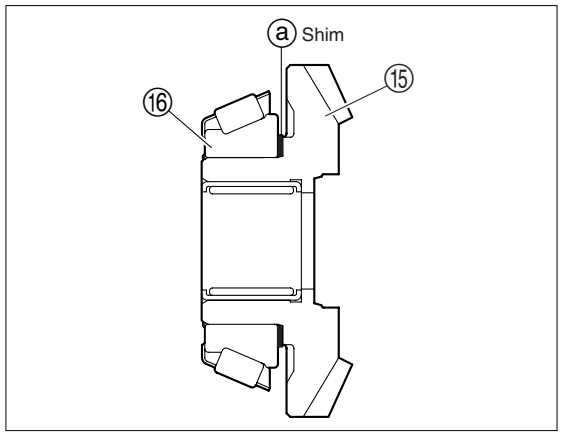
Dial Gauge Reading : mm (in)		Shim Thickness : mm (in) + means addition of shim/- means removal of shim
0.00 - 0.11	(0.00 - 0.0043)	-0.10 (0.0040)
0.12 - 0.23	(0.0048 - 0.0091)	-0.05 (0.0020)
0.24 - 0.48	(0.0095 - 0.0189)	0.00
0.49 - 0.59	(0.0193 - 0.0232)	+0.05 (0.0020)
0.60 - 0.74	(0.0236 - 0.0291)	+0.10 (0.0039)
0.75 - 0.89	(0.0295 - 0.0351)	+0.15 (0.0059)
0.90 - 1.04	(0.0355 - 0.0410)	+0.20 (0.0079)
1.05 - 1.20	(0.0414 - 0.0473)	+0.25 (0.0100)
1.21 - 1.35	(0.0477 - 0.0532)	+0.30 (0.0118)
1.36 - 1.50	(0.0536 - 0.0591)	+0.35 (0.0138)
1.51 - 1.65	(0.0595 - 0.0650)	+0.40 (0.0157)
1.66 - 1.81	(0.0654 - 0.0713)	+0.45 (0.0177)
1.82 - 1.96	(0.0717 - 0.0772)	+0.50 (0.0197)
1.97 - 2.11	(0.0776 - 0.0831)	+0.55 (0.0217)
2.12 - 2.26	(0.0835 - 0.0890)	+0.60 (0.0240)

8. Add shim ⓐ 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 ⓐ :
0.1 mm (0.0039 in) P/N. 3B7-64016-0
0.15 mm (0.0059 in) P/N. 3B7-64015-0



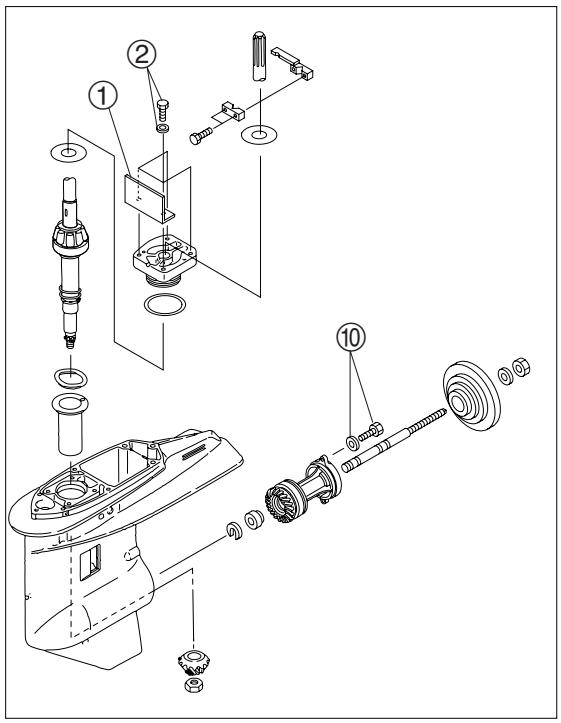
35) Measurement of Back Lash between Pinion (B) and Reverse (C) Gears and Shim Selection

⚠ 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.

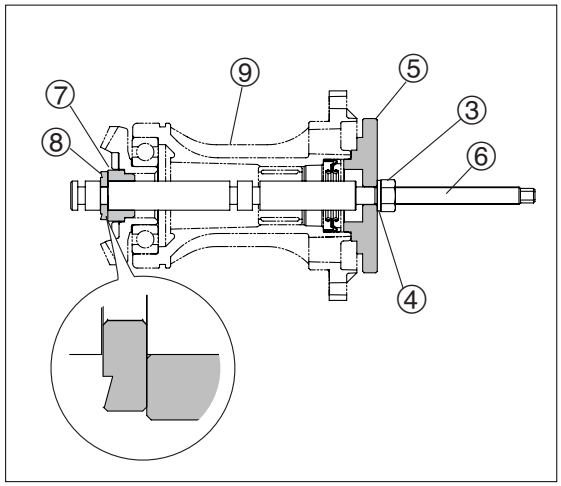
1. In accordance with procedure described in "Assembling Lower Unit" in Chapter 6, install parts up to pump case (lower).

2. Attach dial gauge plate ① and secure it using bolt (M8, L=35mm) ② and flat washer ②.

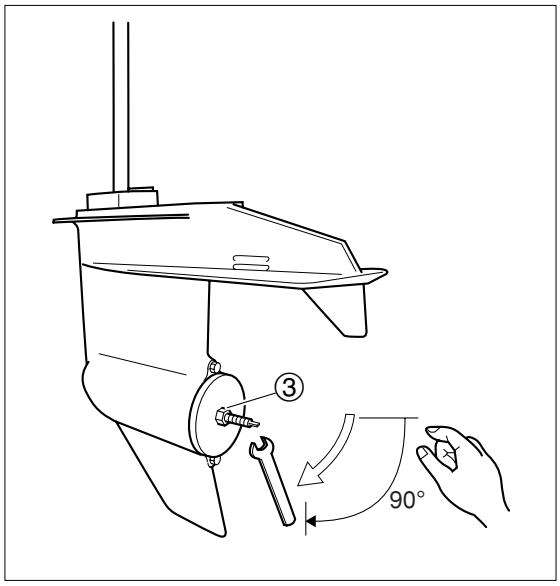


3. Attach backlash measuring tool kit parts ③ to ⑧ to propeller shaft housing ass'y ⑨, put the assembly in the gear case, and secure it using bolt (M8, L=30mm) ⑩ and flat washer ⑩.

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, and then additionally tighten 1/4 of a turn (90˚) by using a tool.

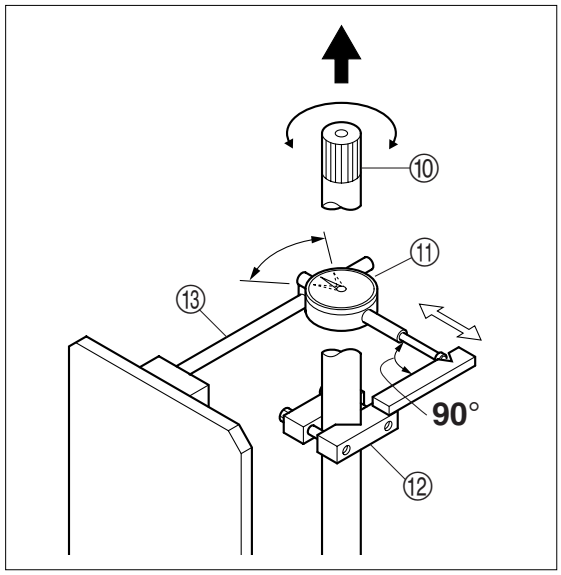


5. Attach backlash measuring tool clamp ⑫ to drive shaft.

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.

Proper Backlash :
0.24 - 0.48 mm (0.0094 - 0.0189 in)

- 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.

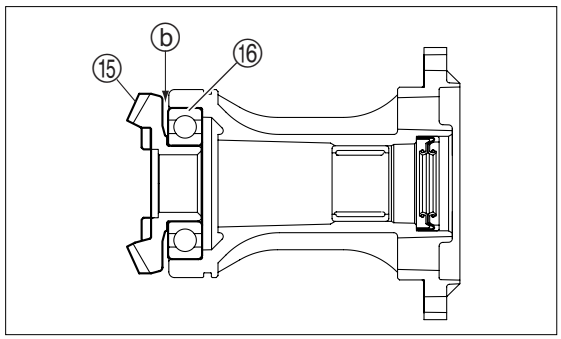
This work can be made easier when the opening of gear case of propeller shaft side is faced upward and fixed horizontally with a holder.

Dial Gauge Reading : mm (in)		Shim Thickness : mm (in) + means addition of shim/- means removal of shim	
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0.49 - 0.59	(0.0193 - 0.0232)	+0.05	(0.0020)
0.60 - 0.74	(0.0236 - 0.0291)	+0.10	(0.0039)
0.75 - 0.89	(0.0295 - 0.0351)	+0.15	(0.0059)
0.90 - 1.04	(0.0355 - 0.0410)	+0.20	(0.0079)
1.05 - 1.20	(0.0414 - 0.0473)	+0.25	(0.0100)
1.21 - 1.35	(0.0477 - 0.0532)	+0.30	(0.0118)
1.36 - 1.50	(0.0536 - 0.0591)	+0.35	(0.0138)
1.51 - 1.65	(0.0595 - 0.0650)	+0.40	(0.0157)
1.66 - 1.81	(0.0654 - 0.0713)	+0.45	(0.0177)
1.82 - 1.96	(0.0717 - 0.0772)	+0.50	(0.0197)
1.97 - 2.11	(0.0776 - 0.0831)	+0.55	(0.0217)
2.12 - 2.26	(0.0835 - 0.0890)	+0.60	(0.0240)

8. Add shim(s) into gap ⓑ between reverse (C) gear ⑮ and bearing ⑯ if necessary.

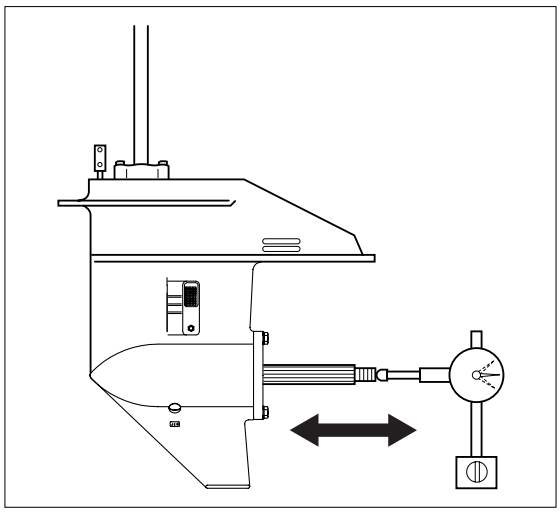
⚠ CAUTION

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

36) 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.

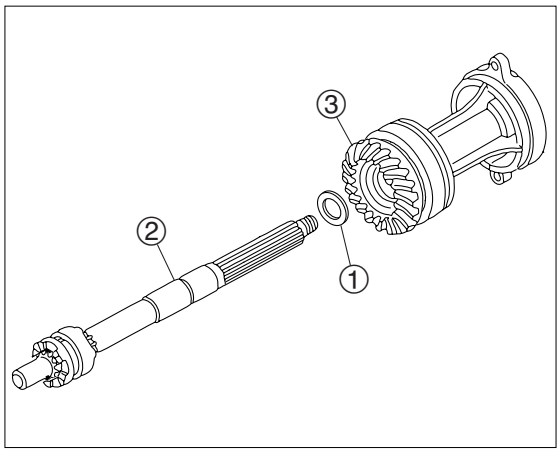
2. Measure play of propeller shaft in forward and reverse directions.

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.

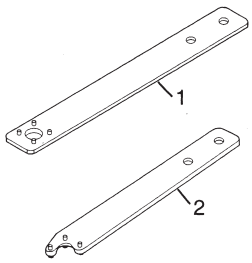
7

Cowl, Bracket and PTT



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1. Special tools



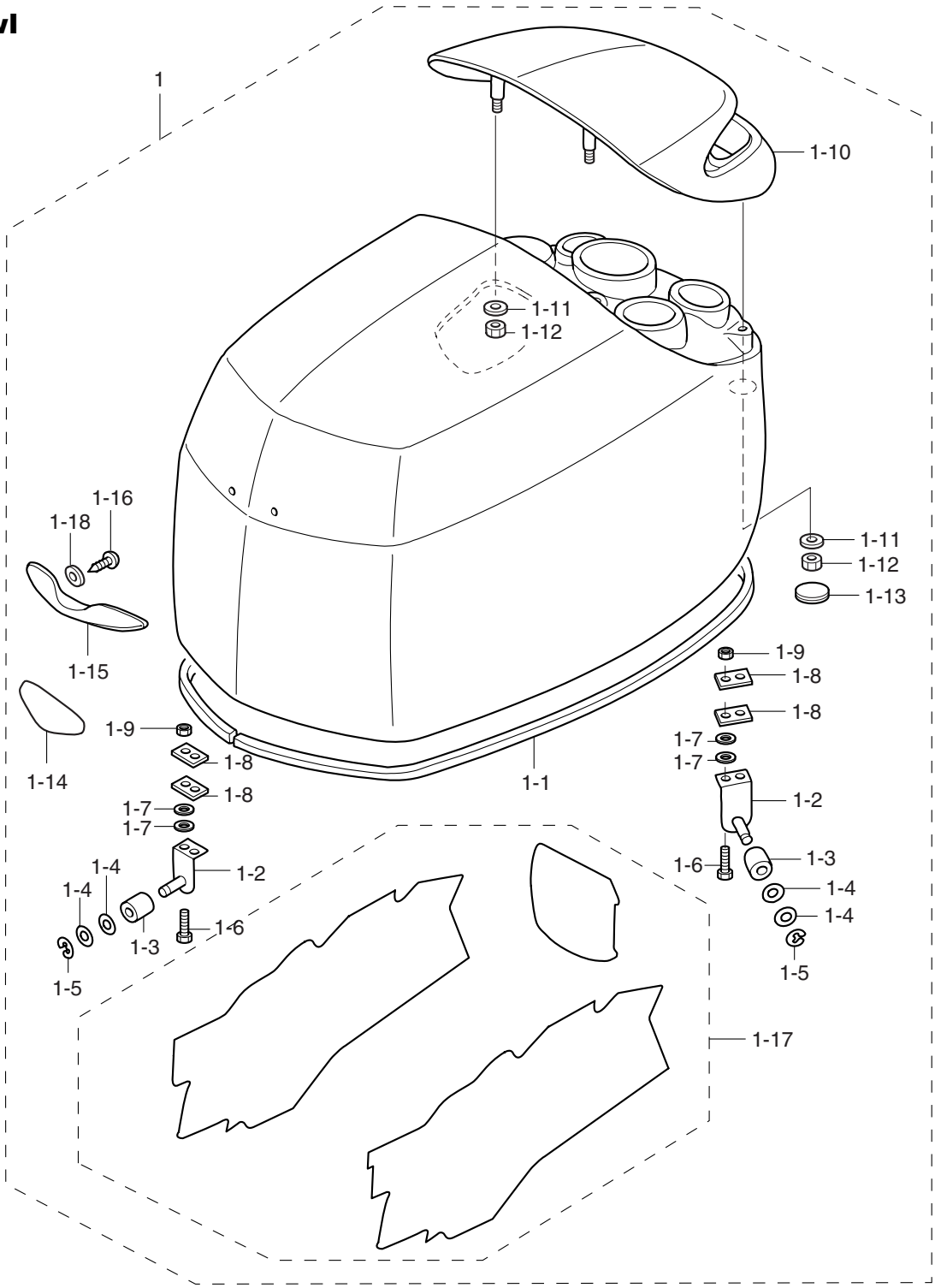
1 : Trim Rod Guide Wrench
P/N. 3B7-72792
2 : Trim Rod Guide Wrench
P/N. 3C8-72791

Removing or attaching PTT piston rod ass'y

2. Parts Layout

P/L Fig. 20

Cowl

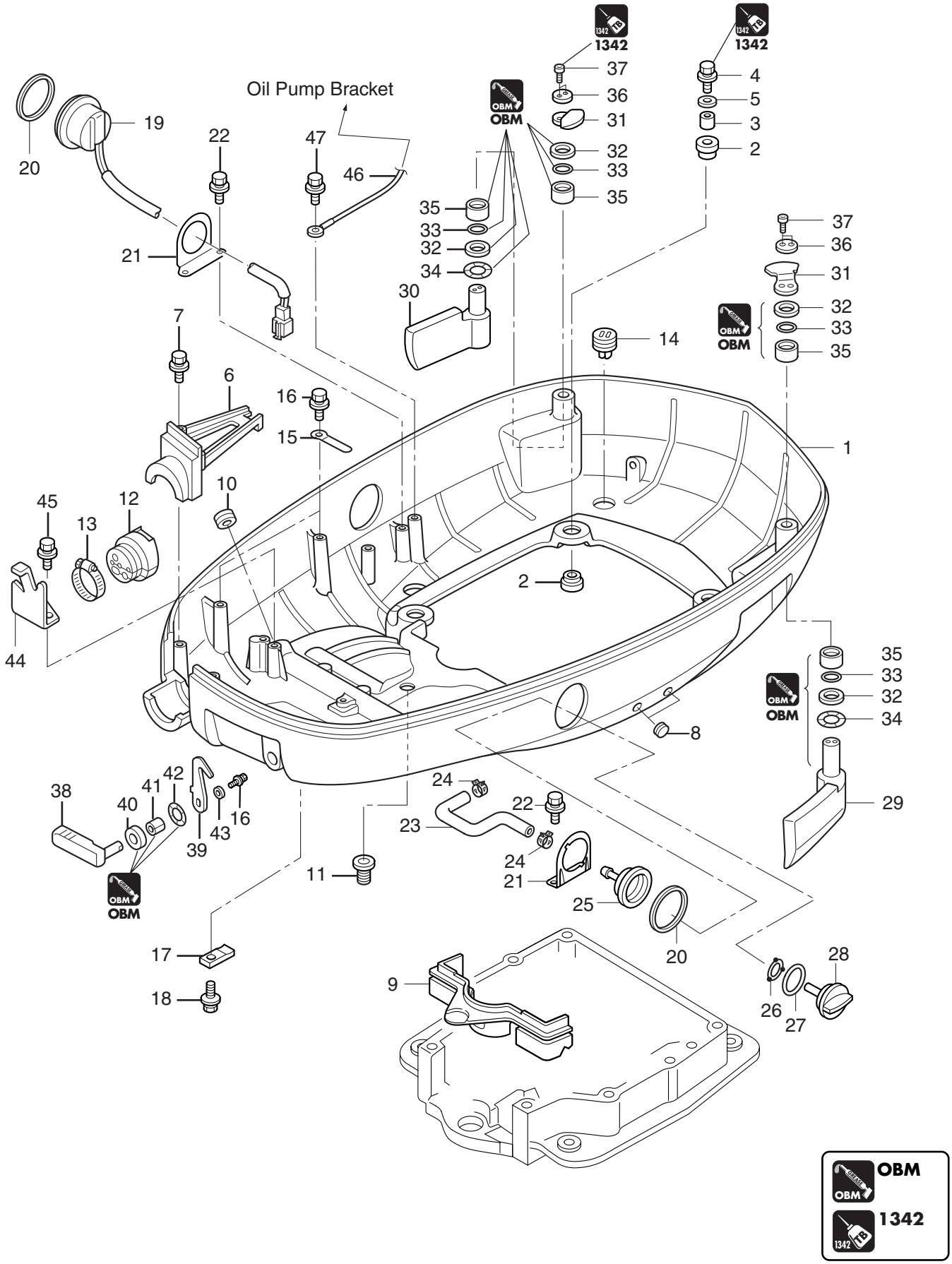


Ref. No.	Description	Q'ty	Remarks
1	Top Cowl	1	UNIQUE
1-1	Top Cowl Seal	1	
1-2	Cover Stay Ass'y	3	
1-3	Roller, 6.1-14.7-14	3	
1-4	Washer	6	M6
1-5	E-Ring, d=5	3	Do not reuse.
1-6	Bolt	6	M5 L=25mm
1-7	Washer	12	M5
1-8	Cover Stay Plate	6	
1-9	Nylon Nut	6	M5

Ref. No.	Description	Q'ty	Remarks
1-10	Tilt Handle	1	
1-11	Washer, 6-16-1.5	4	
1-12	Nylon Nut	4	M6
1-13	Grommet	2	
1-14	Front Mark	1	UNIQUE
1-15	Cowl Handle	1	
1-16	Tapping Screw, 6-16	2	
1-17	Decal Set	set	UNIQUE 2
1-18	Washer, 6.5-23-1.5	2	

Bottom Cowl

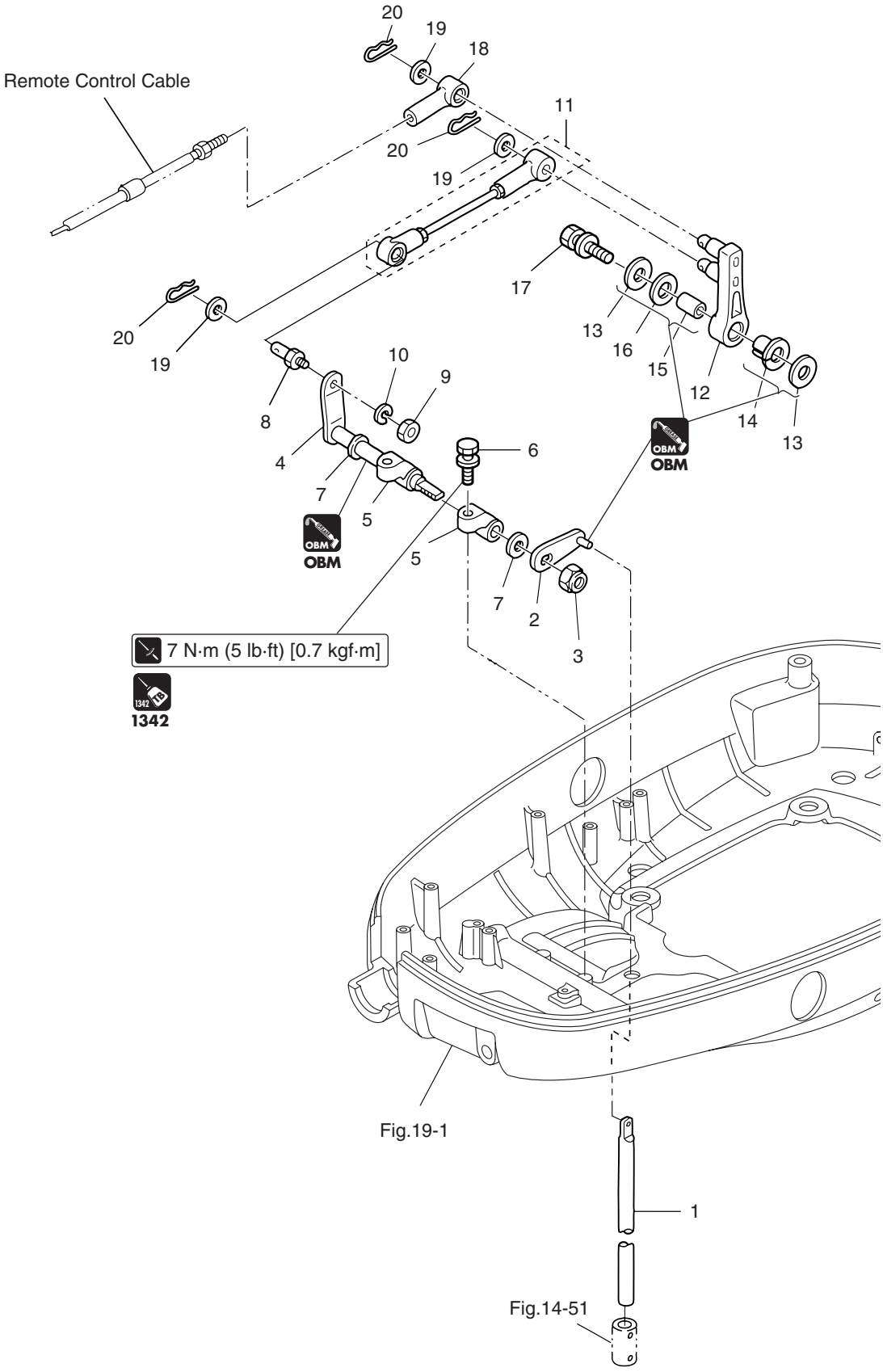
P/L Fig. 19



Ref. No.	Description	Q'ty	Remarks
1	Bottom Cowl	1	
2	Rubber Mount, 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	Cord Clamp	1	
7	Bolt	2	M6 L=25mm W/SW · 9 PW
8	Grommet, 17-2.7	2	
9	Bottom Cowl Grommet "A"	1	
10	"PTT" Cord Grommet	1	
11	Grommet, 17-3	1	
12	Cord Grommet	1	
13	Clamp, 60	1	
14	Grommet	4	
15	Cramp, 6.5-67P	3	
16	Bolt	3	M6 L=12mm W/SW
17	"PTT" Cord Clamp	1	
18	Bolt	1	M6 L=16mm W/PW
19	"PTT" Switch	1	
20	"PTT" Switch Gasket	2	
21	"PTT" Switch Bracket	2	
22	Bolt	4	M6 L=16mm W/PW
23	Flushing Hose	1	
24	Clip, ø17.8	2	
25	Flushing Connector	1	
26	Seal Ring	1	
27	O-Ring, 3.1-24.4	1	Do not reuse.
28	Flushing Connector Cap	1	
29	Hook Lever (Left)	1	
30	Hook Lever (Right)	1	
31	Cover Hook	2	
32	Washer	4	
33	O-Ring, ø3.5-18	4	Do not reuse.
34	Wave Washer	2	
35	Bushing, 18-24-19	4	
36	Washer	2	
37	Bolt	4	M5 L=20mm
38	Hook Lever	1	
39	Cover Hook	1	
40	Seal Ring, 13.8-22-3.7	1	
41	Bushing, 14-16-18	1	
42	Wave Washer	1	
43	Washer, 6-16-1.5	1	
44	Cable Clip	1	
45	Bolt	2	M6 L=16mm W/SW
46	Ground Cable	1	L=270mm
47	Bolt	1	M6 L=12mm W/SW

Shift

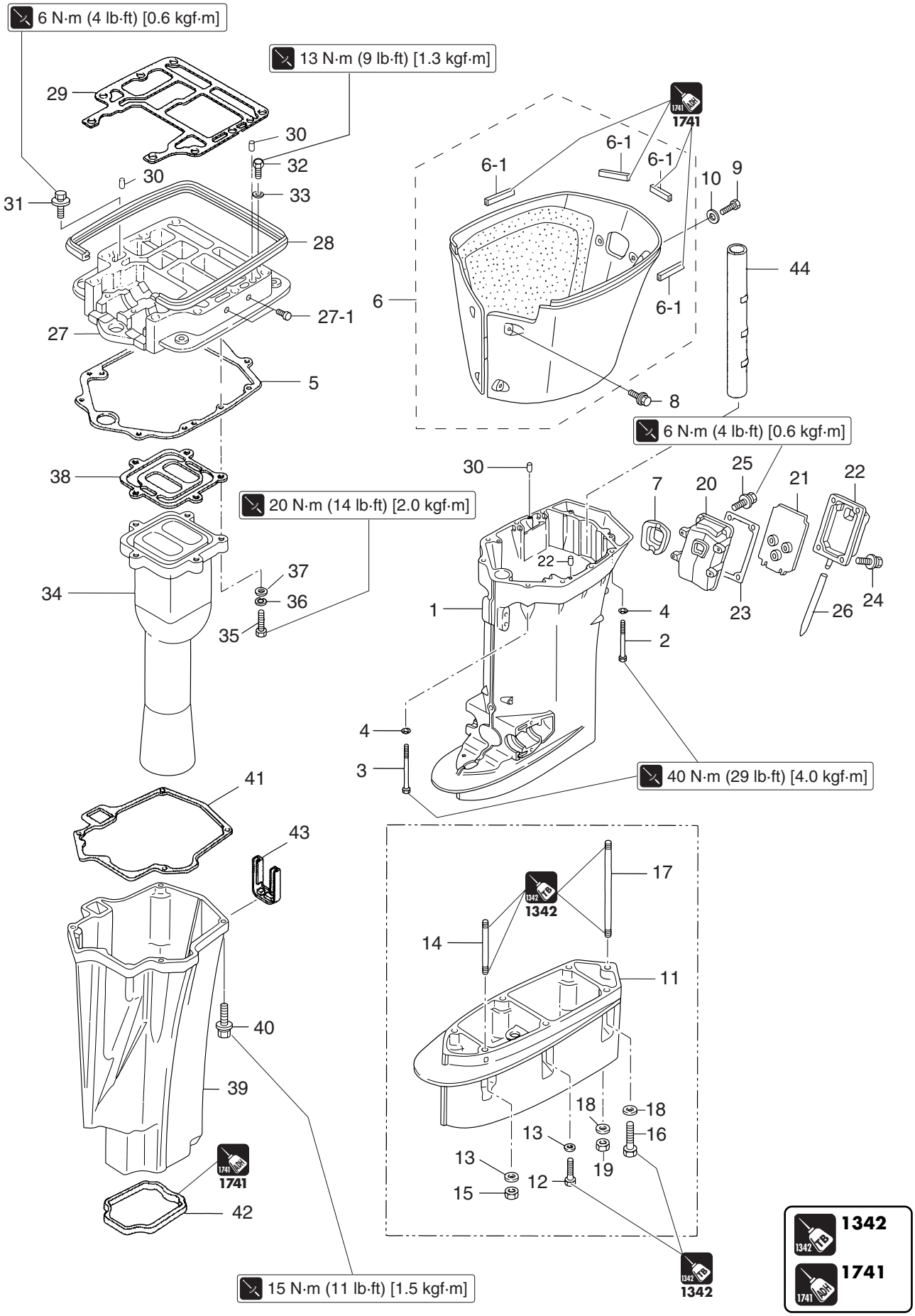
P/L Fig. 16



Ref. No.	Description	Q'ty	Remarks
1	Shift Rod	1	
2	Shift Rod Lever	1	
3	Nylon Nut, 10-P1.5	1	M10
4	Shift Lever Shaft	1	
5	Shift Lever Shaft Holder	2	
6	Bolt	2	M8 L=25mm W/PW
7	Washer, 10.5-18-1.5	2	
8	Cable Pin	1	
9	Nut	1	M6
10	Spring Washer	1	M6
11	Shift Assist Ass'y	1	
12	Shift Arm	1	
13	Washer, 8.5-24-1.5	2	
14	Bushing, 12-14-15.5	1	
15	Collar, 8.4-12-17	1	
16	Washer, 12.5-24-1	1	
17	Bolt	1	M8 L=35mm W/SW
18	Cable Joint	1	
19	Washer, 8.5-18-1.5	3	
20	Snap Pin, d=8	3	

Drive Shaft Housing

P/L Fig. 13

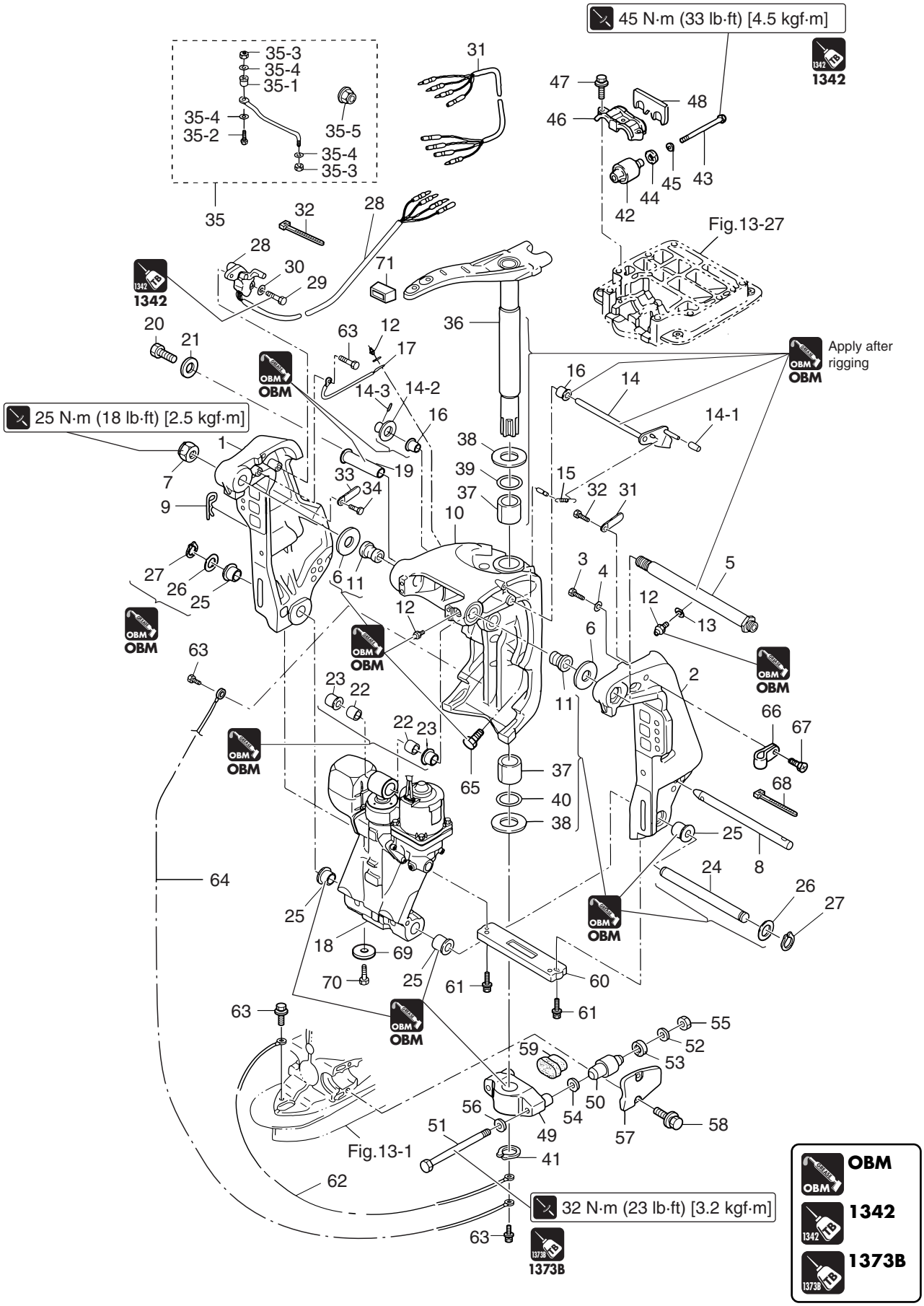


1342
1741

Ref. No.	Description	Q'ty	Remarks
1	Drive Shaft Housing "L"	1	
2	Bolt, 10-107	6	M10 L=107mm
3	Bolt, 10-120	2	M10 L=120mm
4	Washer	8	M10
5	Drive Shaft Housing Gasket	1	
6	Apron Ass'y	1	
6-1	Apron Seal	4	
7	Apron Grommet	1	
8	Bolt	4	M6 L=12mm
9	Apron Bolt, 6-16	2	M6 L=16mm
10	Washer	2	
11	Extension Housing "UL"	1	for Transom "UL"
12	Bolt	3	for Transom "UL" M8 L=35mm
13	Washer	4	for Transom "UL" M8
14	Stud Bolt	1	for Transom "UL" M8 L=25mm
15	Nut	1	for Transom "UL" M8
16	Bolt, 10-40	2	for Transom "UL" M10 L=40mm
17	Stud Bolt, 10-165	1	for Transom "UL" M10 L=165mm
18	Washer	3	for Transom "UL" M10
19	Nut, 10-P1.25	1	for Transom "UL" M10
20	Idle Exhaust Passage	1	
21	Idle Exhaust Passage Separation	1	
22	Idle Exhaust Passage Cover	1	
23	Gasket	1	
24	Bolt	4	M6 L=20mm W/PW
25	Bolt	4	M6 L=35mm W/PW
26	Water Outlet Hose	1	
27	Engine Basement	1	
27-1	Exhaust Plug	2	
28	Engine Basement Seal	1	L=690
29	Engine Basement Gasket	1	
30	Dowel Pin 6-12	4	
31	Bolt	1	M6 L=35mm W/PW
32	Bolt, 8-50	2	M8 L=50mm
33	Washer	2	M8
34	Exhaust Pipe	1	
35	Bolt	5	M8 L=35mm
36	Spring Washer	5	M8
37	Washer	5	M8
38	Exhaust Pipe Gasket	1	
39	Exhaust Housing	1	
40	Bolt	4	M8 L=30mm W/PW
41	Exhaust Housing Gasket	1	
42	Exhaust Housing Grommet	1	
43	Idle Exhaust Port Grommet	1	
44	Reverse Gas Passage Pipe	1	

Bracket

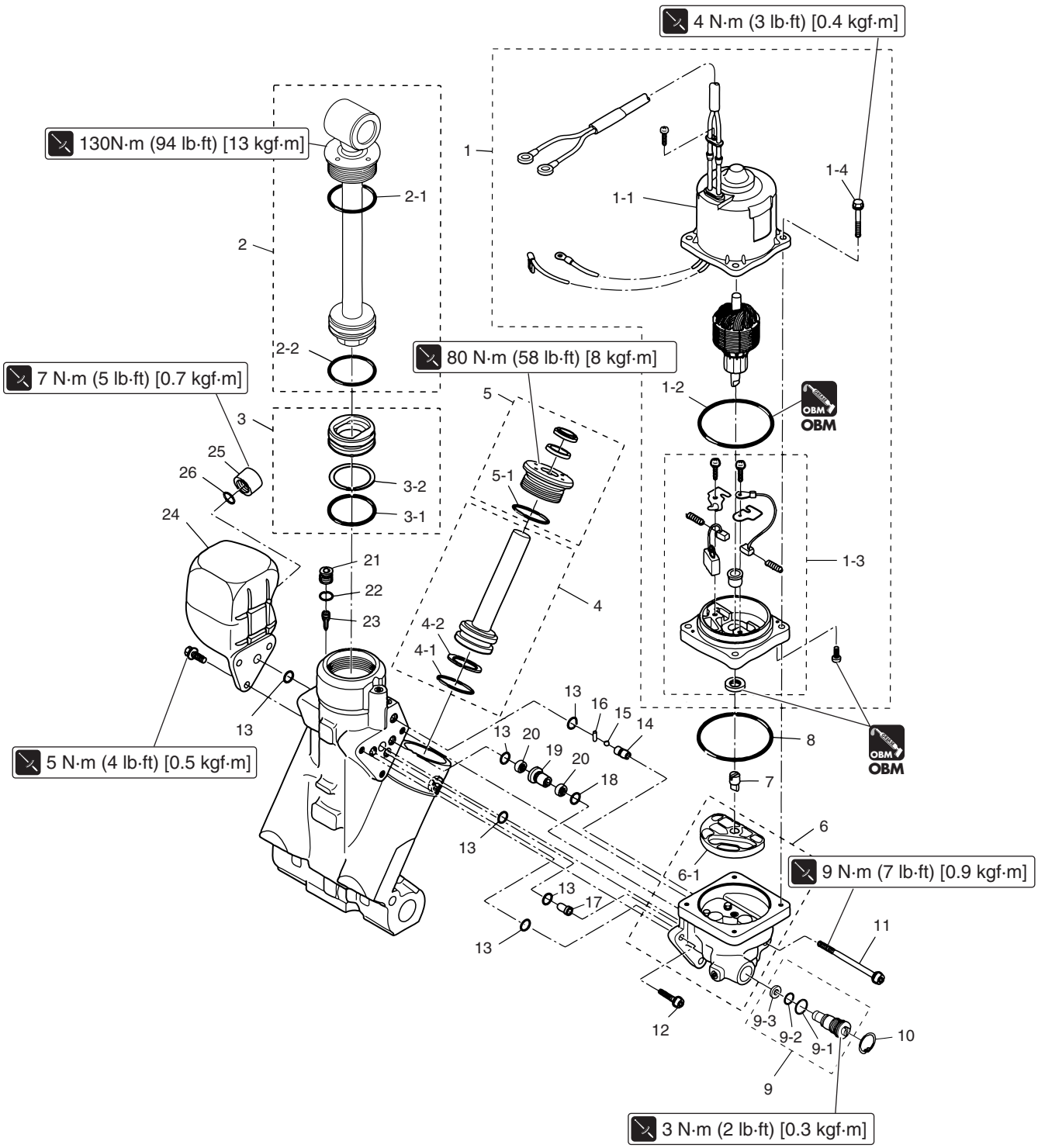
P/L Fig. 17



Ref. No.	Description	Q'ty	Remarks
1	Clamp Bracket (Right)	1	Starboard
2	Clamp Bracket (Left)	1	Port
3	Bolt	1	M10 L=20mm
4	Washer	1	M10
5	Swivel Bracket Shaft	1	Bracket Bolt
6	Washer, 25.7-50-1	2	
7	Nylon Nut, 7/8	1	7/8-14UNF
8	Thrust Rod	1	
9	Thrust Rod Pin	1	
10	Swivel Bracket	1	with Pin (3E0-62475-0)
11	Bushing, 25.6-28.6-40	2	
12	Grease Fitting	5	
13	Washer	1	M6
14	Tilt Stopper	1	
14-1	Tilt Stopper Grip	1	
14-2	Washer, 10.5-18-1.5	1	
14-3	Spring Pin	1	
15	Tilt Stopper Spring	1	
16	Collar, 10.2-12-12	2	
17	Ground Cable	1	L=130mm
18	Power Trim & Tilt	1	
19	Cylinder Pin (Upper)	1	
20	Washer, 6.5-23-1.5	1	
21	Bolt	1	M6 L=12mm
22	Bushing, 18-24-19	2	
23	Bushing, 18-20-20.5	2	
24	Cylinder Pin (Lower)	1	
25	Bushing, 22-25.4-23.5	4	
26	Washer, 22.6-30-2	2	
27	C-Ring, d=22	2	
28	Trim Sensor	1	L=1,700mm
29	Bolt	2	M6 L=20mm
30	Washer, 6-16-1.5	2	
31	Trim Sensor Extension Cord	1	L=6,000mm
32	Lead Wire Band, 100	2	
33	Clamp, 6.5-47.5P	3	
34	Bolt	1	M6 L=12mm
35	Drag Link "H "	1	
35-1	Drag Link Spacer	1	
35-2	Bolt, 3/8-50	1	3/8-24UNF L=50mm
35-3	Nylon Nut, 3/8	2	3/8-24UNF
35-4	Washer, 9.6-18-2	3	
35-5	Drag Link Seal Ring	1	
36	Steering Shaft	1	
37	Bushing, 32-40-45	2	
38	Thrust Plate	2	
39	Steering Shaft Seal Ring	1	
40	O-Ring, 4.5-32	1	**Do not reuse.**
41	C-Ring, d=32	1	
42	Upper Rubber Mount	2	
43	Upper Rubber Mount Bolt	2	
44	Upper Rubber Damper	2	
45	Washer, 12.2-36-3	2	
46	Upper Mount Holding Plate	1	Rubber Mount Cap (Upper)
47	Bolt	3	M8 L=35mm W/PW
48	Upper Damper	1	
49	Mount Bracket	1	
50	Lower Rubber Mount	2	
51	Lower Rubber Mount Bolt	2	
52	Washer, 13-34-3	2	
53	Rubber Damper, 21-36-5	2	
54	Washer, 12.2-25-2	2	
55	Nut, 12-P1.5	2	M12 P=1.5
56	Washer	2	
57	Lower Mount Holding Plate	2	Rubber Mount Cap (Lower)
58	Bolt, 8-25	4	M8 L=25mm
59	Lower Rubber Damper	1	
60	Anode	1	
61	Bolt	2	M6 L=30mm W/SW
62	Ground Cable	1	L=110mm
63	Bolt	3	M6 L=12mm W/PW
64	Ground Cable	1	L=210mm
65	Bolt, 12-20	2	
66	Clamp, 6.5-14L	1	M6 12mm W/PW
67	Screw	1	
68	Lead Wire Band, 104	2	
69	Anode	1	
70	Bolt	1	M6 16mm W/PW
71	Steering Arm Damper "B"	1	

Power Trim & Tilt

P/L Fig. 18



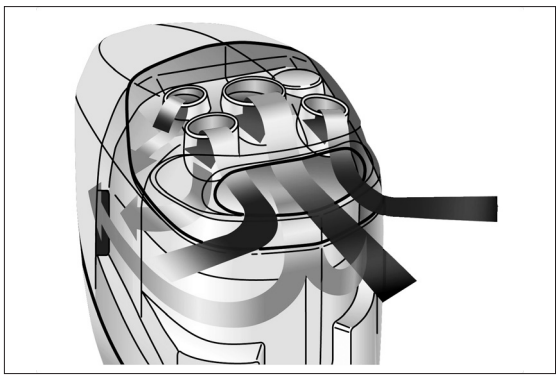
OBM

Ref. No.	Description	Q'ty	Remarks
1	Motor	1	Cable L=1,250mm
1-1	Yoke Ass'y	1	
1-2	Motor O-Ring	1	Do not reuse.
1-3	Bracket	1	
1-4	Bolt	4	
2	Piston Rod Ass'y (Tilt)	1	
2-1	O-Ring	1	Do not reuse.
2-2	O-Ring	1	Do not reuse.
3	Free Piston	1	
3-1	O-Ring	1	Do not reuse.
3-2	Back-UP Ring	1	
4	Trim Piston	2	
4-1	O-Ring	2	Do not reuse.
4-2	Back-UP Ring	2	
5	Rod Guide Sub Ass'y (Trim)	2	
5-1	O-Ring	2	Do not reuse.
6	Pump	1	
6-1	Filter B	1	
7	Pump Coupling	1	
8	O-Ring, 1.8-69.6	1	Do not reuse.
9	Manual Valve	1	
9-1	O-Ring	1	Do not reuse.
9-2	Packing	1	Do not reuse.
9-3	Back-UP Ring	1	
10	C-Ring	1	
11	Bolt	1	
12	Bolt	2	
13	O-Ring	6	Do not reuse.
14	Orifice	1	
15	Ball	1	
16	Pin	1	
17	Orifice	1	
18	O-Ring	1	Do not reuse.
19	Valve Seat	1	
20	Filter	2	
21	Plug	1	
22	O-Ring	1	Do not reuse.
23	Filter	1	
24	Reservoir Tank	1	
25	Cap	1	
26	O-Ring	1	Do not reuse.

3. Inspection Items

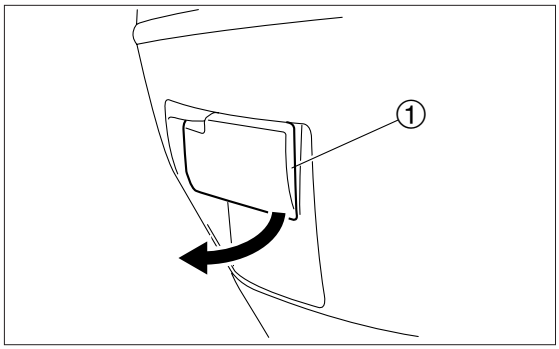
1) Inner Cowl

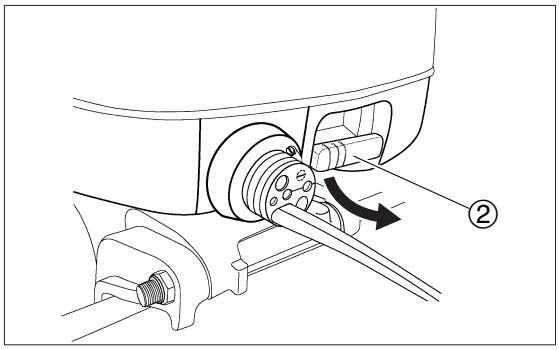
Inner cowl structure is adopted to reduce acoustic noise and protection of engine from invasion of water.



2) Removing Top Cowl

1. Turn upper motor cover hook levers ① and ② and remove upper motor cover.





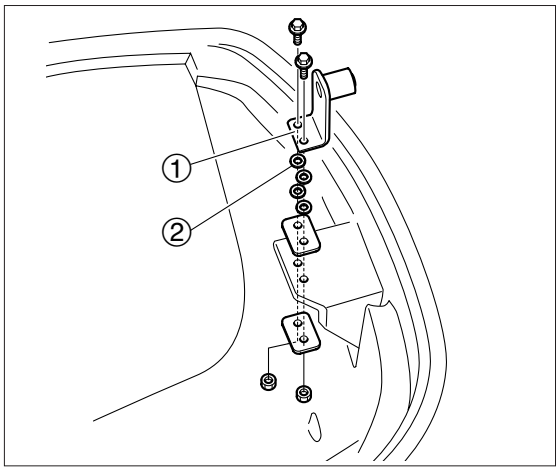
3) Adjustment of Cover Hook

Push cover to check for play, and adjust if necessary.

Remove cover stay ①.
Add or remove washer(s) ② for adjustment.

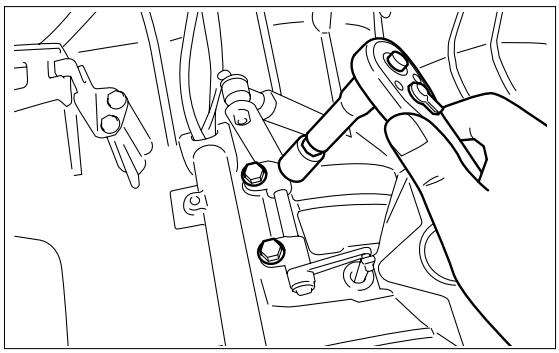
⚠ CAUTION

Remove washer(s) if too much play.
Add washer(s) if too tight.



4) Removing Bottom Cowl

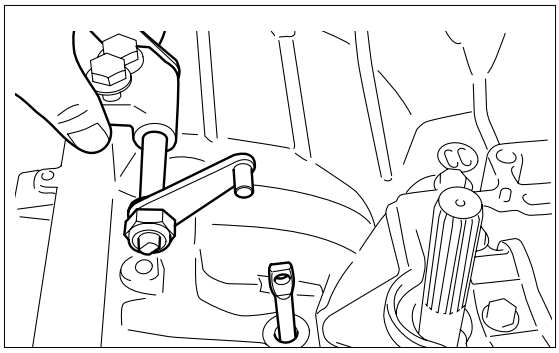
1. Remove power trim pump electrical cables from bottom cowl.



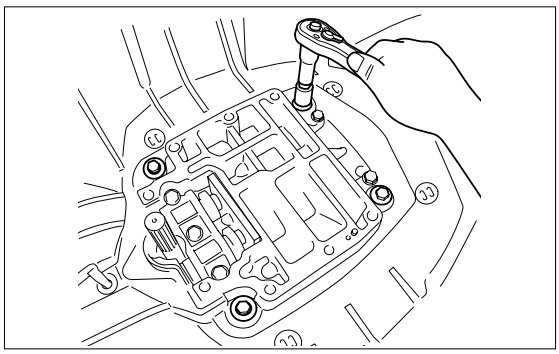
> There is a clamp on the back of bottom cowl to secure cables.

2. Loosen bolts that secures shift lever shaft holder.

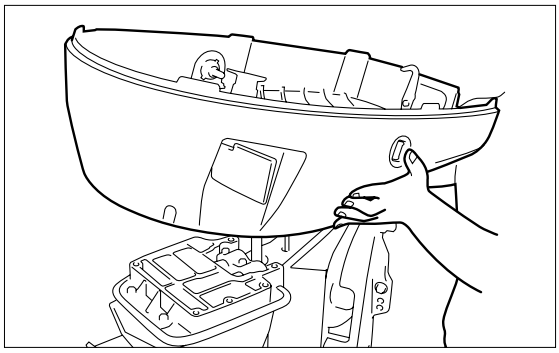
3. Remove shift rod lever from shift rod.



4. Loosen and remove four bolts that secure bottom cowl to engine base.



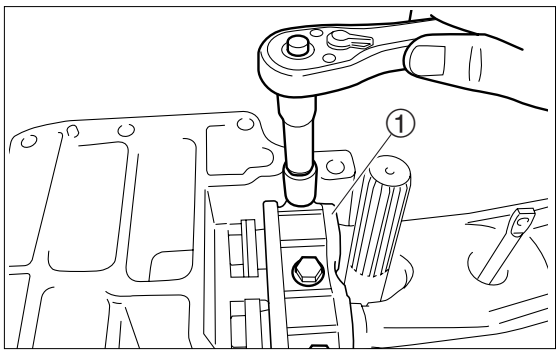
5. Remove bottom cowl.



5) Removing Drive Shaft Housing

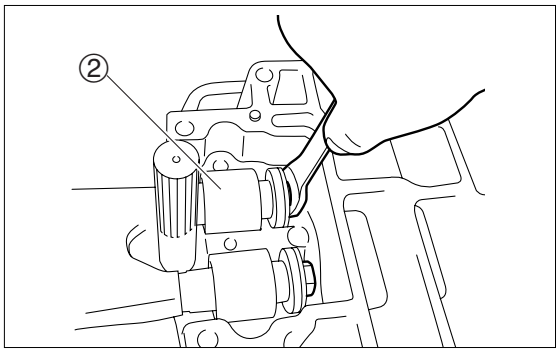
Use the following steps to remove drive shaft housing.

1. Loosen and remove upper rubber mount cap installation bolts to remove mount cap ①.

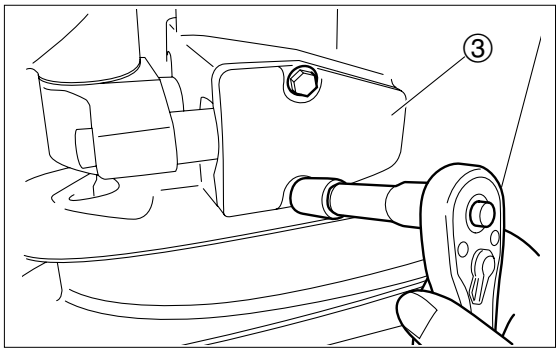


2. Loosen and remove upper rubber mount installation bolts to remove rubber mount ②.

Loosen right and left rubber mount installation bolts in several steps alternately and equally.



3. Loosen and remove lower rubber mount cap installation bolts to remove mount cap ③.

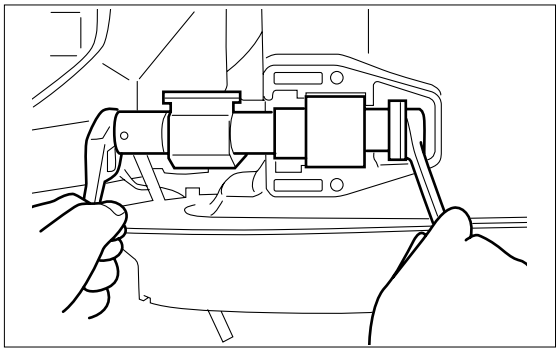


4. Loosen lower rubber mount cap installation bolt and remove the nut.

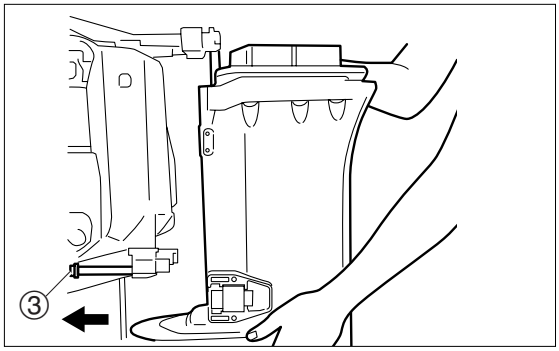
Fully tilt down outboard motor when loosening mount bolt.
Remove only the nut and do not remove mount bolt.

⚠ CAUTION

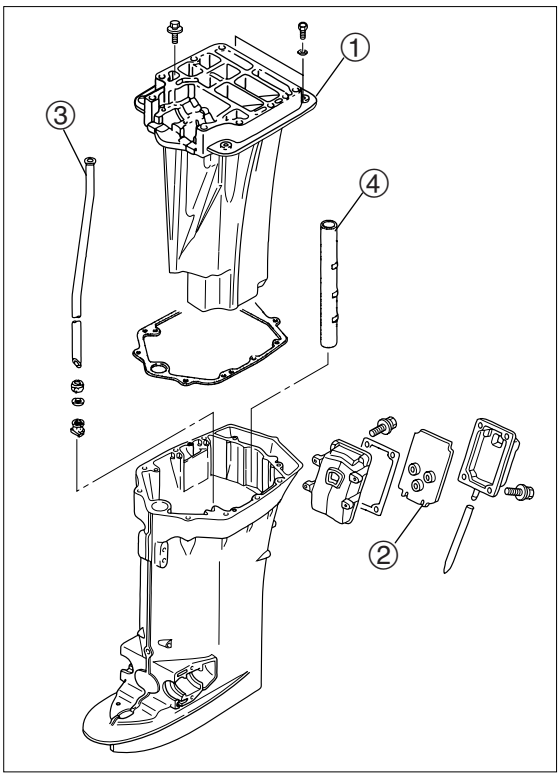
Drive shaft housing drops if mount bolt is removed in this step.



5. Pull out lower rubber mount bolt ③ while holding drive shaft housing at its top and bottom securely, and remove drive shaft housing.

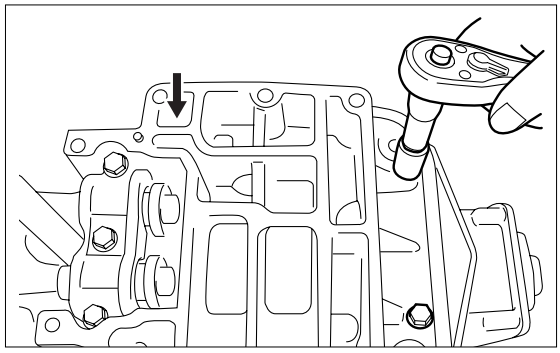


6) Disassembly of Drive Shaft Housing



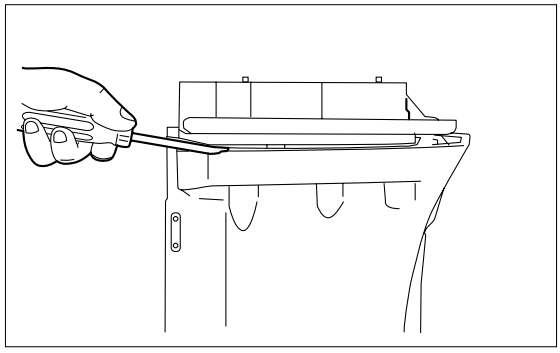
1. Remove bolts that secure engine base to drive shaft housing.

> Remove M6 installation bolt located in the area shown by the arrow.

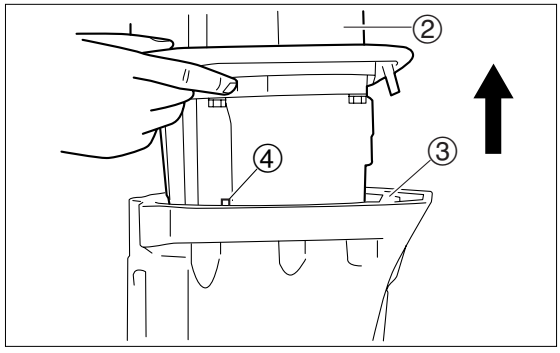


2. Tap lightly with a plastic hammer to separate engine base from the housing if it is seized.

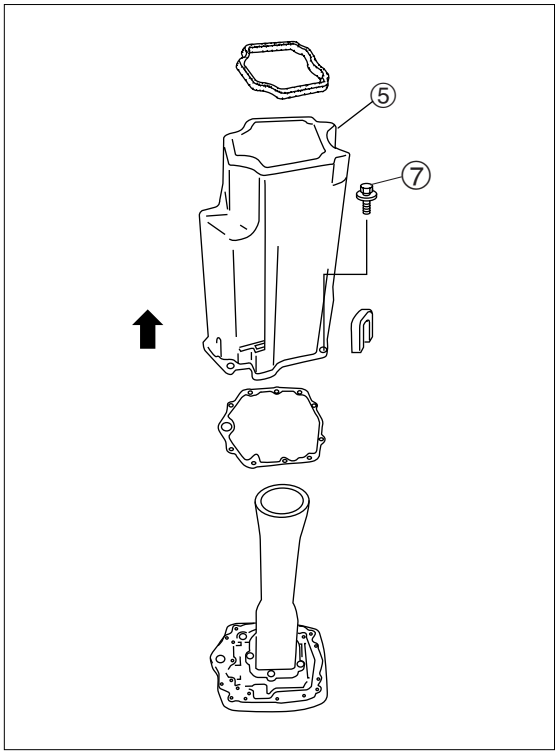
> If necessary, use a bladed screw driver to pry the engine base taking care not to scratch mating surface.



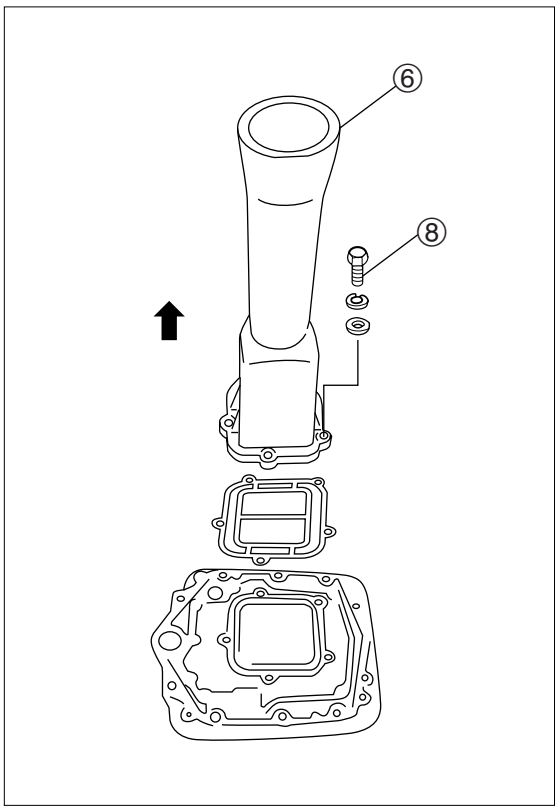
3. When removing drive shaft housing ③, be careful not to lose dowel pin ④ for locating engine base ②.



5. Loosen and remove bolts ⑦ that secure exhaust housing ⑤ to engine base and remove exhaust housing.

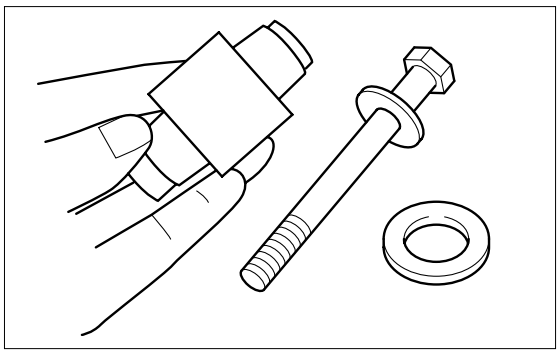


6. Loosen and remove bolts ⑧ that secure exhaust pipe ⑥ to engine base and remove exhaust pipe.



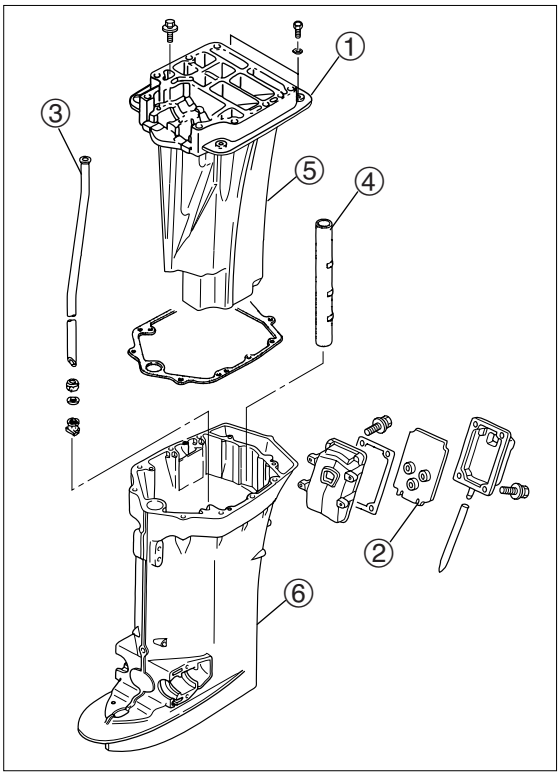
7) Inspection of Drive Shaft Housing

1. Check mount rubber and dumper rubber for crack and deterioration. Replace if necessary.



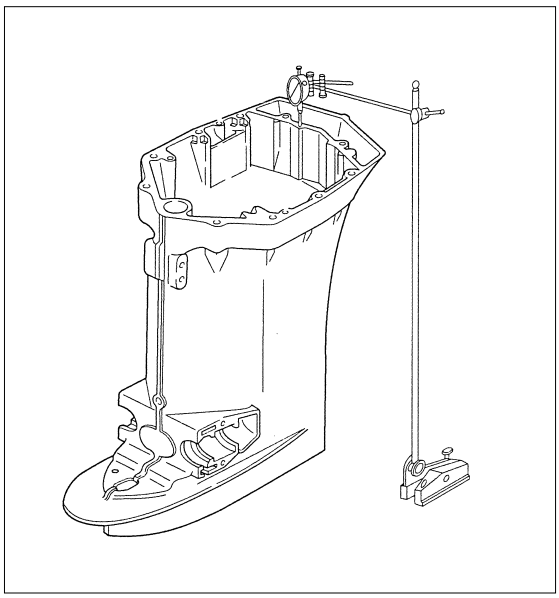
2. Check water pipe ③ and reverse gas passage ④ for corrosion and deformation.
   Replace if necessary.

3. Check engine base ①, exhaust housing ⑤ and drive shaft housing ⑥ for corrosion, and idle exhaust passage ② for damage.



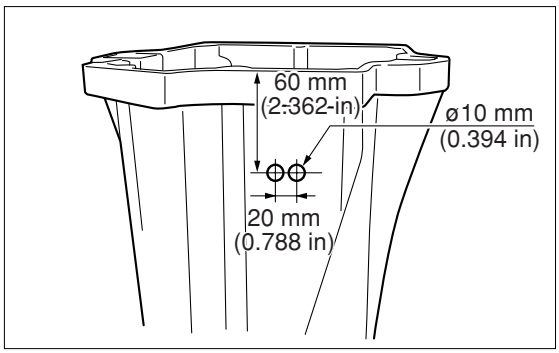
4. Check if drive shaft housing is distorted.
   Place the housing on the surface plate and use dial gauge to measure distortion on the upper face of the housing. Replace if the difference is over 0.228mm (0.0090in) on each measuring point.

> Use of distorted drive shaft housing may cause severe wear of drive shaft spline which may lead to damage on the crank shaft spline.



5. Check that drive shaft housing is provided with two holes on the area opposite to reverse gas pipe installation face.

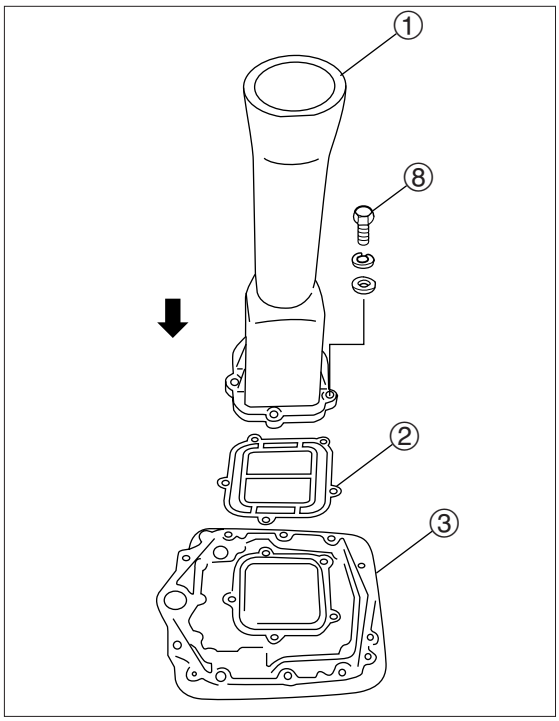
> The drive shaft housing of model 115 is provided with two holes.



8) Assembly of Drive Shaft Housing Parts

1. Install exhaust pipe ① and gasket ② to engine base ③ and tighten bolts ⑧ to specified torque.

Exhaust Pipe Bolts ⑧ :
20 N · m (14 lb · ft) [2.0 kgf · m]

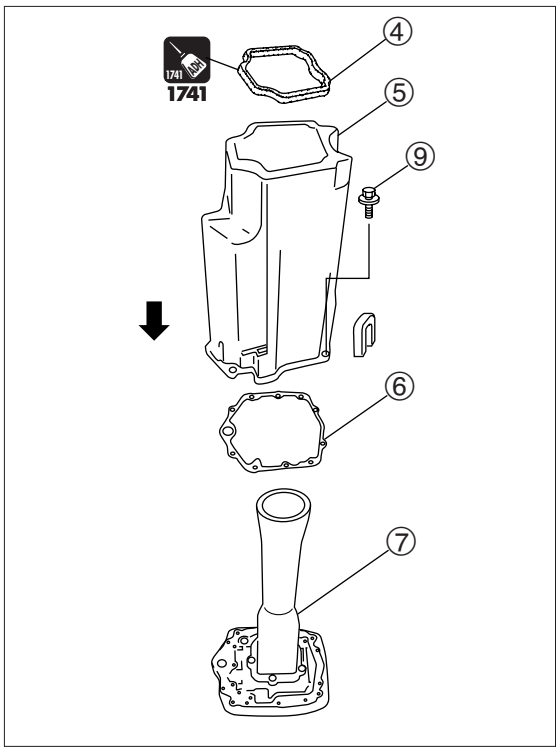


2. Install exhaust housing grommet ④ to exhaust housing ⑤.

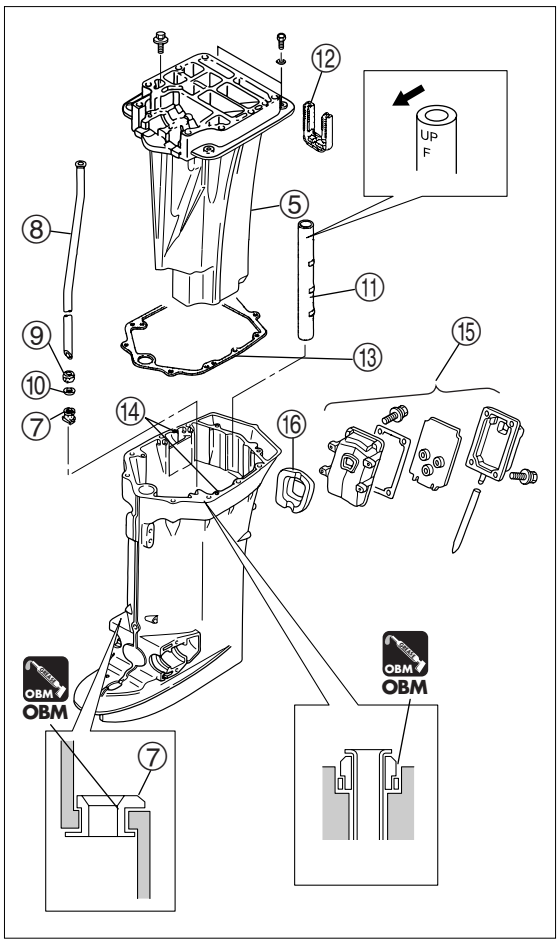
> When installing the grommet by using adhesive, clean adhering area to remove dirt and oil and dry the area before applying adhesive.

3. Install exhaust housing ⑤ and gasket ⑥ to engine base ③ and tighten bolts ⑨ to specified torque.

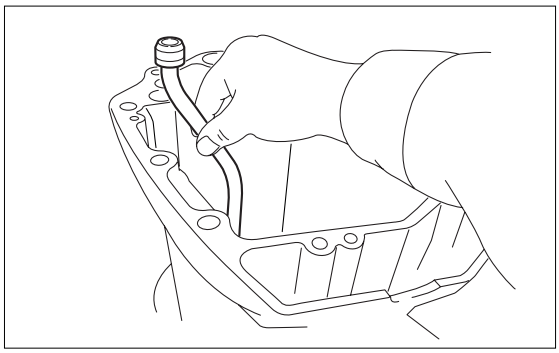
Exhaust Housing Bolts ⑨ :
15 N · m (11 lb · ft) [1.5 kgf · m]

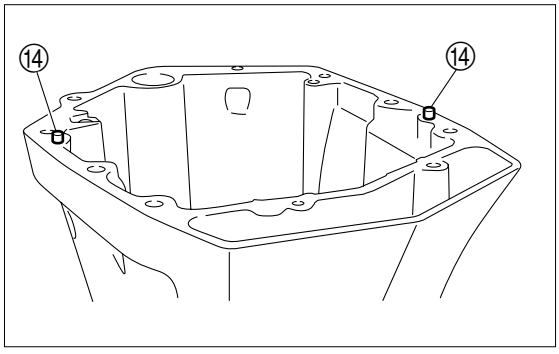


4. Install water pipe auxiliary mount ⑦ to drive shaft housing.



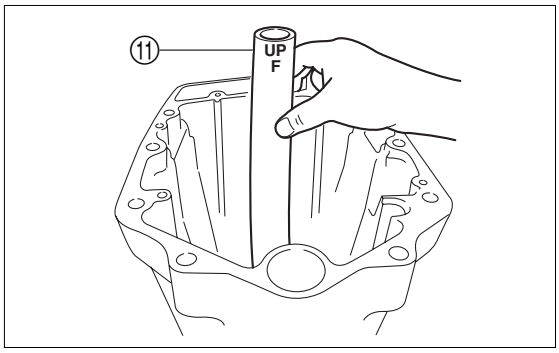
5. Install water pipe to drive shaft housing, and attach gasket after confirming that dowel pins ⑭ are on the drive shaft housing.



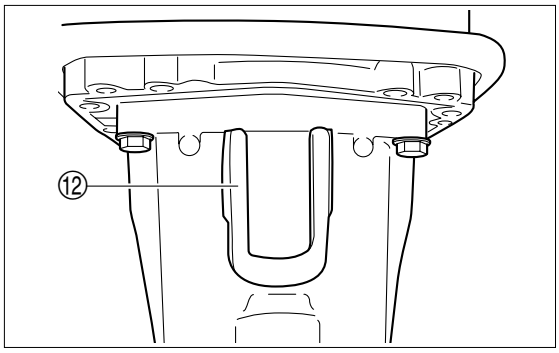


7

6. Attach reverse gas passage in the drive shaft housing facing "UP" mark of reverse gas passage ⑪ upward and "F" mark forward.

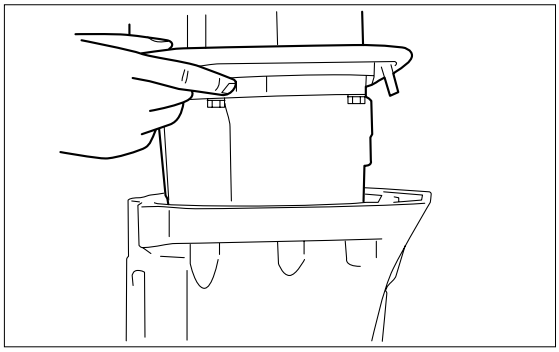


7. Install idle exhaust port grommet ⑫ to exhaust housing.



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.

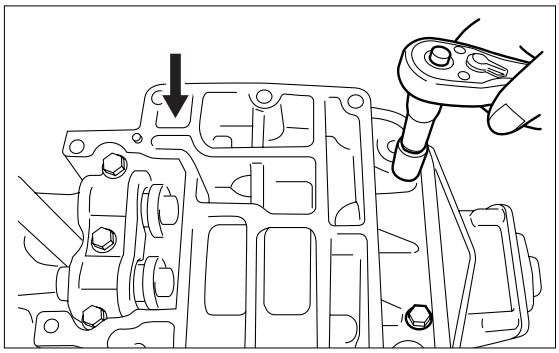


9. Install engine base to drive shaft housing by tightening installation bolts to specified torque.

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]



9) Assembling Drive Shaft Housing Parts

When assembling drive shaft housing parts, reverse the disassembling procedure.

1. Install upper mount ① and tighten bolts ② to specified torque.

Upper Rubber Mount Bolts ② :
45 N · m (33 lb · ft) [4.5 kgf · m]

⚠ CAUTION

Install the mount with the side of smaller size ⓐ facing forward.

2. Install upper mount holding plate ③.

3. Install dumper rubber ⑤ to mount bracket ④.

⚠ CAUTION

Install dumper rubber with the grooved side ⓒ facing forward.

4. Put lower rubber mount ⑥ to drive shaft housing and tighten bolts ⑦ and nuts ⑧ to specified torque.

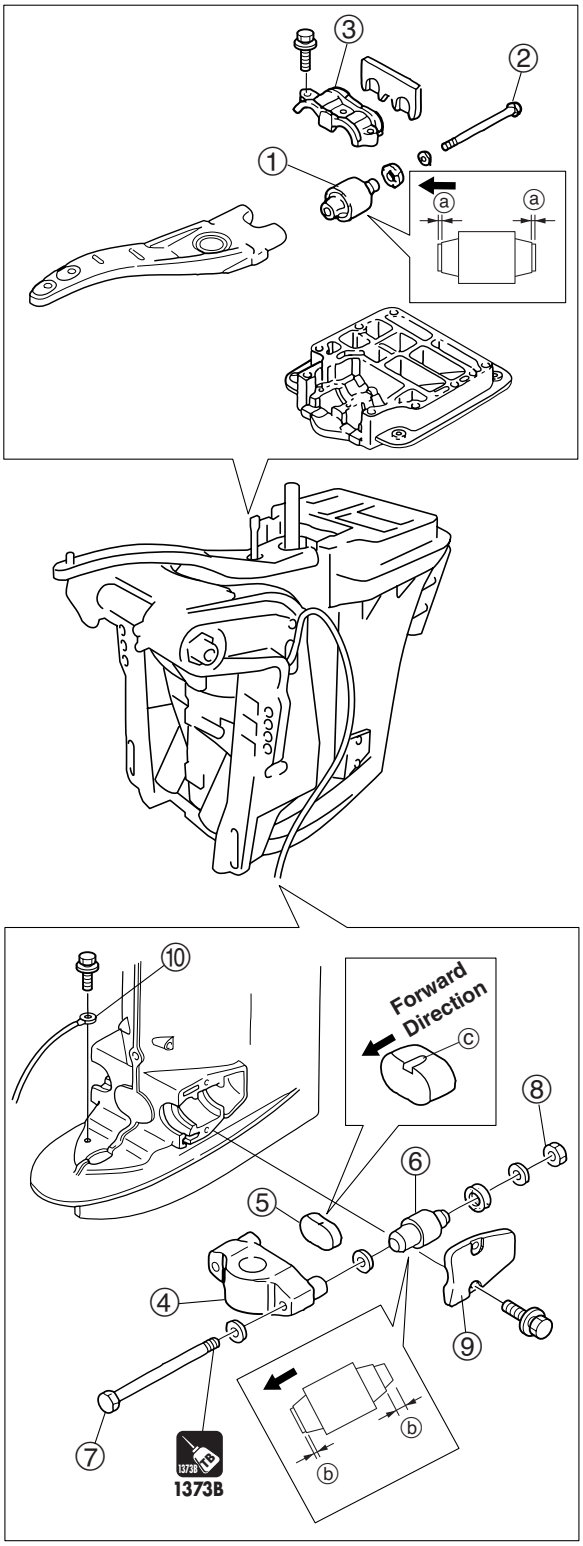
Lower Rubber Mount Bolt and Nut ⑦ and ⑧ :
32 N · m (23 lb · ft) [3.2 kgf · m]

⚠ CAUTION

Install the mount with the side of smaller size ⓑ facing forward.

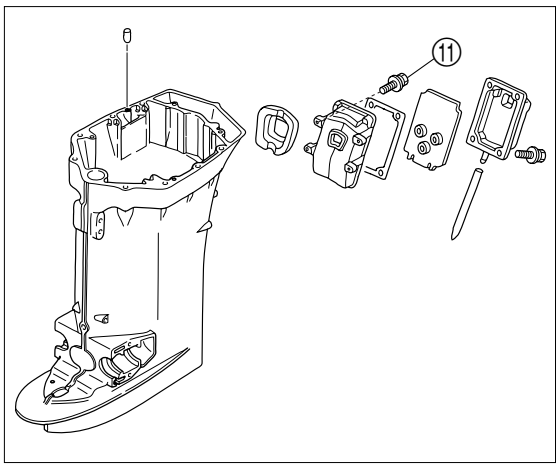
5. Install mount holding plates ⑨.

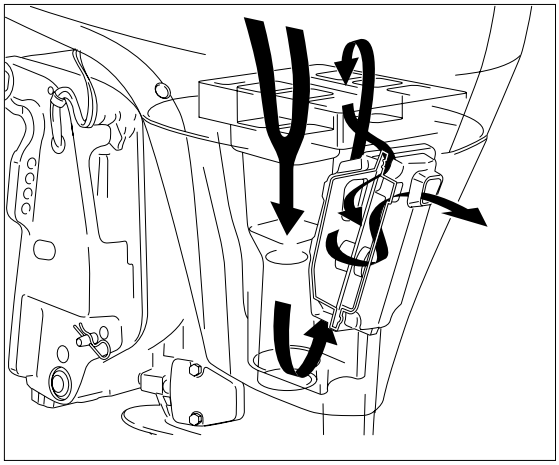
6. Attach ground wire ⑩.



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.

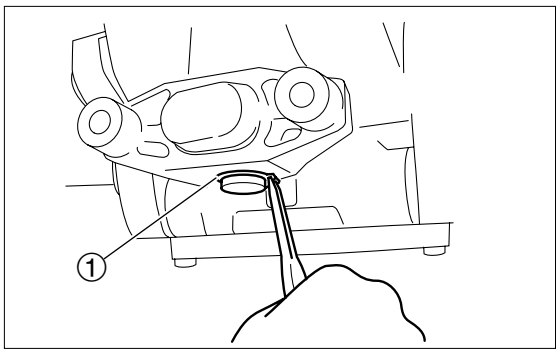
Idle Exhaust Installation Bolts ⑪ :
6 N · m (4 lb · ft) [0.6 kgf · m]





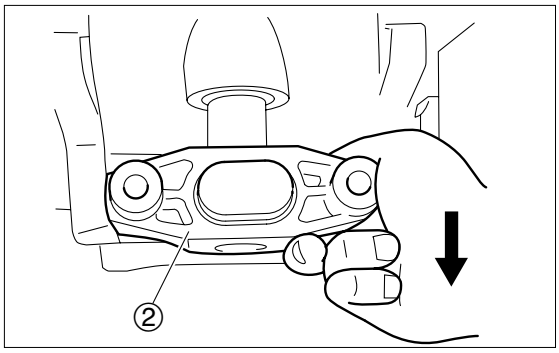
10) Removing Steering Shaft Arm

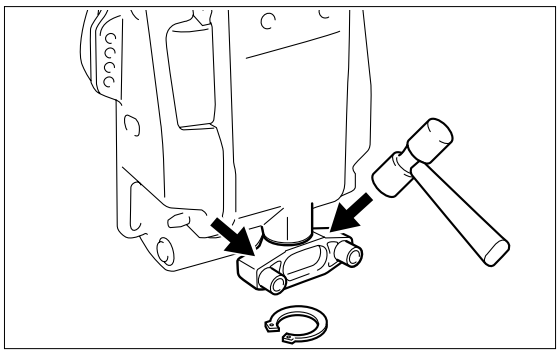
1. Remove "C" ring ① that supports mount bracket.



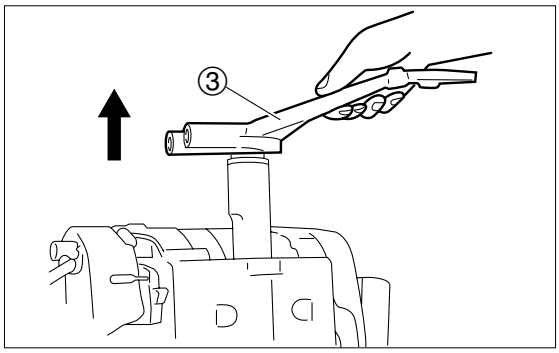
2. Remove mount bracket ②.

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.



11) Removing PTT Unit

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

⚠ WARNING

Be sure to lock the outboard motor with tilt stopper after tilting it up.
Outboard motor may tilt down accidentally if hydraulic pressure in the PTT unit drops for some reason.

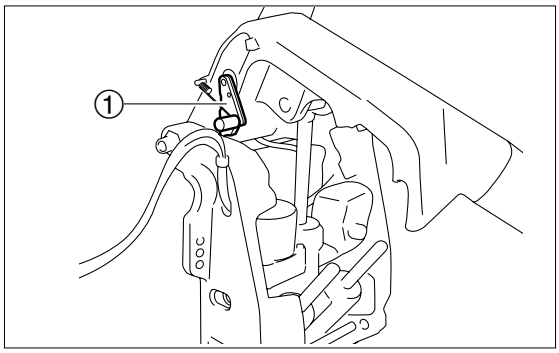
⚠ CAUTION

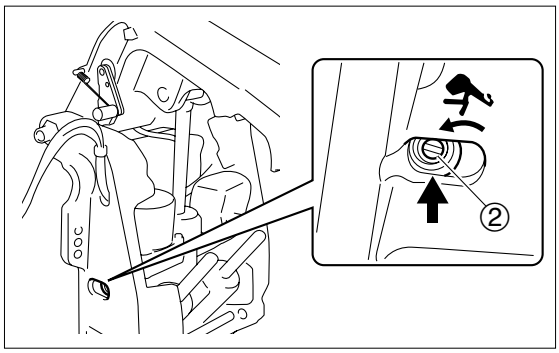
If PTT unit does not operate (electrically), loosen manual valve ② and tilt up the outboard motor manually.

⚠ CAUTION

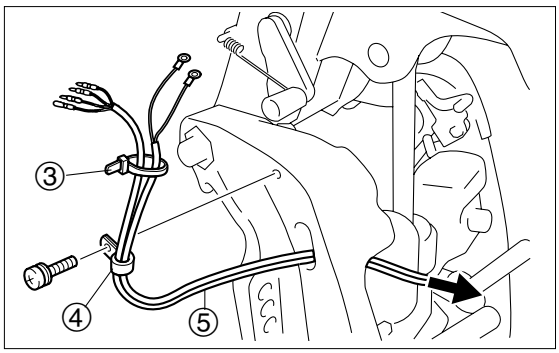
If manual valve ② is loosened, tighten it to specified torque after tilting up the outboard motor.

Manual Valve ② :
3 N · m (2 lb · ft) [0.3 kgf · m]



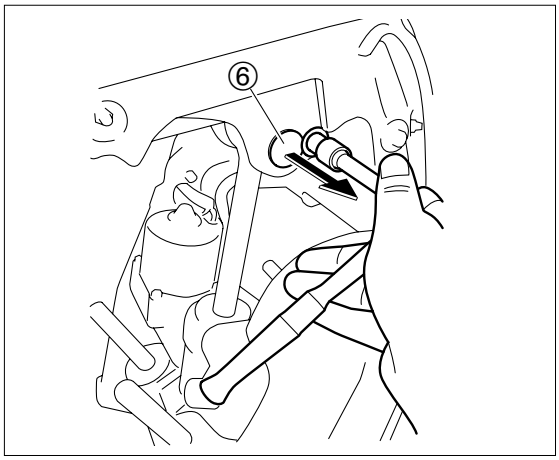


2. Remove tie wrap ③ and clamp ④ and draw PTT wires ⑤ to the direction shown.



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.

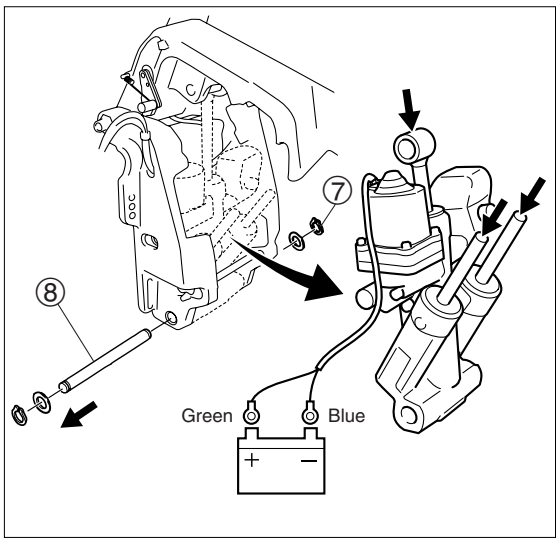


4. Retract tilt rod and trim rods.

5. Remove "C" ring ⑦ and cylinder pin lower ⑧, and remove PTT unit.

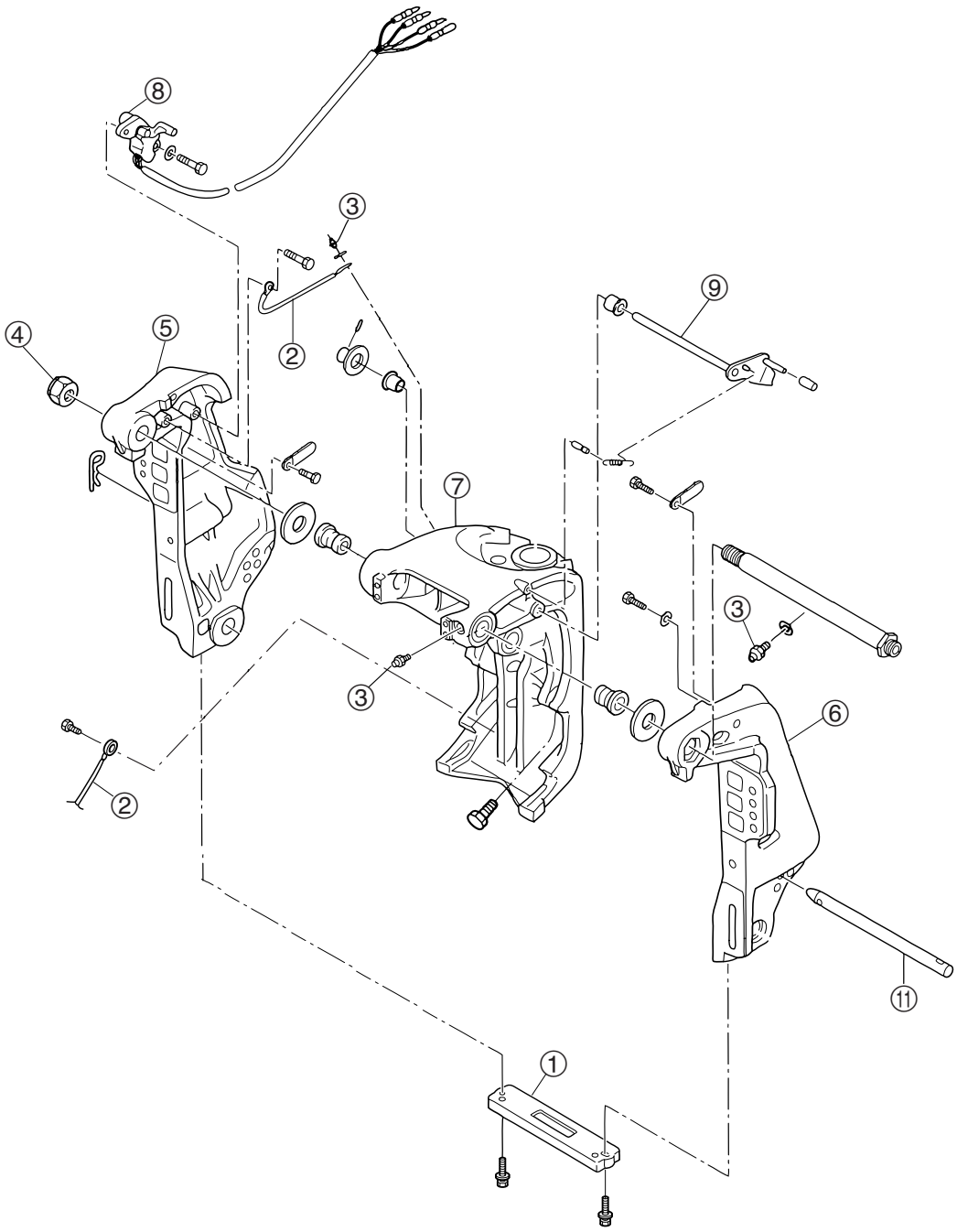
⚠ CAUTION

When pulling out cylinder pin lower ⑧, use a hand to hold PTT and another hand to pull out pin.



12) 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.



13) Assembling Clamp Bracket Parts

1. Install trim sensor ① to clamp bracket.

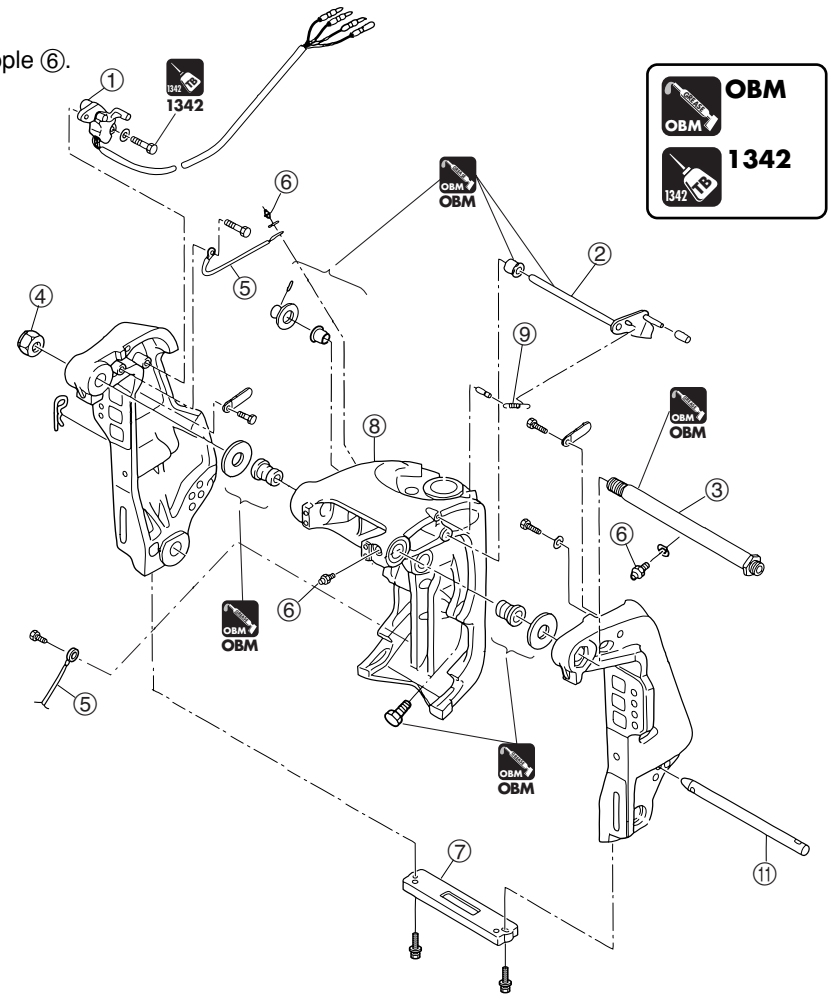
2. Install tilt stopper ② and tilt stopper spring ⑨ to swivel bracket ⑧.

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.



14) Installation of PTT Unit

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

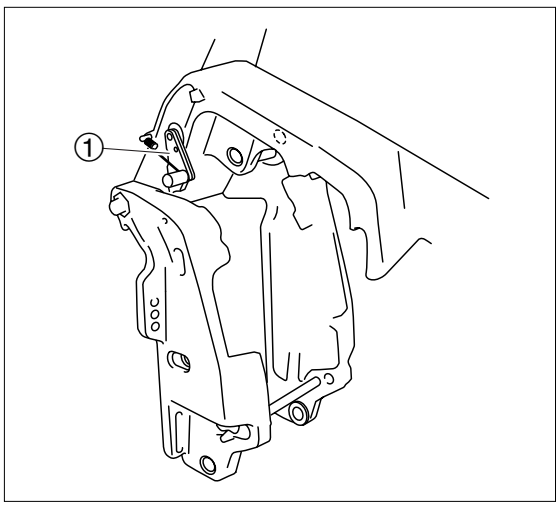
⚠ WARNING

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.

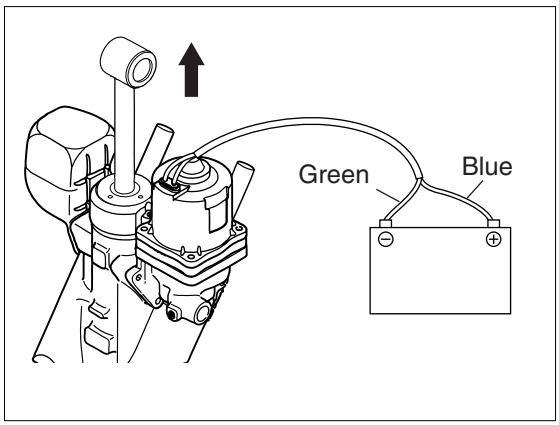


5. Attach bushings to PTT (upper) and swivel bracket.

6. Extend tilt rod until PTT tilt rod hole aligns with swivel bracket hole.

7. Install cylinder pin upper ④ and secure with bolt ⑤.

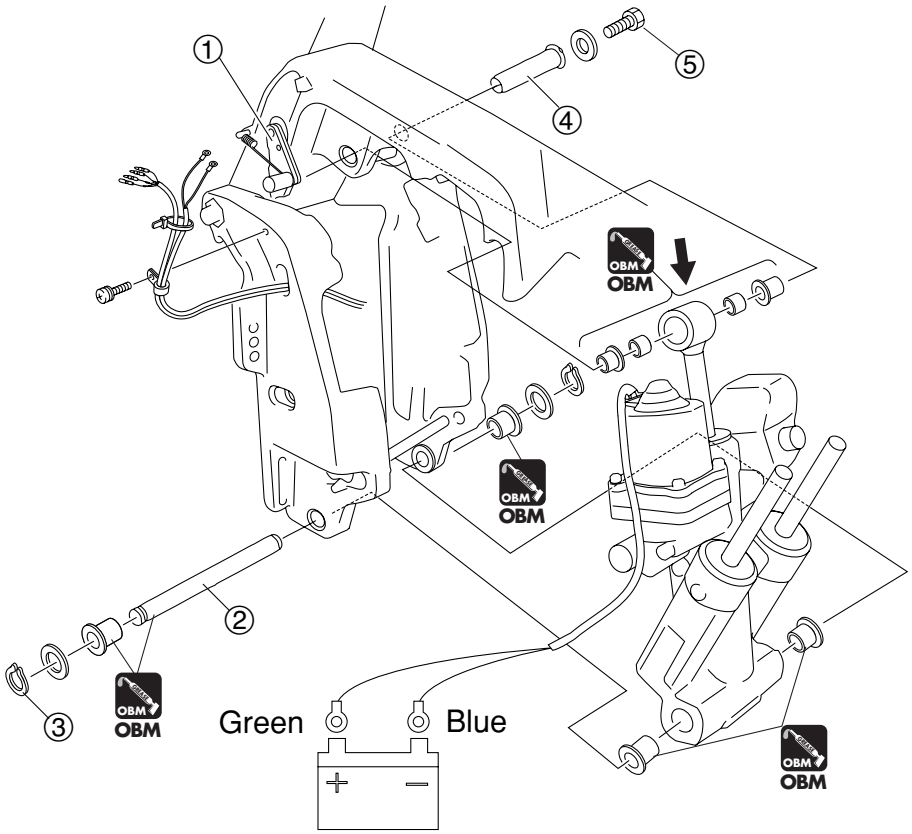
8. Run PTT and trim sensor leads through clamp bracket hole and collect them using wire clamp and tile wrap.



Connect blue lead to battery positive terminal to extend tilt rod.
Connect green lead to battery positive terminal to retract tilt rod.

⚠ WARNING

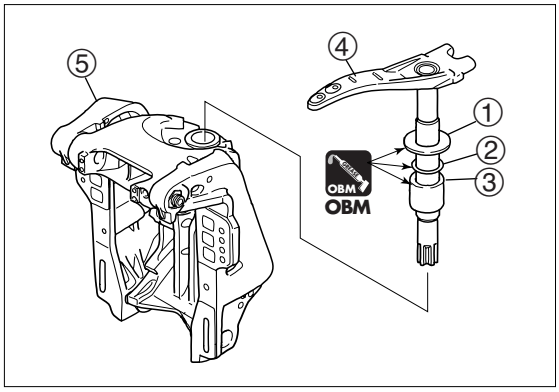
Connecting electrical wires to battery terminals may cause sparks to occur. Do not perform this work when flammable matter is near the working area.



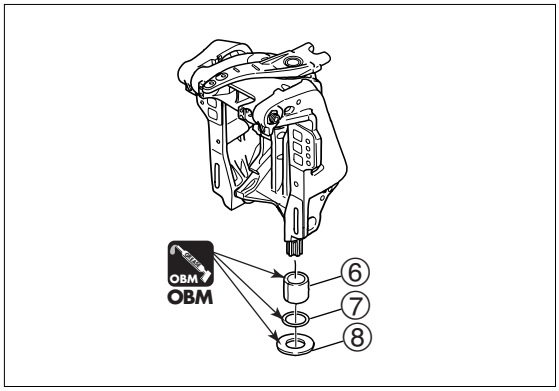
7

15) Assembling Steering Arm Parts

1. Put thrust plate ①, O ring ② and bushing ③ on the steering shaft ④, and install the steering shaft from above.



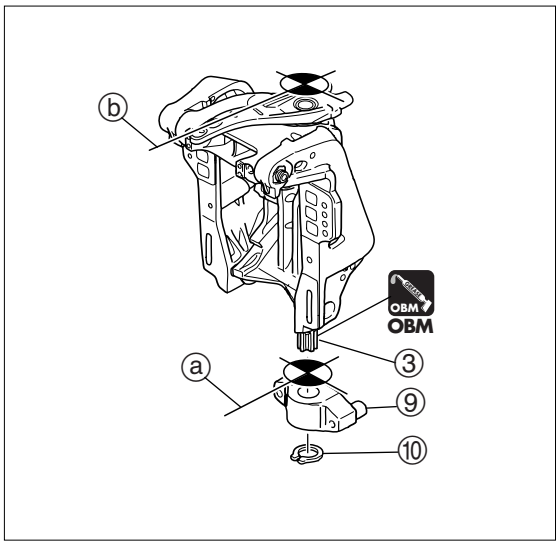
2. Put bushing ⑥, O ring ⑦ and thrust plate ⑧ on the shaft.



3. Install mount bracket ⑨.

⚠ CAUTION

When installing mount bracket ⑨, make center line ⓐ of mount bracket parallel with center line ⓑ of steering arm.



4. Attach "C" ring ⑩.

5. Grease through grease nipple.

16) Removing Motor

1. Fully extend tilt rod and trim rods.

⚠ CAUTION

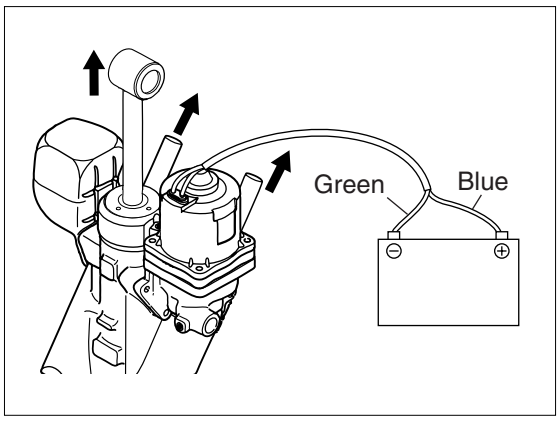
Check that tilt rod and trim rods are fully extended.
Disassembling the unit with the rods retracted causes the hydraulic fluid to spurt.

⚠ CAUTION

When working on the PTT unit, tilt down the outboard motor to vertical position.

⚠ WARNING

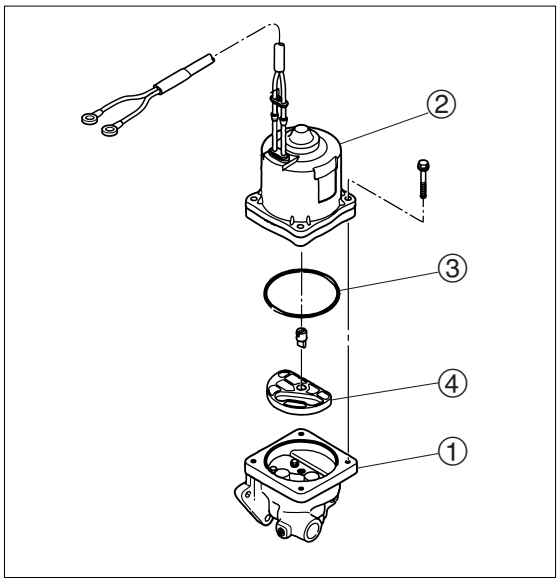
Connecting electrical wires to battery terminals may cause sparks to occur. Do not perform this work when flammable matter is near the working area.



2. Remove power trim and tilt motor ②, O ring ③ and gear pump filter ④ from pump ①.

⚠ WARNING

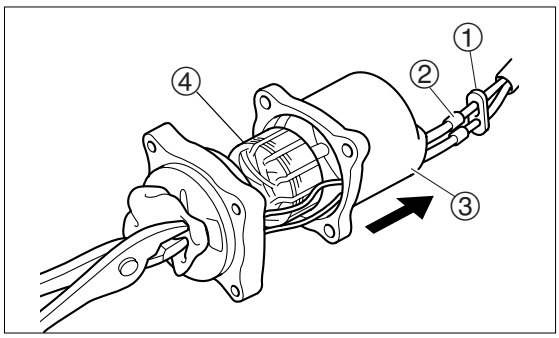
- **Before removing power trim and tilt motor, fully extent trim rods and tilt arm to prevent the fluid from spurting due to internal pressure.**
- **When removing tilt motor from power trim and tilt unit, do not push down trim rod or tilt arm. Doing so causes fluid to spurt.**



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.

Cover armature shaft end with clean cloth, hold the shaft using a pair of pliers, and remove armature ④ from stator carefully.



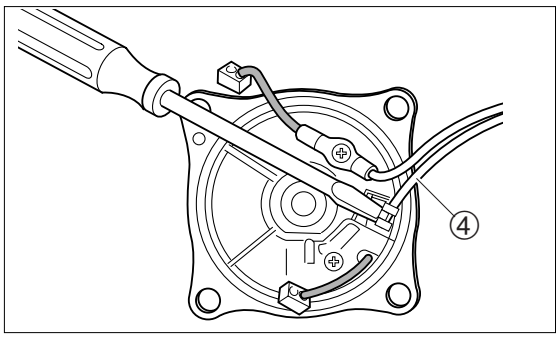
5. Remove armature from PTT motor base.

Do not apply grease or oil to commutator.

7

6. Disconnect PTT motor lead wire ④.

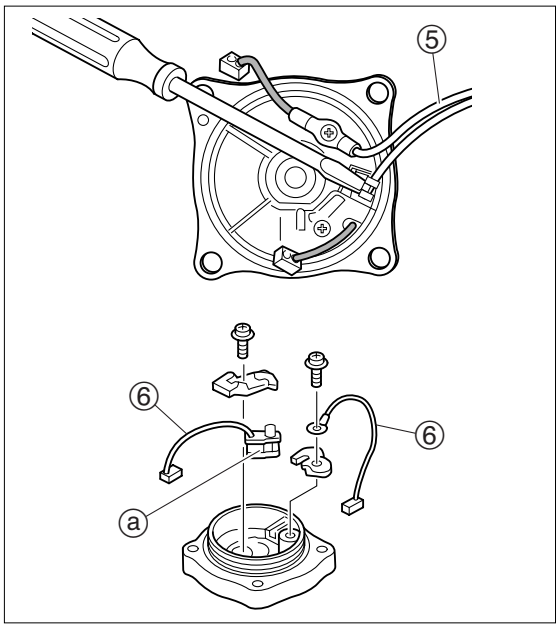
Hold the plug with a bladed screw driver and pull out PTT motor lead.



7. Remove screw, disconnect PTT motor lead ⑤, and then, remove brushes ⑥.

⚠ CAUTION

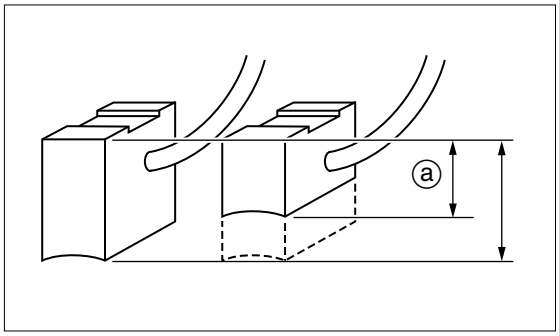
- **Do not disconnect PTT motor lead from stator.**
- **Do not touch bi-metal ⓐ. Doing so affects operation of circuit breaker.**



17) Inspection of Power Trim and Tilt Motor

1. Measure brush length.
   Replace if it is less than specified value.

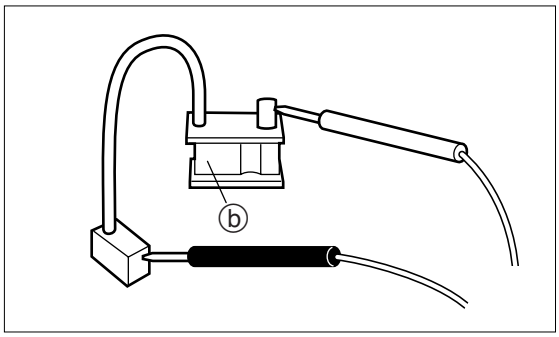
Brush Wear Limit ⓐ :
4.8 mm (0.19 in.)



2. Check electrical conductivity of brush and circuit breaker.
   Replace if not conductive.

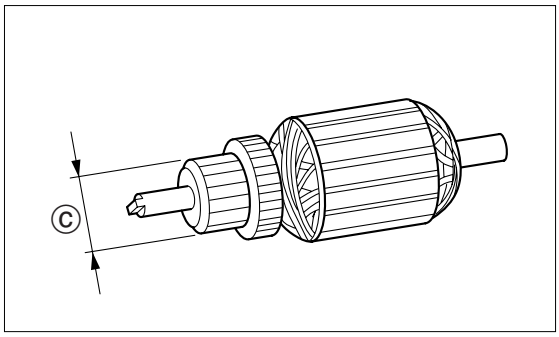
⚠ CAUTION

- **Do not disconnect PTT motor lead from stator.**
- **Do not touch bi-metal ⓑ. Doing so affects operation of circuit breaker.**



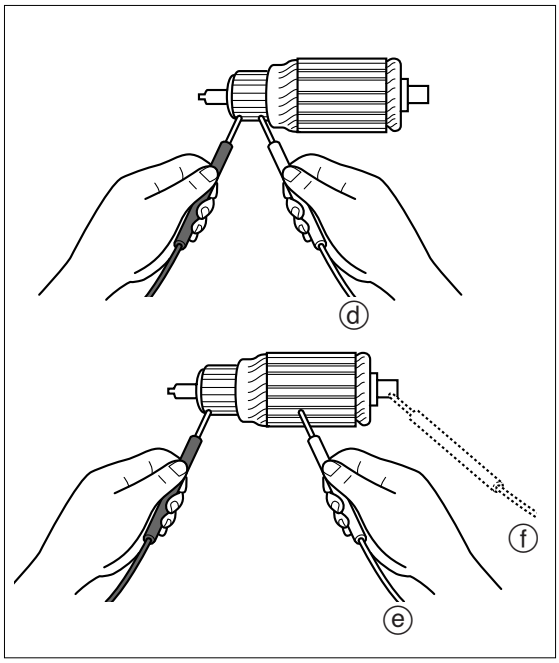
3. Measure diameter of commutator.
   Replace if the following specification is not met.

Lower Limit of Commutator Diameter ⓒ :
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 ⓓ - Armature Core ⓔ	Not Conductive
Commutator ⓓ - Armature Shaft ⓕ	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.

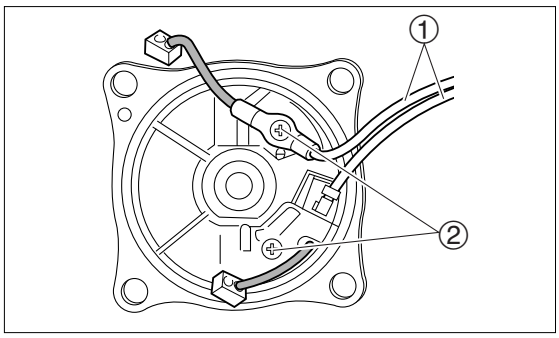
⚠ CAUTION

When bearing or oil seal is removed, replace it with new one.

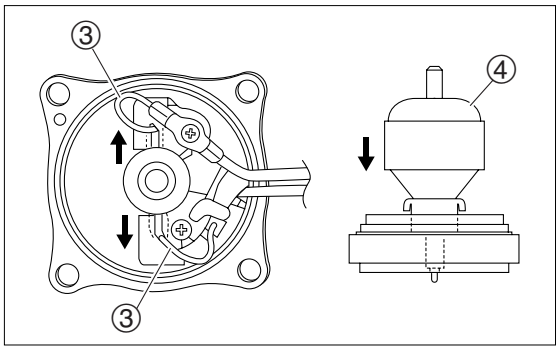
7

18) Assembling Power Trim and Tilt Motor Parts

1. Connect PTT motor leads and secure them with screws ②.

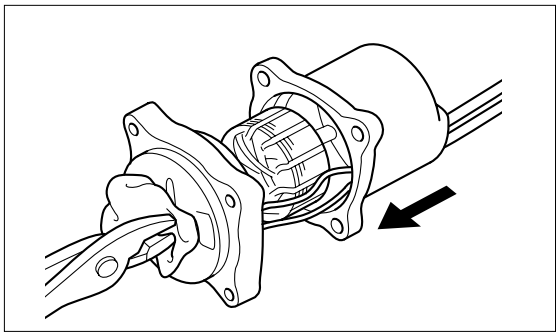


2. Put brushes ③ into brush holders, and attach armature ④.

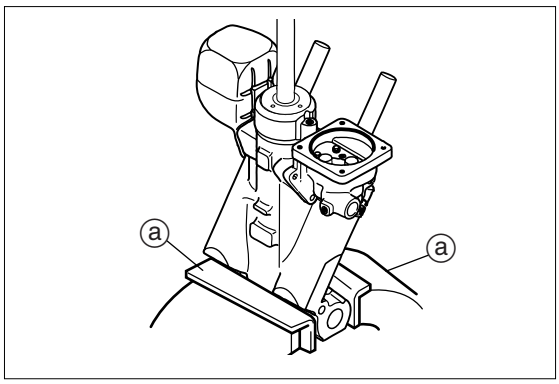


3. Install stator to base.

Cover armature shaft end with clean cloth, hold the shaft using a pair of pliers, and install armature to stator carefully.



19) Removing Reservoir



1. Put an aluminum plate on each side of ⓐ vise as shown, and hold power trim and tilt unit with the vise.

⚠ CAUTION

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.

Place a vessel below power trim and tilt unit to catch PTT fluid if it is spilt.

2. Remove reservoir and O ring.

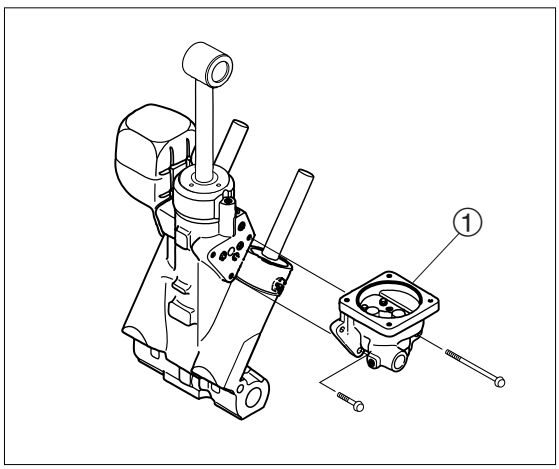
⚠ WARNING

- **Before removing power trim and tilt motor, fully extent trim rods and tilt arm to prevent the fluid from spurting due to internal pressure.**
- **When removing tilt motor from power trim and tilt unit, do not push down trim rod or tilt arm. Doing so causes fluid to spurt.**

3. Drain PTT fluid from reservoir, and check the interior for damage.
   Replace if necessary.

4. Check reservoir cap and O ring and replace if necessary.

20) Disassembly of Gear Pump



1. Remove gear pump ①.

⚠ CAUTION

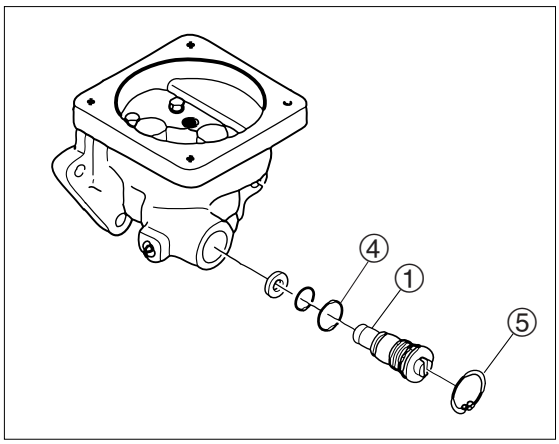
Confirm the order of assembling of valve seat ass'y, valve pin and O ring when disassembling.

2. Remove O ring, down relief valve and filter from gear pump.

⚠ CAUTION

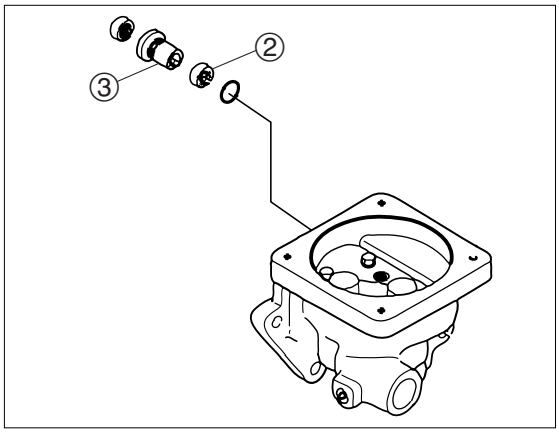
Remove the back filter using compressed air, being careful not to blow the filter out abruptly.

21) Disassembling Bracket Unit and Assembling the Parts

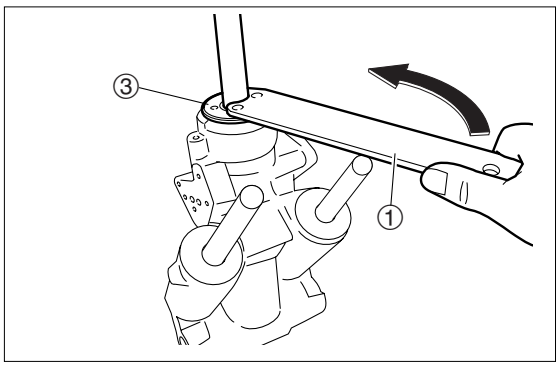


1. Remove manual valve ①.
2. Attach a new O ring to down relief valve.
3. Attach filter ② to down relief valve ③, and put the filter assembly in the gear pump.
4. Attach new O ring ④ to manual valve.
5. Install manual valve to gear pump and secure it with "C" ring ⑤.

Manual Valve :
3 N · m (2.2 lb · ft) [0.3 kgf · m]



22) Disassembly of Tilt Cylinder and Trim Cylinder, and Assembly of the Parts



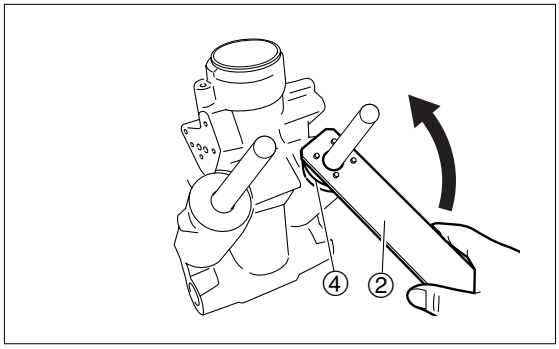
1. Loosen and remove tilt cylinder rod guide ③ by using trim rod guide wrench ① and remove tilt piston ass'y.

⚠ CAUTION

When removing tilt cylinder rod guide, fully extend trim rods and tilt arm.

2. Drain PTT fluid.

Trim Rod Guide Wrench ① :
P/N. 3C8-72791



3. Loosen and remove trim cylinder rod guide ④ by using trim rod guide wrench ② and remove trim piston ass'y.

Trim Rod Guide Wrench ② :
P/N. 3B7-72792

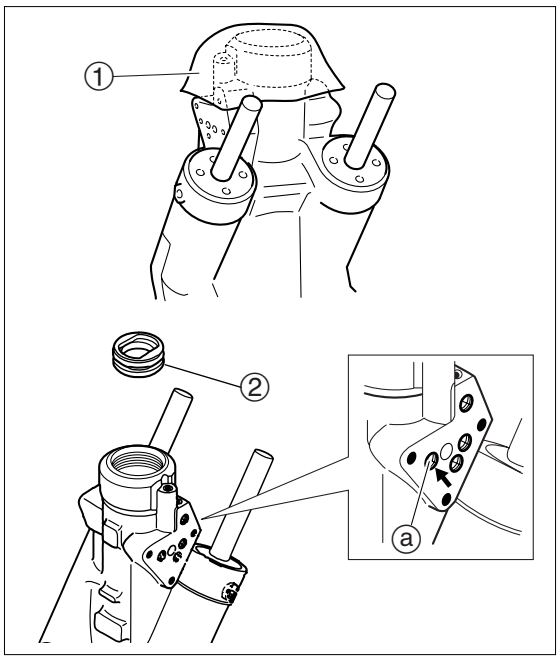
4. Drain PTT fluid.
5. Install piston ass'y and temporary tighten trim cylinder rod guide.

6. Cover tilt cylinder opening with clean cloth ① and apply compressed air from hole ⓐ to remove free piston ②.

⚠ 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.

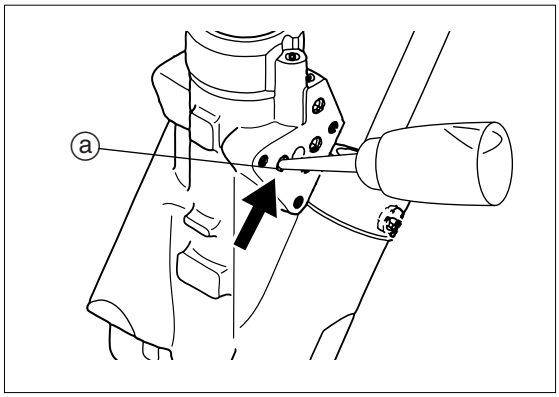
7. Loosen tilt cylinder rod guide and take out trim piston ass'y.



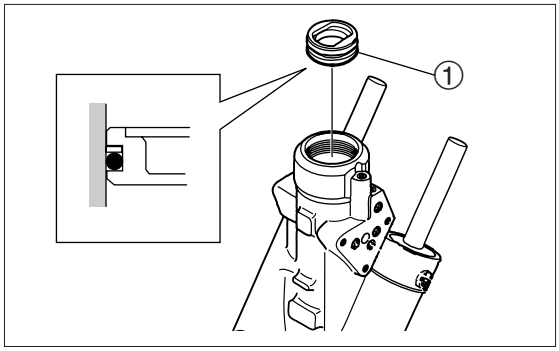
23) Assembling PTT Unit Parts

1. Put recommended PTT fluid into the unit through hole ⓐ.

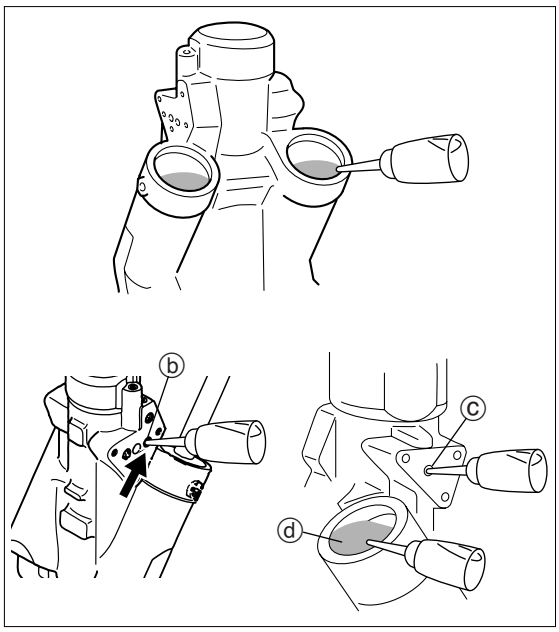
Recommended Power Trim and Tilt Fluid :
ATF DEXRON III
682 cm³ (23.0 floz.)



2. Push free piston ① into tilt cylinder unit fully to the bottom.



3. Fill with PTT fluid from ⓑ, ⓒ, and ⓓ to a proper level.



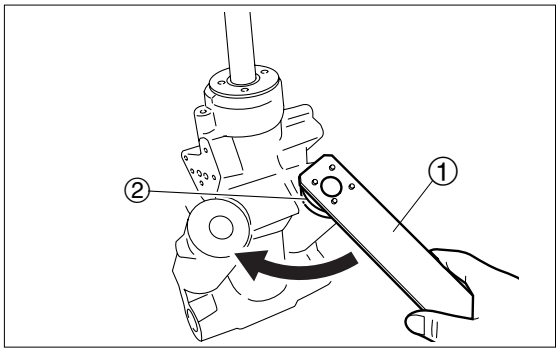
4. Install trim piston ass'y to trim cylinder, and tighten trim rod guide ② to specified torque.

⚠ 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]

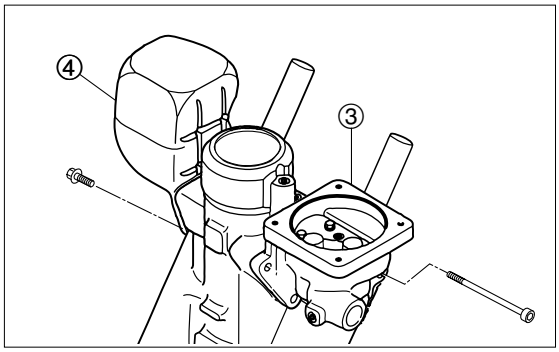
Trim Rod Guide Wrench ① :
P/N. 3C8-72792



5. Attach new O ring, valve pin and valve seat ass'y to tilt cylinder.

6. Install gear pump ③.

Gear Pump Installation Bolts :
9 N · m (7 lb · ft) [0.9 kgf · m]

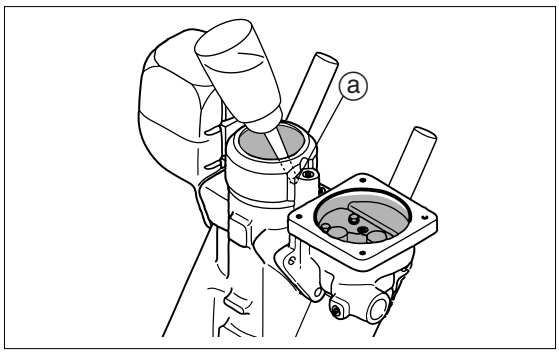


7. Put O ring on the reservoir cap.

8. Install reservoir ④, 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 ⓐ to a proper level.



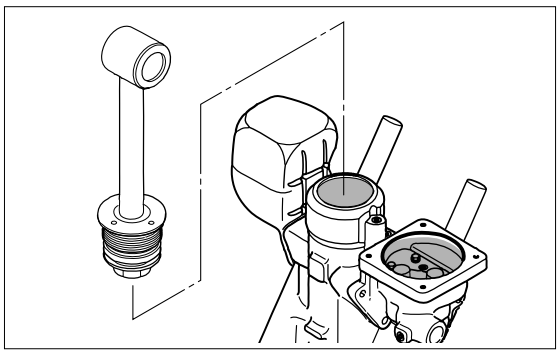
10. Install tilt piston to cylinder, and tighten tilt rod guide ⑤ to specified torque.

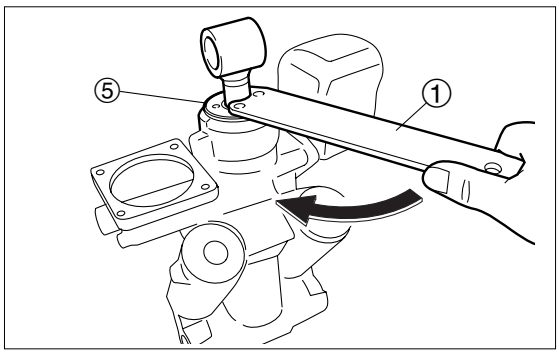
⚠ CAUTION

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.

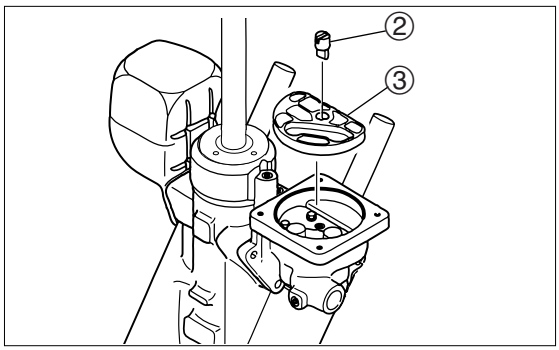
Tilt Rod Guide ⑤ :
130 N · m (94 lb · ft) [13.0 kgf · m]

Trim Rod Guide Wrench ① :
P/N. 3C8-72791

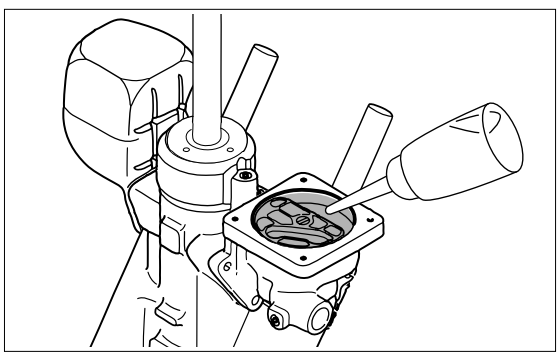




11. Attach joint ② and gear pump filter ③ to gear pump.



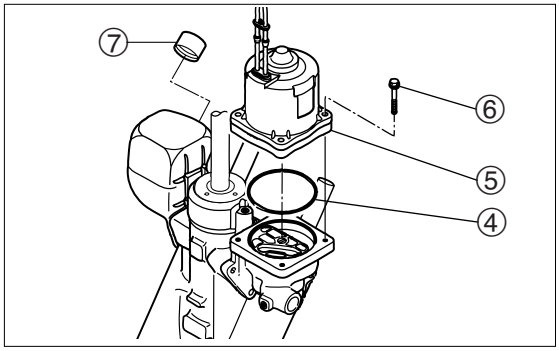
12. Fill gear pump with PTT oil to a proper level.



7

13. Remove air bubbles by using a means such as a syringe.

14. Install O ring ④ and power trim and tilt motor ass'y ⑤, and tighten bolts ⑥ to specified torque.



⚠ CAUTION

Engage armature shaft joint groove with the shaft of pump.

Tilt Motor Ass'y Installation Bolts ⑥ :
4 N · m (3 lb · ft) [0.4 kgf · m]

15. Remove reservoir cap 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.

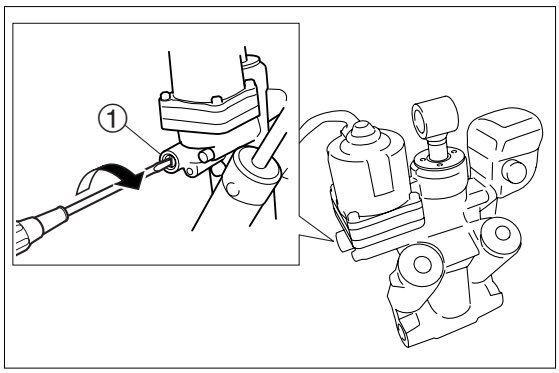
17. Tighten reservoir cap ⑦ to specified torque.

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

18. Purge air from power trim and tilt unit.

19. Check hydraulic pressure of power trim and tilt unit.

24) Air-Purging PTT Unit



1. Turn manual valve ① clockwise to tighten.
2. Set PTT unit upright.
3. Remove reservoir cap and check PTT fluid level.

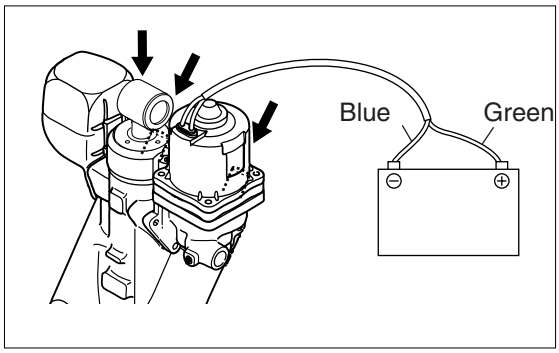
> **⚠ CAUTION**
>
> **If the fluid level is correct, the fluid should overflow out of the filter hole when the reservoir cap is removed.**

4. Add fluid until filter hole is filled if necessary.

> **PTT Fluid :**
> ATF DEXIRON III

5. Tighten reservoir cap to specified torque.

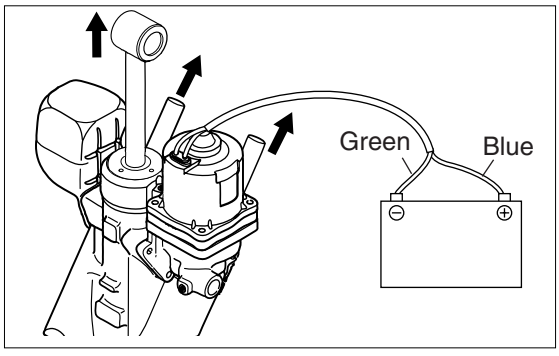
> **Reservoir Cap :**
> 7 N · m (5 lb · ft) [0.7 kgf · m]



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.

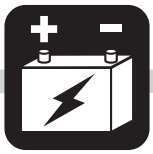
Rod	PTT Motor Lead	Battery Terminal
UP	Blue	⊕
	Green	⊖

> **⚠ 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.

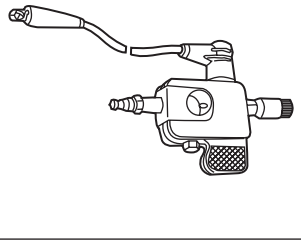
8

Electrical System



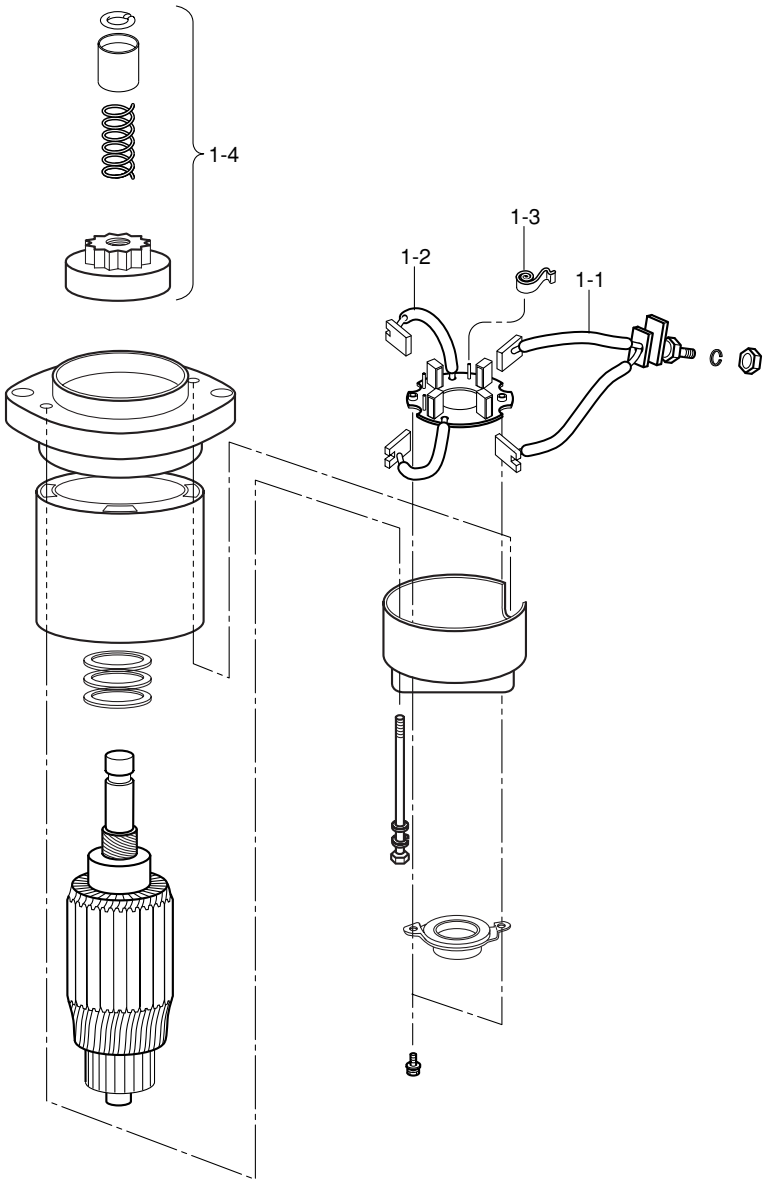
1. Special Tools ····· 8-2
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1. Special Tools

	
Spark Tester P/N. 3F3-72540-0	
Checking sparks	

2. Parts Layout

Starter Motor



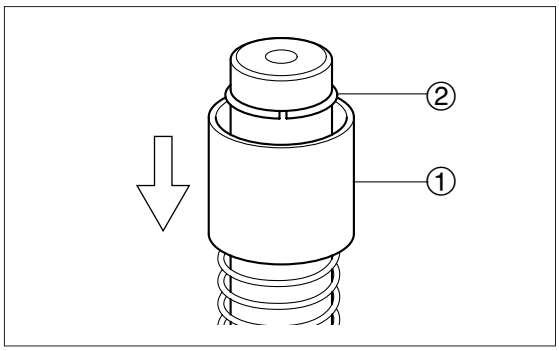
Ref. No.	Description	Q'ty	Remarks
1	Starter Motor	1	
1-1	Carbon Brush (+)	2	
1-2	Carbon Brush (-)	2	
1-3	Brush Spring	4	
1-4	Pinion	1	Do not reuse clip.

3. Inspection Items

1) Disassembly of Starter Motor

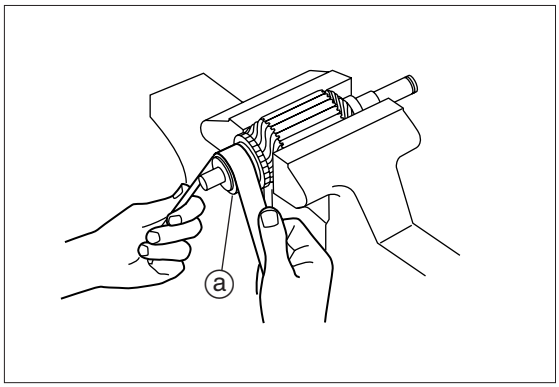
1. Push down pinion stopper ①, remove pinion stopper clip ②, and then, remove pinion return spring and pinion.

2. Remove bolt and screw, and disassemble starter motor.



2) Inspection of Armature

1. Check armature commutator ⓐ for deposit of carbon and other dirt. Clean by using sand paper #600 if necessary.



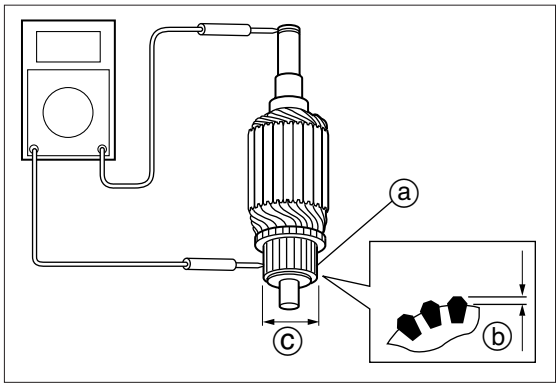
2. Measure commutator ⓐ groove depth ⓑ.
   Replace starter motor if the depth is less than specified value.

Groove Depth ⓑ :	0.5 - 0.8 mm (0.020 - 0.032 in)
Wear Limit :	0.2 mm (0.008 in)

3. Check conductivity between commutator ⓐ and shaft.
   Replace starter motor if conductive.

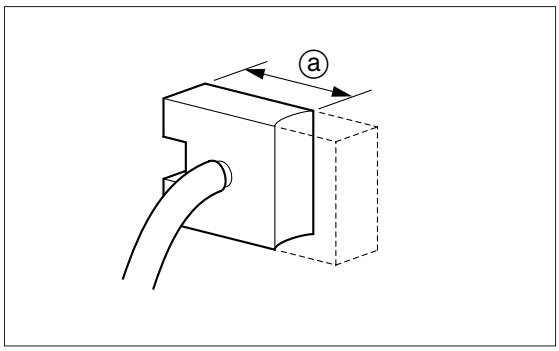
4. Measure commutator ⓐ outer diameter ⓒ.
   Replace starter motor ass'y if the diameter is less than specified value.

Diameter ⓒ :	33 mm (1.30 in)
Wear Limit :	32 mm (1.26 in)



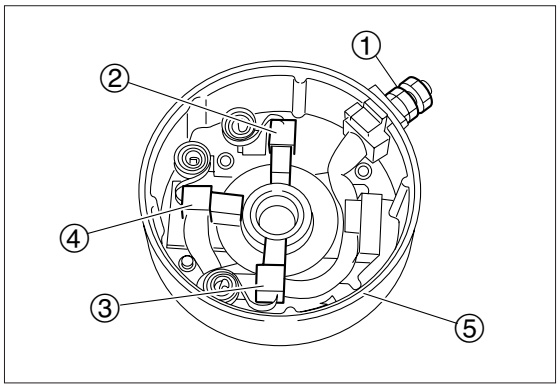
3) Inspection of Brushes

1. Measure brush length ⓐ, and replace brush if the length is less than specified value.



Brush Length ⓐ : Standard Value	14 - 15 mm (0.55 - 0.59 in)
Wear Limit :	12 mm (0.47 in)

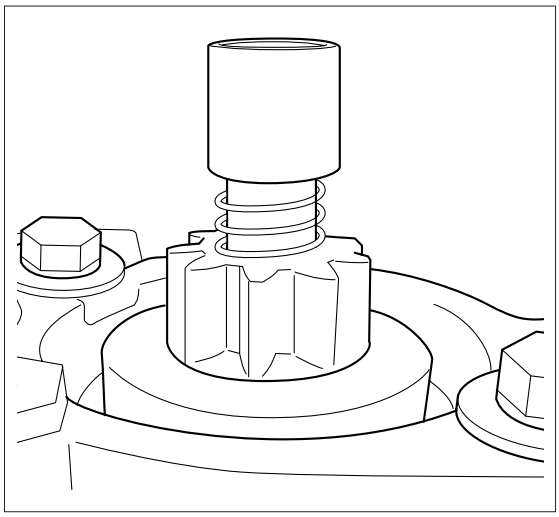
2. Check conductivity between brush and starter terminal. Replace brush ass'y if any of the following conditions is met.



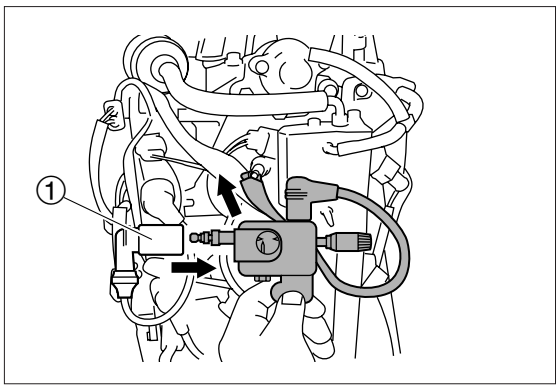
Between Brush and Brush	② - ④ ③ - ④	Conductive
Between Brush and Motor Base	② - ⑤ ③ - ⑤	Conductive
Between Brush and Starter Motor Terminal	② - ① ③ - ①	No Conductivity
Between Brush and Motor Base	④ - ⑤	No Conductivity

4) Inspection of Pinion

1. Check pinion teeth for nick and wear.
   Replace if necessary.



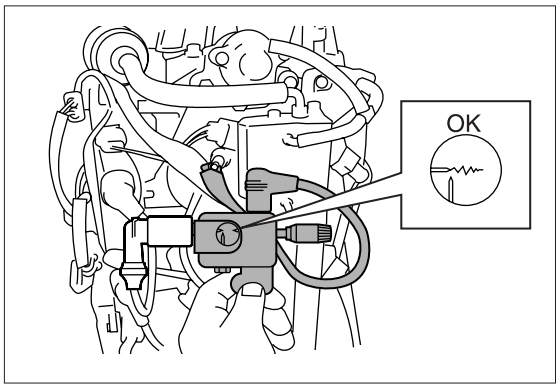
5) Inspection of Ignition and spark



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

Spark Performance :
10 mm (0.4 in) or over

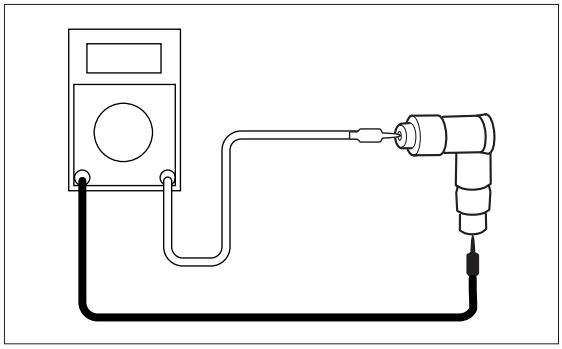


4. Start engine and check spark. Check spark system when sparks are weak.

⚠ 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.**

6) Inspection of Plug Cap

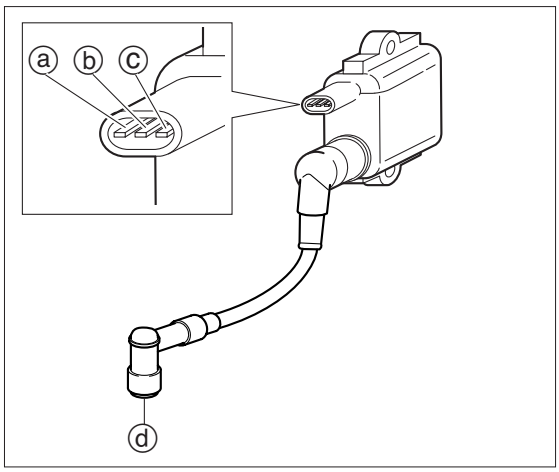


Remove the part and test it as a separate unit.

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 :
3.75 - 6.75 kΩ @20˚C (68 ˚F)

7) Inspection of Ignition Coils



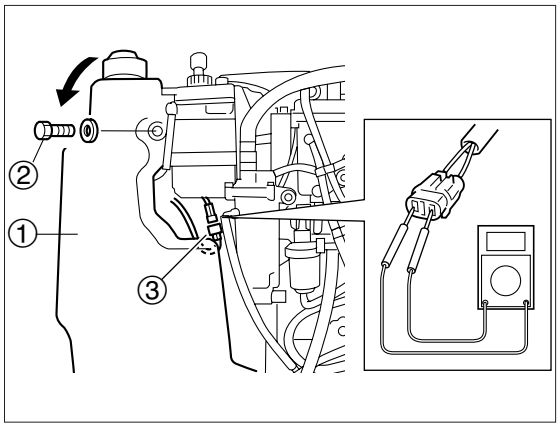
1. Remove ignition coil coupler.
2. Measure ignition coil resistance. Replace if other than specified value.

This test can be made without removing parts.

Ignition Coil Resistance :
Primary Side : Between ⓐ and ⓑ 0.4 - 0.6 Ω
Secondary Side : Between ⓒ and ⓓ 10.8 - 16.2 kΩ
(6.8 - 10.2 kΩ without plug cap)

3. Install plug cap onto high tension cord by twisting clockwise.
4. Connect plug cap to spark plug.

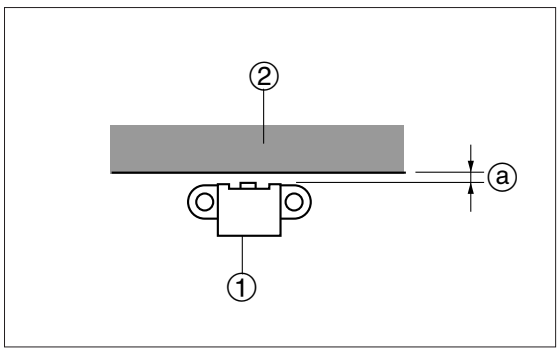
8) Inspection of Pick Up Coil (Crank Position Sebsor)



1. Remove oil tank ① installation bolt ② (upper one) and move oil tank a little.
2. Disconnect pick up coil ③ 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)
400 - 600 Ω

9) Inspection of Pick Up Coil Air Gap



1. Measure air gap ⓐ between pick up coil ① and flywheel ②.
   Adjust air gap if out of specified range.

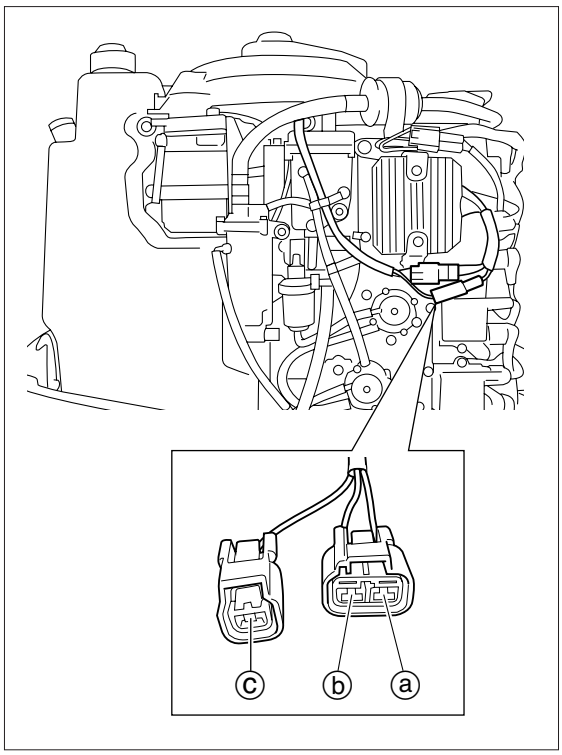
Air Gap ⓐ :
0.5 - 0.9 mm (0.020 - 0.035 in)

8

10) Inspection of Alternator

1. Disconnect alternator connector and measure resistance between terminals.
   Replace alternator if the resistance is out of specified range.

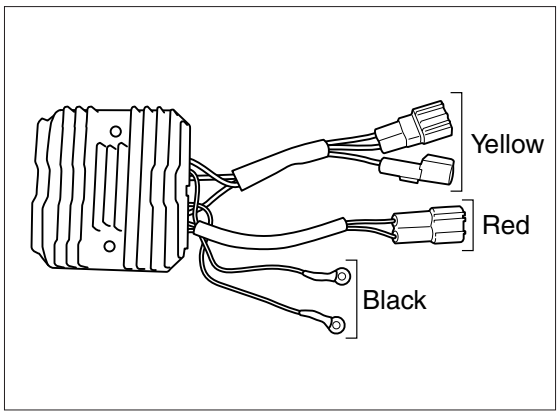
Resistance between Terminals of Connectors ⓐ, ⓑ and ⓒ : @20˚C (68 ˚F)
0.12 - 0.19 Ω



11) 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)						
		Red	Red	Black	Black	Yellow	Yellow	Yellow
Tester Lead Negative (-) Side (Black)	Red		ON (0Ω)	OFF	OFF	OFF	OFF	OFF
	Red	ON (0Ω)		OFF	OFF	OFF	OFF	OFF
	Black	ON (5kΩ)	ON (5kΩ)		ON (0Ω)	ON (3kΩ)	ON (3kΩ)	ON (3kΩ)
	Black	ON (5kΩ)	ON (5kΩ)	ON (0Ω)		ON (3kΩ)	ON (3kΩ)	ON (3kΩ)
	Yellow	ON (4kΩ)	ON (4kΩ)	ON (3kΩ)	ON (3kΩ)		ON (5kΩ)	ON (5kΩ)
	Yellow	ON (4kΩ)	ON (4kΩ)	ON (3kΩ)	ON (3kΩ)	ON (5kΩ)		ON (5kΩ)
	Yellow	ON (4kΩ)	ON (4kΩ)	ON (3kΩ)	ON (3kΩ)	ON (5kΩ)	ON (5kΩ)	

Notes:

① Use HIOKI HiTESTER MODEL 3030 or equivalent tester for this measurement, and do not use megger or other instrument.

② When the tester's pointer moves, the result is "ON", or "OFF" when not. 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.

③ Disconnect all connections, and measure as an independent unit.

④ This check provides only rough indication, and perfect measurement cannot be made with the tester.

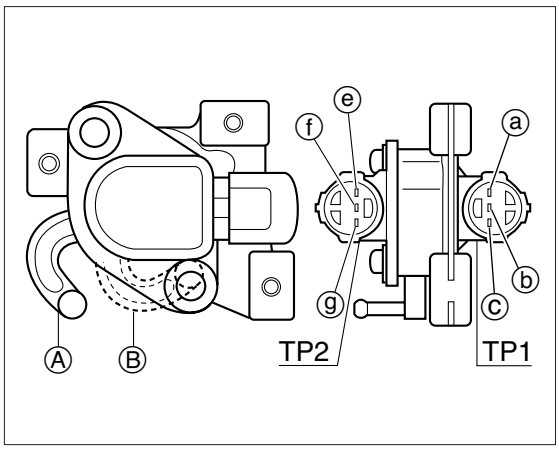
12) Inspection of Throttle Position Sensor

1. Measure resistance between terminals.
   Replace throttle position sensor if the resistance is out of specified range.

This test can be made without removing parts.

When lever is at position Ⓐ (wide open throttle) :
Between ⓐ - ⓒ
Between ⓔ - ⓖ : 4 - 6 kΩ
Between ⓐ - ⓑ
Between ⓔ - ⓕ : 0.5 - 1 kΩ

When lever is at position Ⓑ (fully closed throttle) :
Between ⓐ - ⓒ
Between ⓔ - ⓖ : 4 - 6 kΩ
Between ⓐ - ⓑ
Between ⓔ - ⓕ : 4 - 6 kΩ

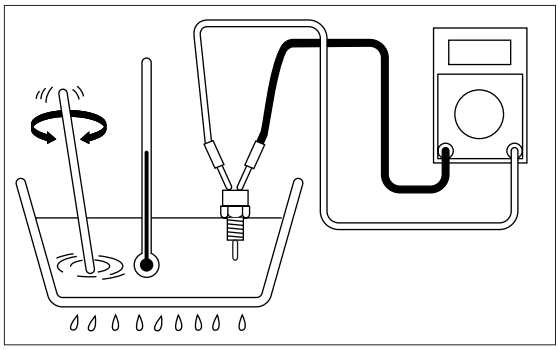


13) Inspection of Water Temperature Sensor

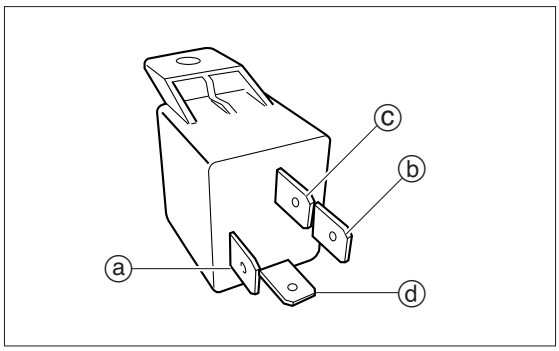
Remove the part and test it as a separate unit.

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)



14) Inspection of Power Relay



1. Measure resistance between ⓐ and ⓑ terminals.
   Replace relay if the resistance is out of specified range.

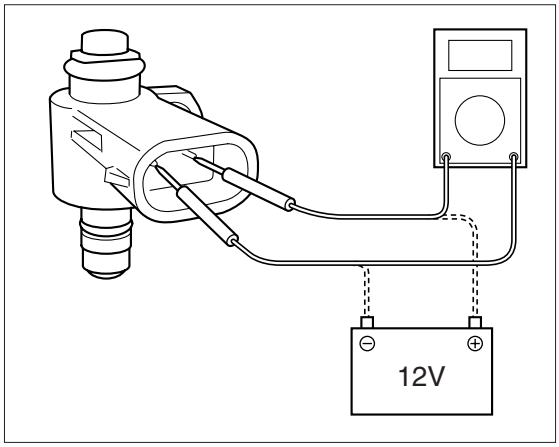
This test can be made without removing parts.

Resistance between ⓐ and ⓑ terminals : @20˚C (68˚F)
90 - 110 Ω

2. Apply 12V between terminals ⓐ and ⓑ and check conductivity between ⓒ and ⓓ.

Resistance between terminals : @20˚C (68˚F)
To be conductive when 12V is applied between ⓐ and ⓑ.
To be non conductive when no voltage is applied between ⓐ and ⓑ.

15) Inspection of Air Injectors



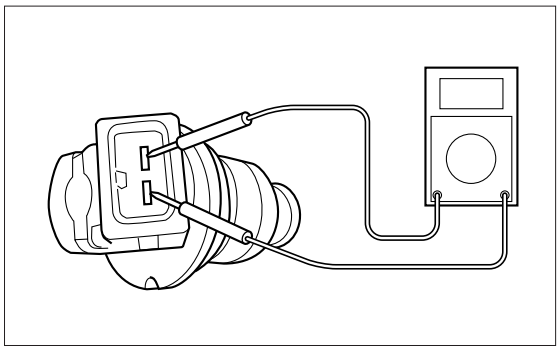
1. Measure resistance between terminals.
   Replace air injector if the resistance is out of specified range.

This test can be made without removing parts.

Resistance between terminals : @20˚C (68 ˚F)
1.2 - 1.4 Ω

2. Apply 12V to the terminals to check if the part "clicks".
   If not, replace air injector.

16) Inspection of Fuel Injectors



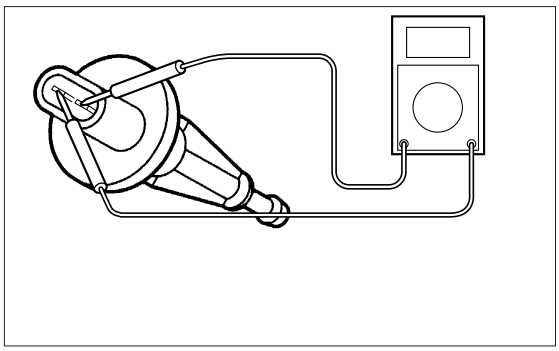
1. Measure resistance between the terminals, and replace fuel injector if the resistance is out of specified range.

This test can be made without removing parts.

Resistance between terminals : @20˚C (68˚F)
1.7 - 1.9 Ω

2. Apply 12V to the terminals to check if the part "clicks".
   If not, replace fuel injector.

17) Inspection of MAT (Manifold Temperature) Sensor

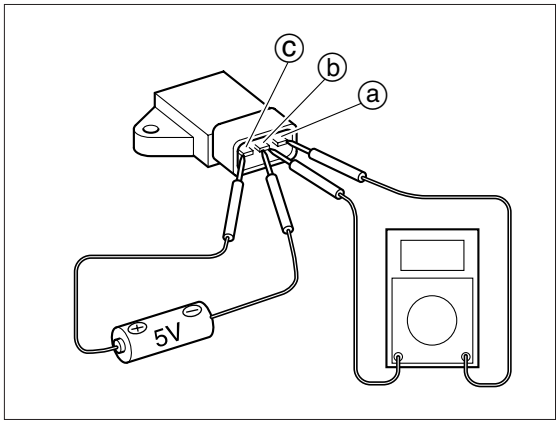


1. Measure MAT sensor resistance. Replace if other than specified value.

This test can be made without removing parts.

MAT (Manifold Temperature) Sensor
Temperature (Reference Value) :
2.35 - 2.55kΩ at 20˚C (68˚F)
0.30 - 0.35kΩ at 80˚C (176˚F)

18) Inspection of MAP Sensor (Manifold Air Pressure Sensor)

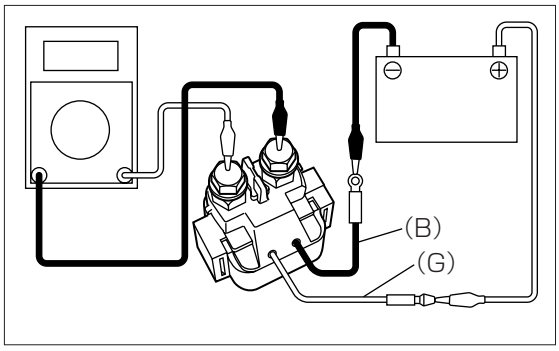


1. Apply 5V between terminals ⓑ and ⓒ, and measure output voltage between terminals ⓐ and ⓑ.
Replace MAP sensor if the output voltage is out of specified range.

This test can be made without removing parts.

Output Voltage between ⓐ and ⓑ : @25˚C (77˚F) and atmospheric pressure
3.1 - 4.6V

19) Inspection of Starter Solenoid



This test can be made without removing parts.

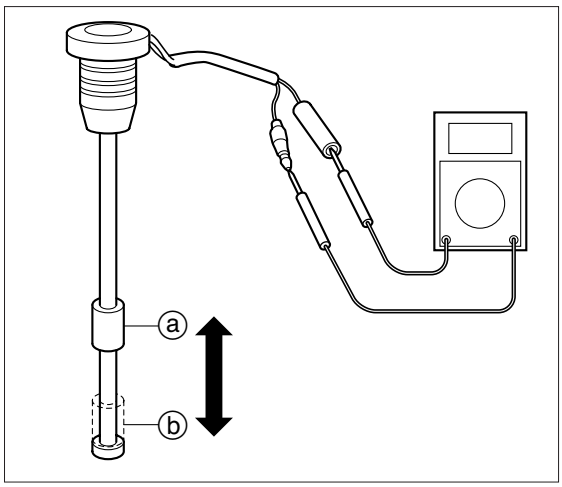
1. Connect tester lead wires to both terminal of starter solenoid.
2. Connector green (G) lead wire to battery positive terminal.
3. Connector black (B) lead wire to battery negative terminal.
4. Check electrical conductivity between terminals of starter solenoid. Replace if no conductivity.
5. Remove battery terminal from green (G) or black (B) lead wire, and check there is no conductivity between starter solenoid terminals. Replace if conductive.

20) Inspection of Oil Level Sensor

1. Check electrical conductivity between terminals of oil level sensor.
   Check oil level sensor if out of specified range.

This test can be made without removing parts.

To be non conductive if float is at position ⓐ.
To be conductive if float is at position ⓑ.

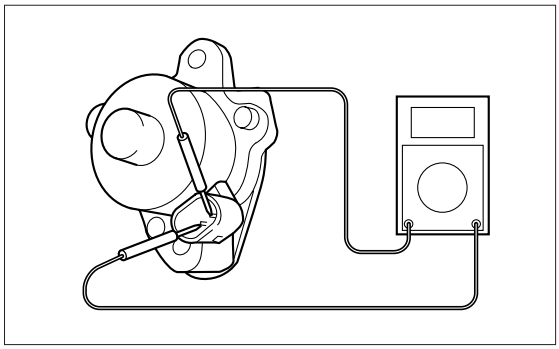


21) Inspection of Oil Pump

1. Measure resistance between terminals, and replace oil pump if the resistance is out of specified range.

This test can be made without removing parts.

Resistance between terminals : @20˚C (68 ˚F)
1.84 - 2.08 Ω



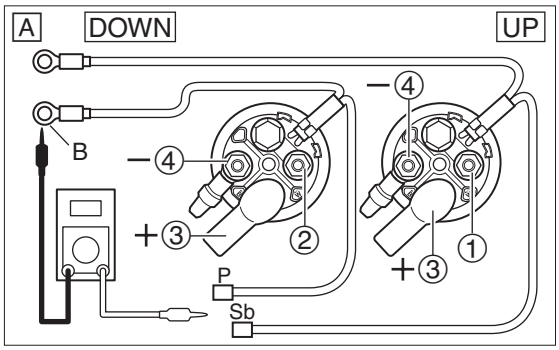
8

22) Inspection of PTT Solenoid

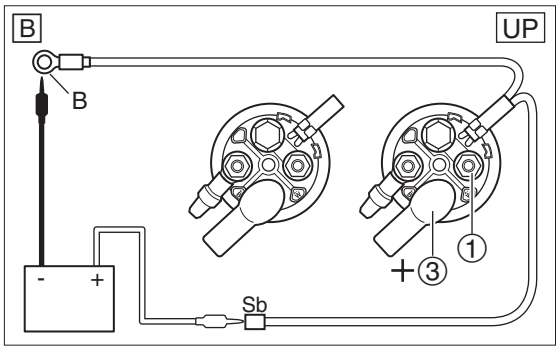
This test can be made without removing parts.

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.

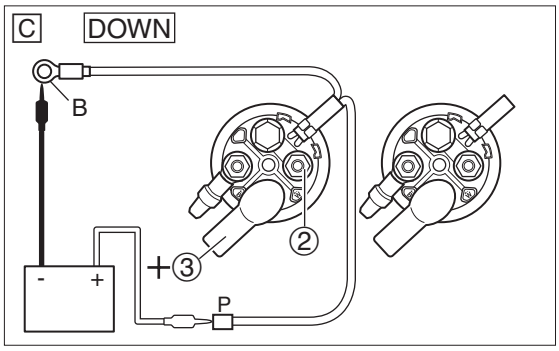
PTT Solenoid Conductivity	
Sky Blue (Sb) -Black (B) Pink (P) -Black (B)	Conductive
Terminal ① - Terminal ④ (-) Terminal ② - Terminal ④ (-)	Conductive
Terminal ① - Terminal ③ (+) Terminal ② - Terminal ③ (+)	No Conductivity



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.



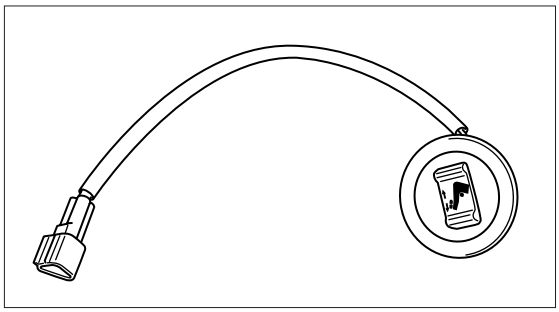
7. Connect circuit tester leads between terminals ② and ③ of PTT solenoid.
8. As shown in diagram C, connect pink (P) terminal to positive battery terminal, and black (B) lead wire to negative battery terminal.
9. Check electrical conductivity between terminals ② and ③. If non conductive, replace DOWN side PTT solenoid.



23) 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)		○	○



9

Troubleshooting



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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".

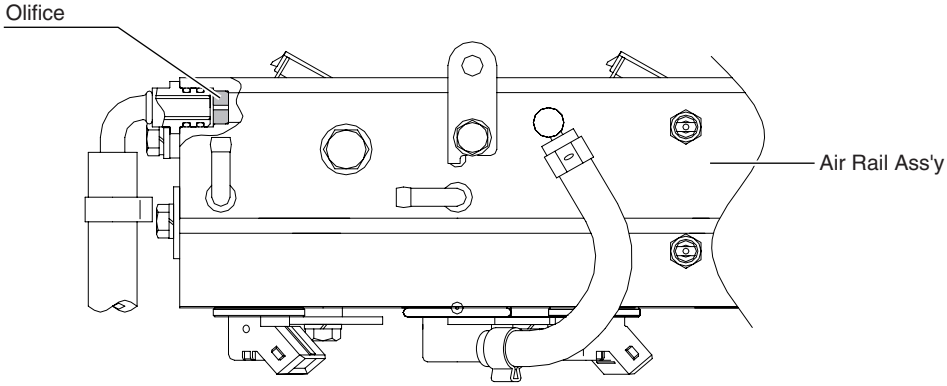
Symptom	Item		Self-diagnosable (○)	Beep	Warning indicator A (Oil level)	Warning lamp B (Water temp.)	Warning lamp C (Battery volt.)
1. Starter motor will not rotate or is slow.	1-1.	Shift					
	1-2.	Battery	○				Flashing
	1-3.	Fuse					
	1-4.	Wiring					
	1-5.	Electrical components					
2. Engine can 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: 0.6 - 0.64 MPa (85.3 - 91.4psi) [6 - 6.4kg/cm^2]	○		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.

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: 0.6 - 0.64MPa (85.3 - 91.4psi) [6 - 6.4kg/cm^2]					
		Air rail internal fuel pressure is high. Normal value range: 0.6 - 0.64MPa (85.3 - 91.4psi) [6 - 6.4kg/cm^2]					
	2-3. Air Compressor System	Air pressure is low. Normal value range: 0.53 - 0.57MPa (75.4 - 81.1psi) [5.3 - 5.7kg/cm^2]					
		Air pressure is high. Normal value range: 0.53 - 0.57MPa (75.4 - 81.1psi) [5.3 - 5.7kg/cm^2]					
	2-4. Electrical System	Fuse					
		Stop Switch					
		Air Injector					
		Spark Plug	○		Flashing	Flashing	Flashing

Olifice(*2)



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.

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: 0.6 - 0.64MPa (85.3 - 91.4psi) [6 - 6.4kg/cm^2]					

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.	
3-1-2.	Piston ring(s) is seized.	Check, and repair if necessary.
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.

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: 0.6 - 0.64MPa (85.3 - 91.4psi) [6 - 6.4kg/cm^2)					
		Fuel pressure is high. Normal value range: 0.6 - 0.64MPa (85.3 - 91.4psi) [6 - 6.4kg/cm^2)					
	3-3. Air System	Air pressure is low. [Normal value range: 0.53 - 0.57MPa (75.4 - 81.1psi)] [5.3 - 5.7kg/cm^2]					
		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
			○		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.	

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: 0.6 - 0.64MPa (85.3 - 91.4psi) [6 - 6.4kg/cm^2]					
	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.	

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
			○				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.

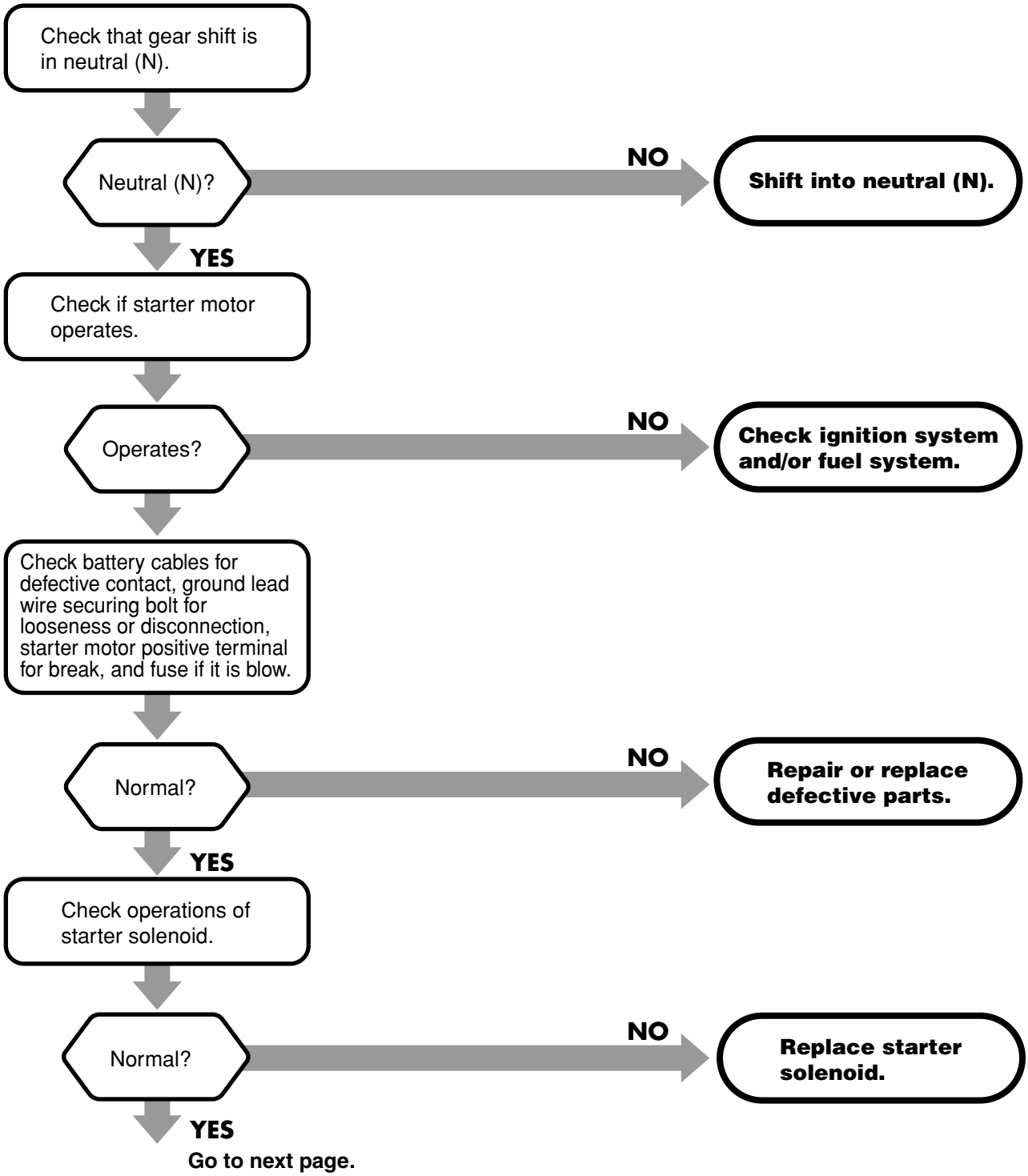
Troubleshooting

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.

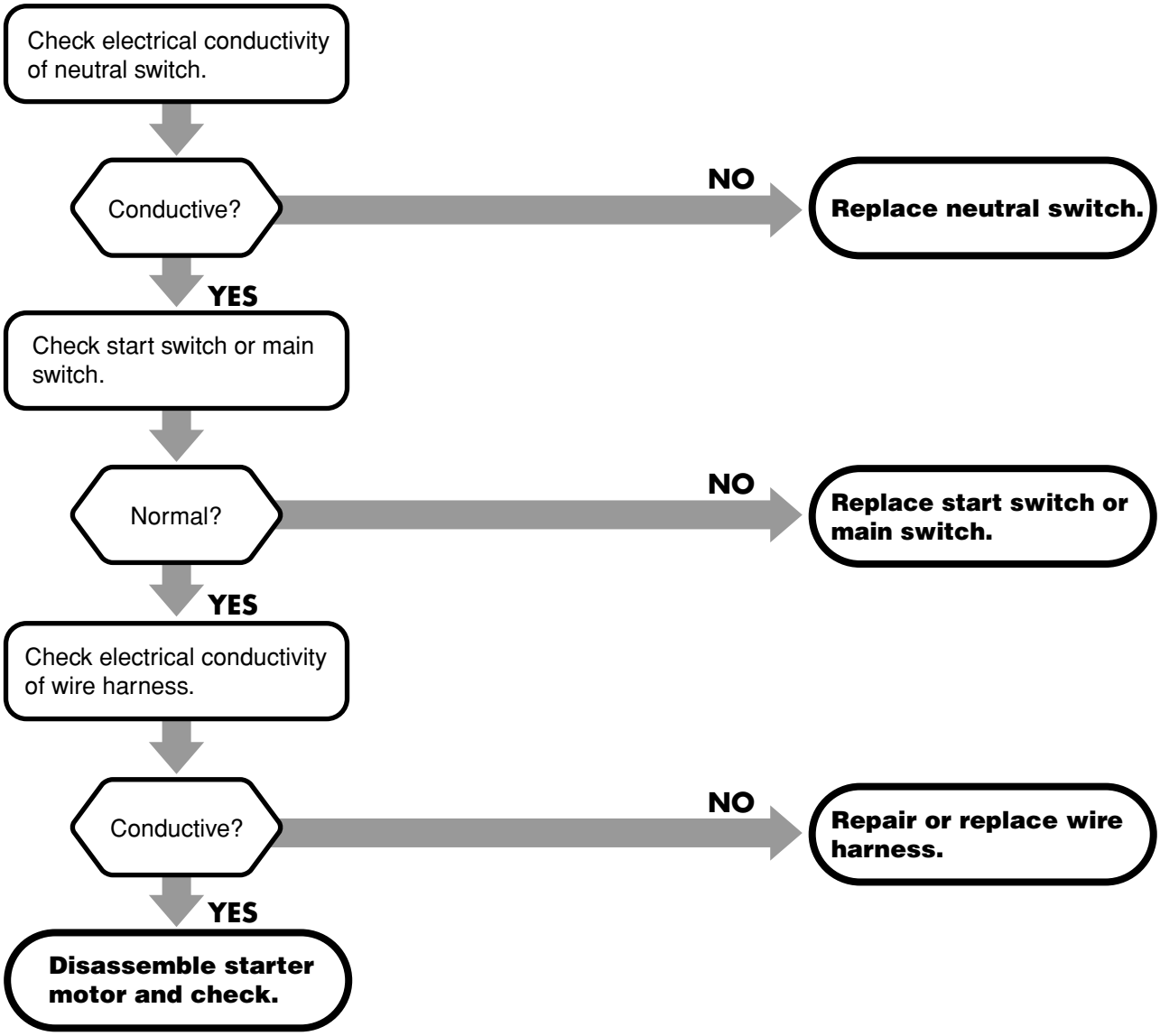
Power Unit

State 1 **Engine will not start or is hard to start.**

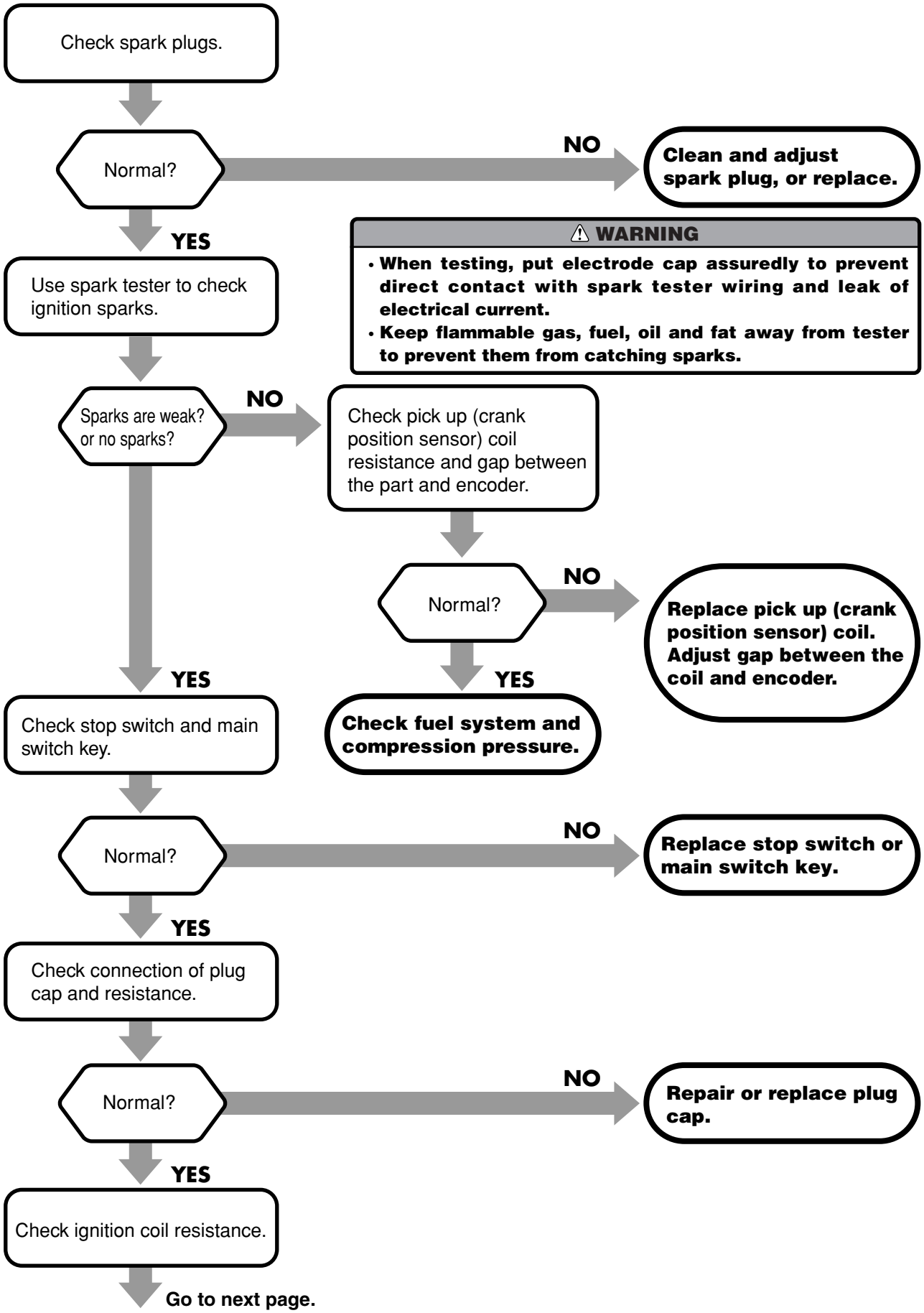
Starting System

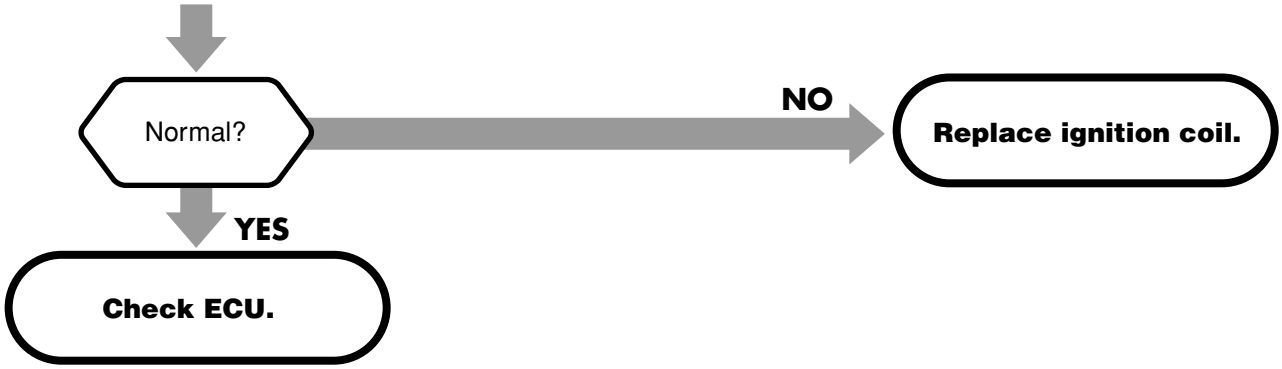


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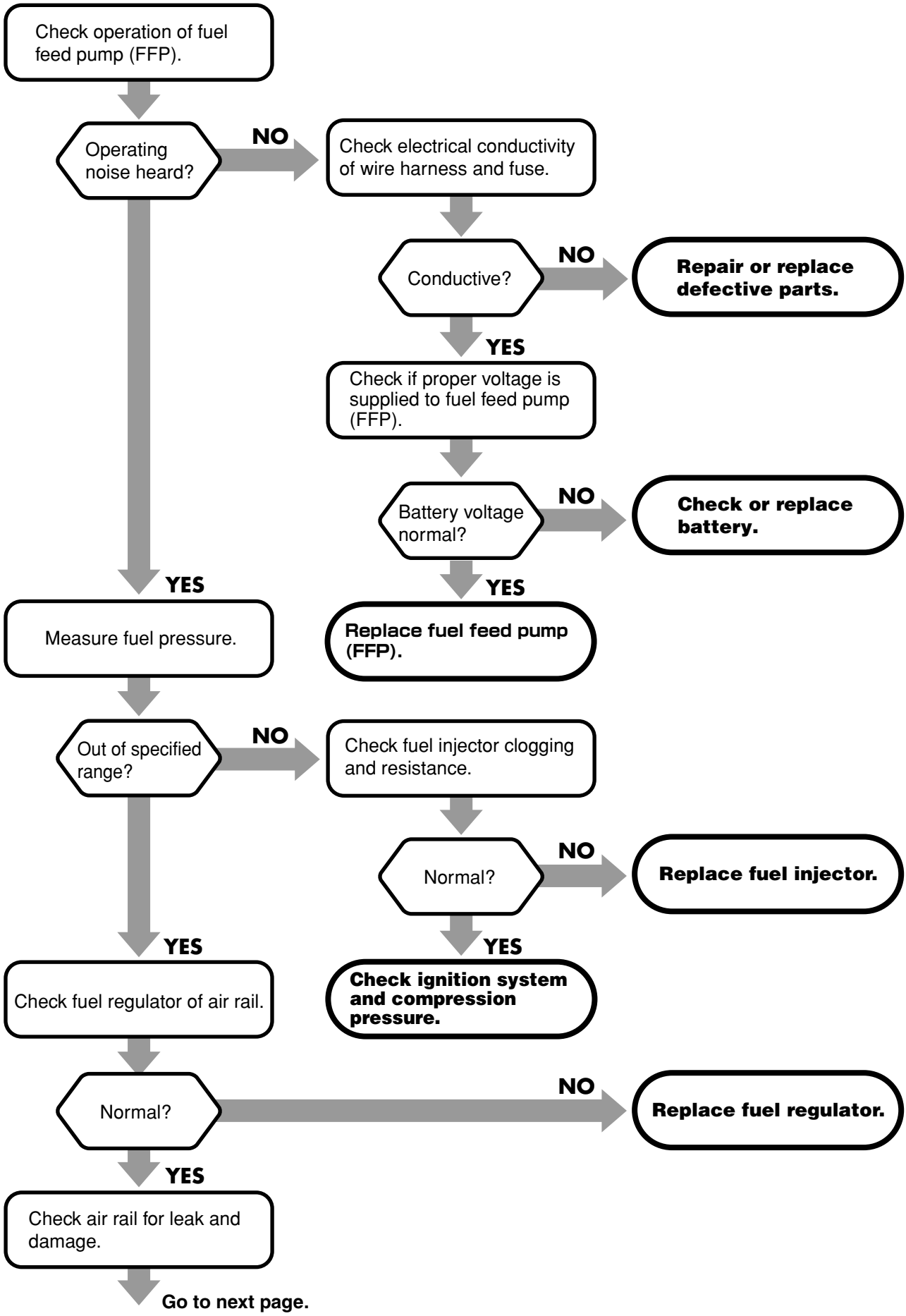

Check electrical conductivity of neutral switch.
Conductive?
NO
Replace neutral switch.
YES
Check start switch or main switch.
Normal?
NO
Replace start switch or main switch.
YES
Check electrical conductivity of wire harness.
Conductive?
NO
Repair or replace wire harness.
YES
Disassemble starter motor and check.

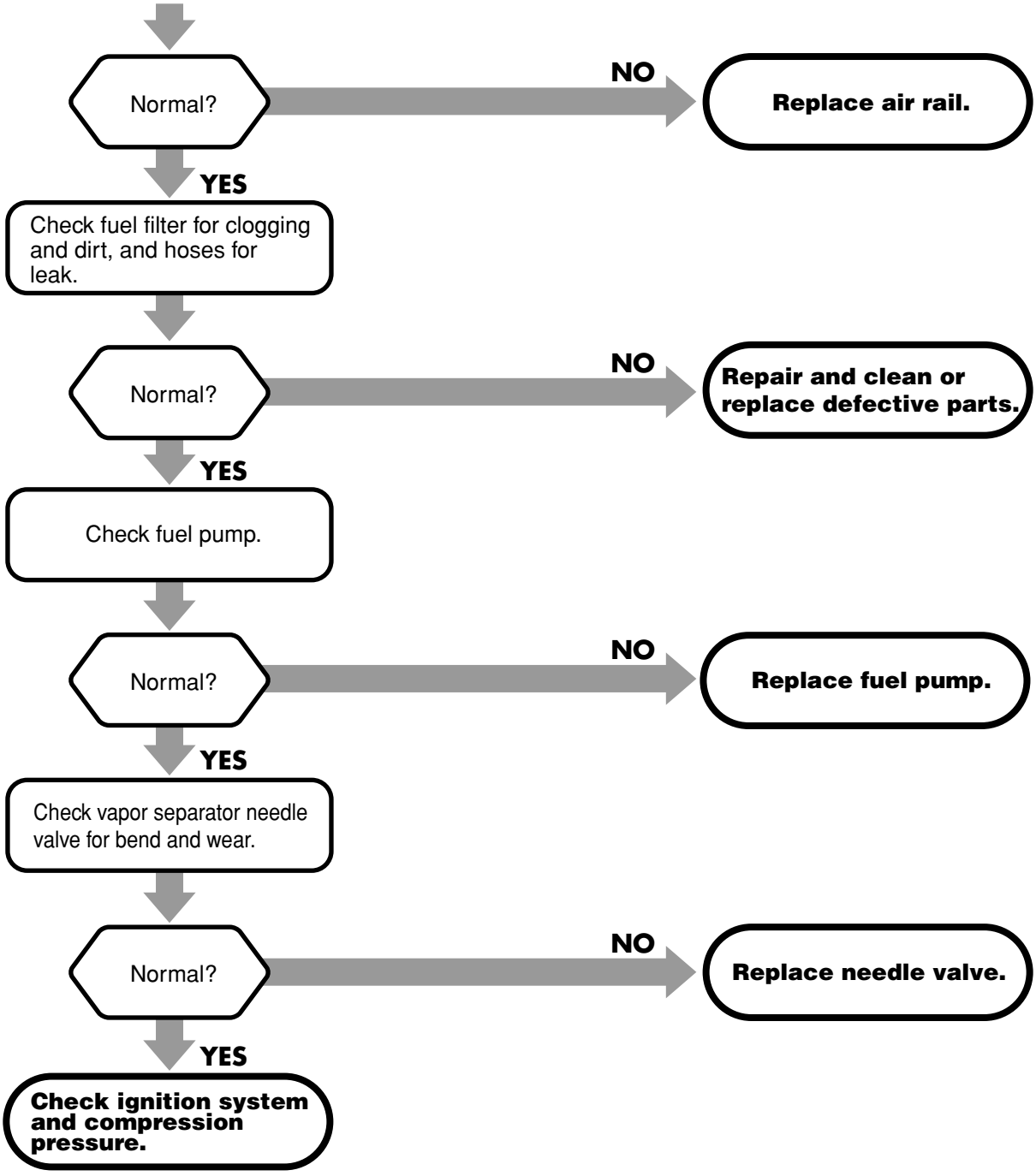
Ignition System



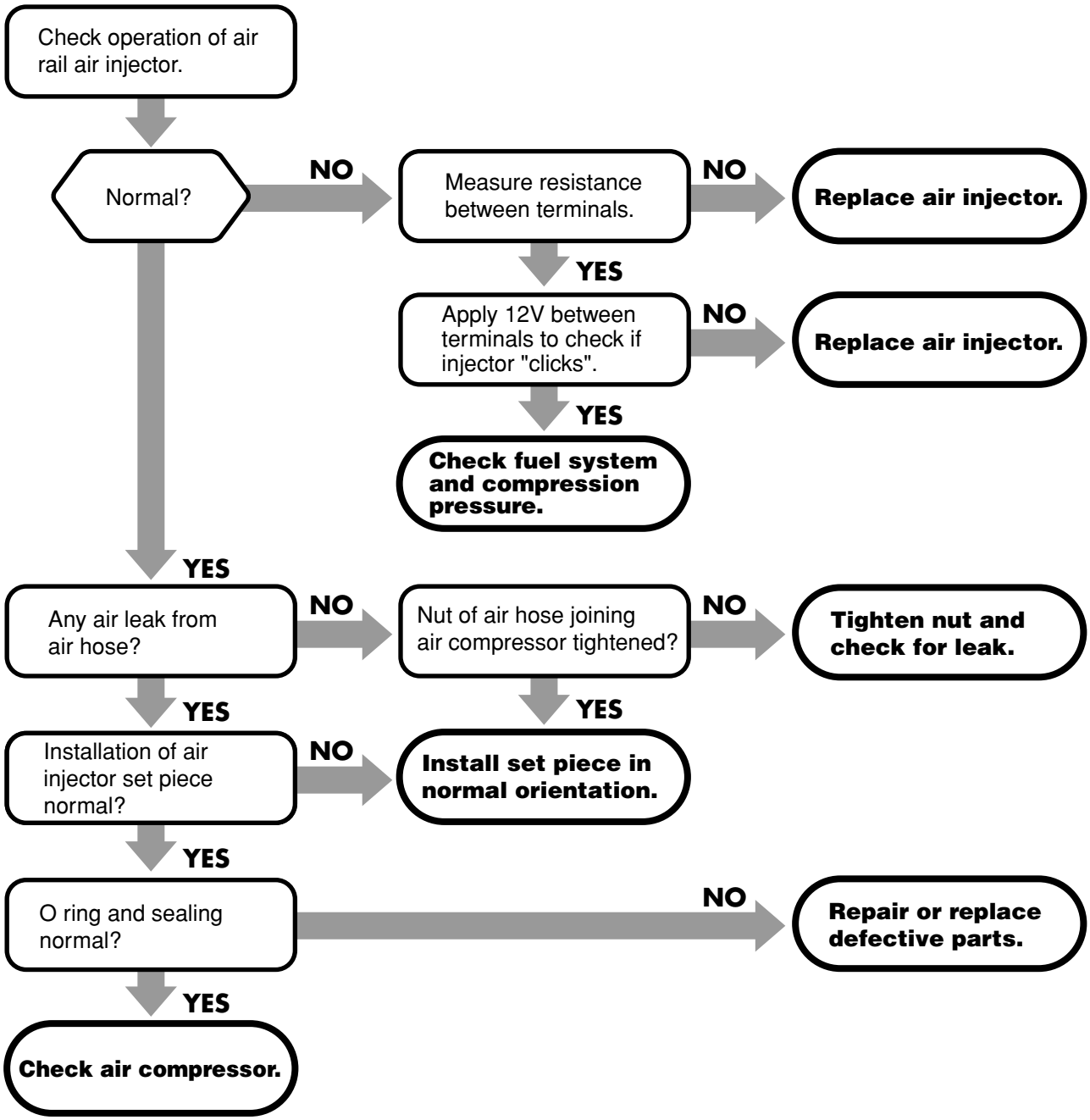

Normal?
NO
Replace ignition coil.
YES
Check ECU.

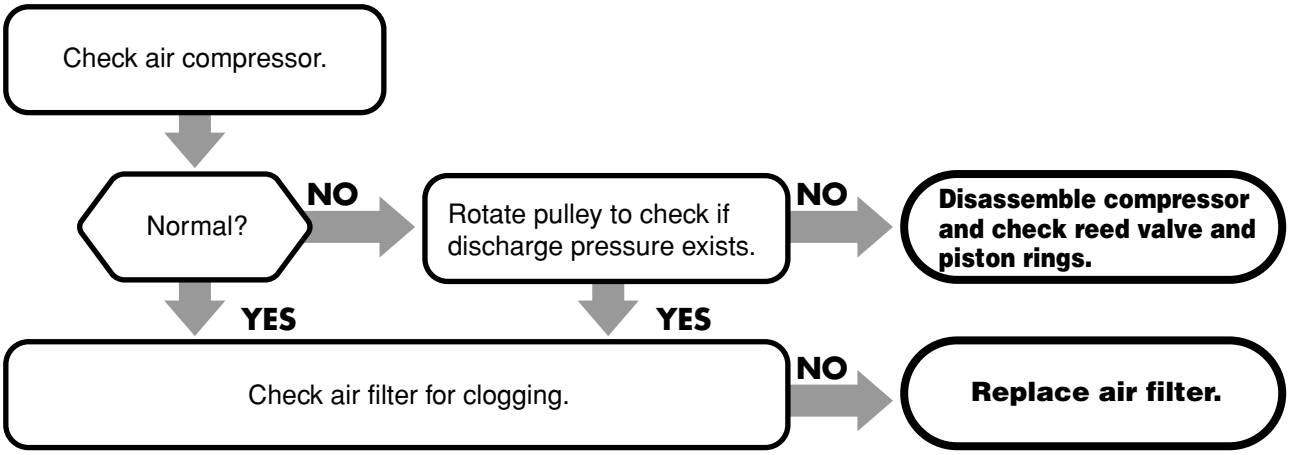
Fuel System


Check operation of fuel feed pump (FFP).
Operating noise heard?
NO
Check electrical conductivity of wire harness and fuse.
Conductive?
NO
Repair or replace defective parts.
YES
Check if proper voltage is supplied to fuel feed pump (FFP).
Battery voltage normal?
NO
Check or replace battery.
YES
Replace fuel feed pump (FFP).
YES
Measure fuel pressure.
Out of specified range?
NO
Check fuel injector clogging and resistance.
Normal?
NO
Replace fuel injector.
YES
Check ignition system and compression pressure.
YES
Check fuel regulator of air rail.
Normal?
NO
Replace fuel regulator.
YES
Check air rail for leak and damage.
Go to next page.

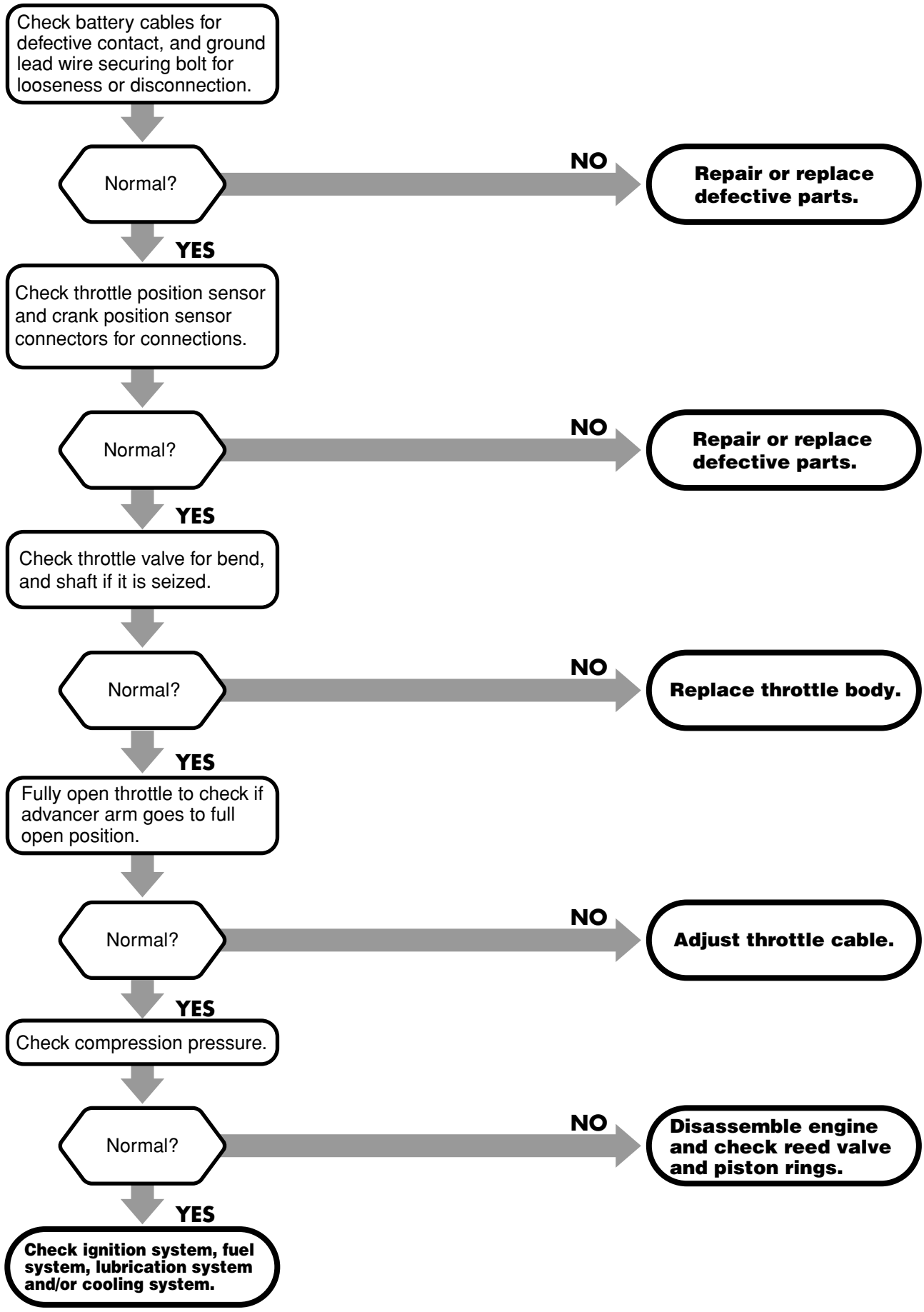

Normal?
NO
Replace air rail.
YES
Check fuel filter for clogging and dirt, and hoses for leak.
Normal?
NO
Repair and clean or replace defective parts.
YES
Check fuel pump.
Normal?
NO
Replace fuel pump.
YES
Check vapor separator needle valve for bend and wear.
Normal?
NO
Replace needle valve.
YES
Check ignition system and compression pressure.

Air System

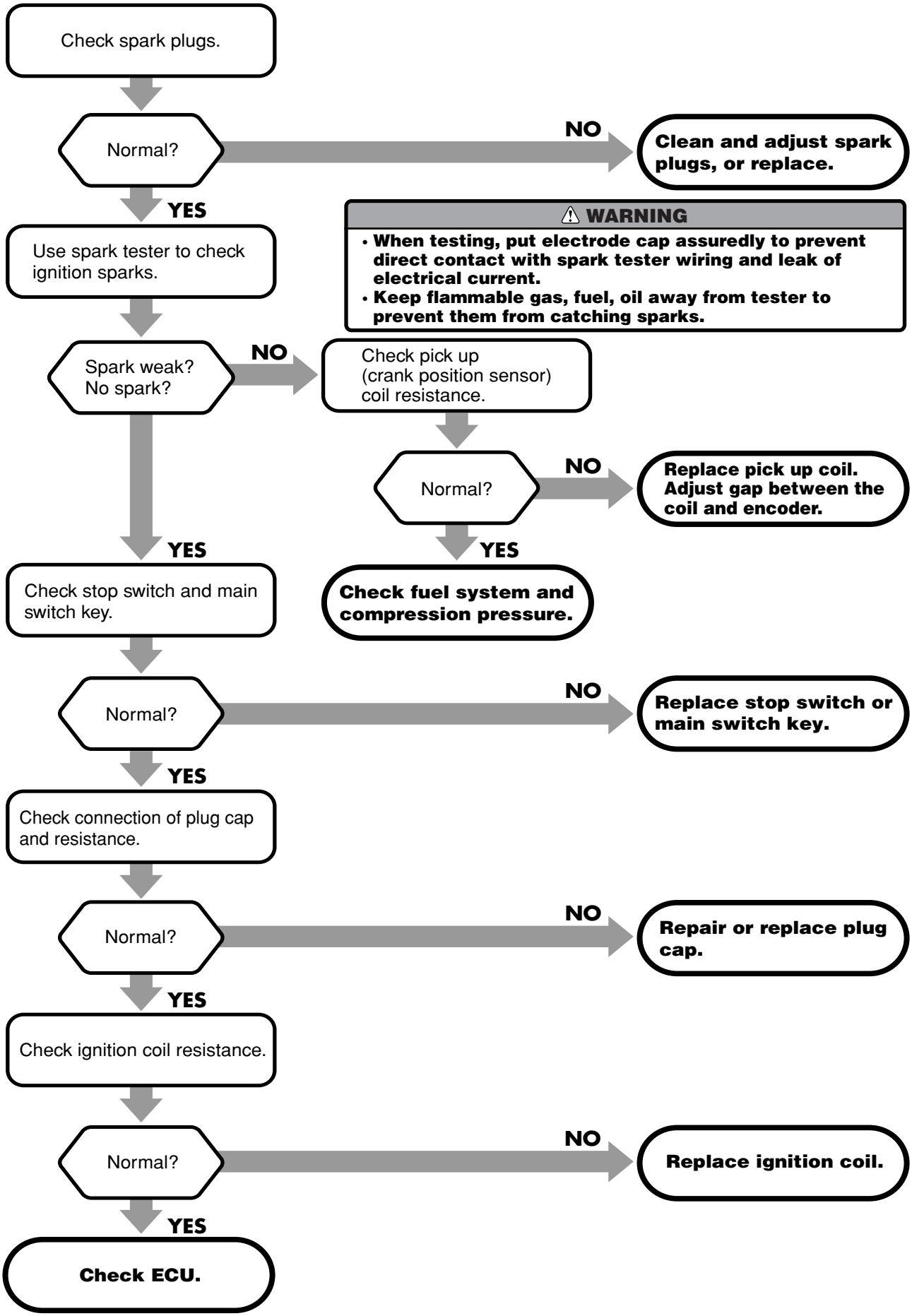

Check operation of air rail air injector.
Normal?
NO
Measure resistance between terminals.
NO
Replace air injector.
YES
Apply 12V between terminals to check if injector "clicks".
NO
Replace air injector.
YES
Check fuel system and compression pressure.
YES
Any air leak from air hose?
NO
Nut of air hose joining air compressor tightened?
NO
Tighten nut and check for leak.
YES
YES
Installation of air injector set piece normal?
NO
Install set piece in normal orientation.
YES
O ring and sealing normal?
NO
Repair or replace defective parts.
YES
Check air compressor.


Check air compressor.
Normal?
NO
Rotate pulley to check if discharge pressure exists.
NO
Disassemble compressor and check reed valve and piston rings.
YES
YES
Check air filter for clogging.
NO
Replace air filter.

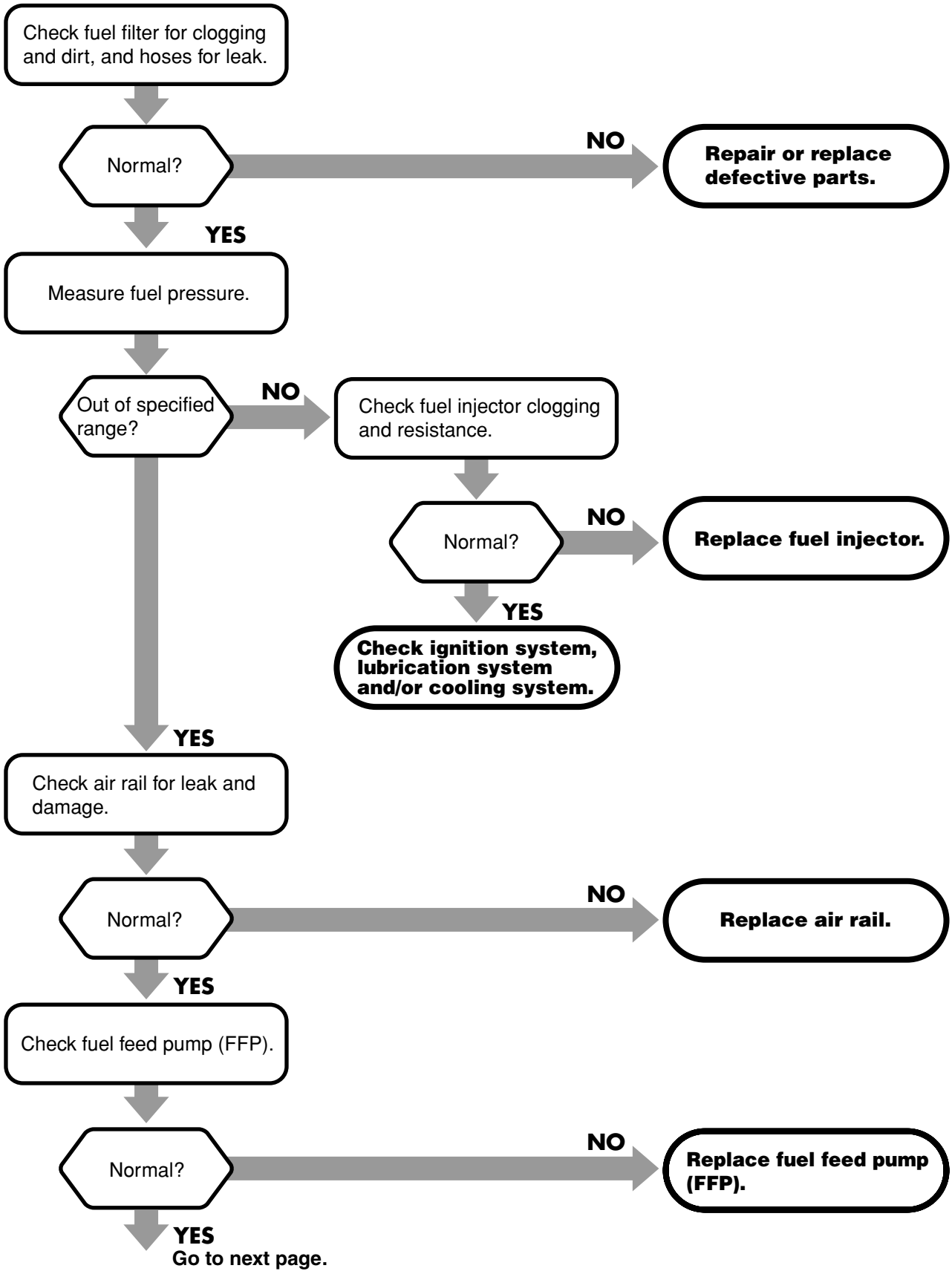
State 2 **Full throttle engine revolution speed is low, engine revolution speed falls off, or engine stalls.**

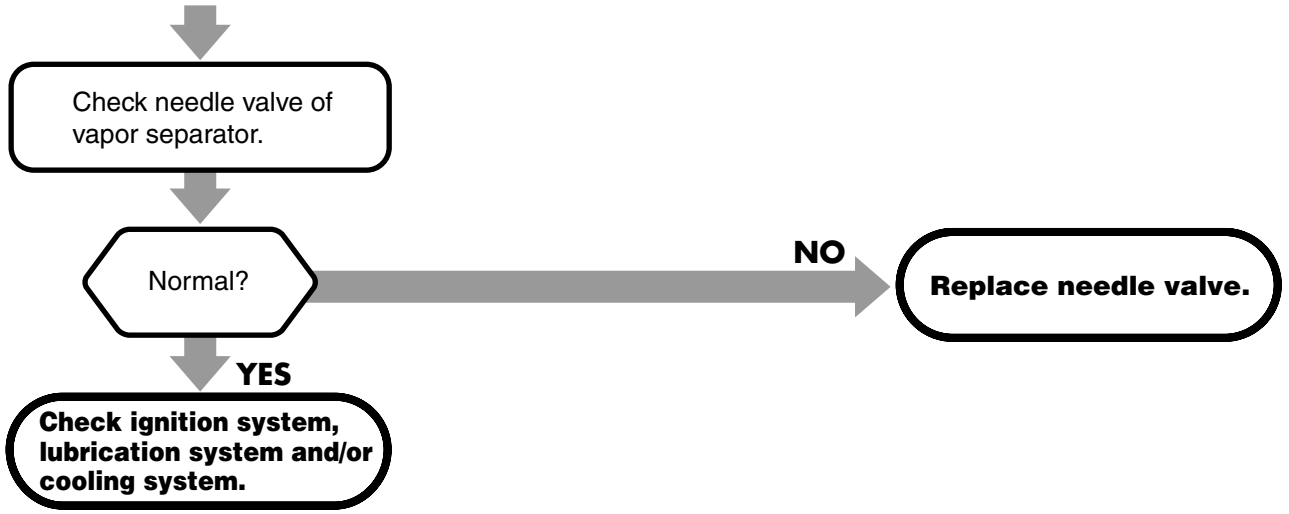


Ignition System

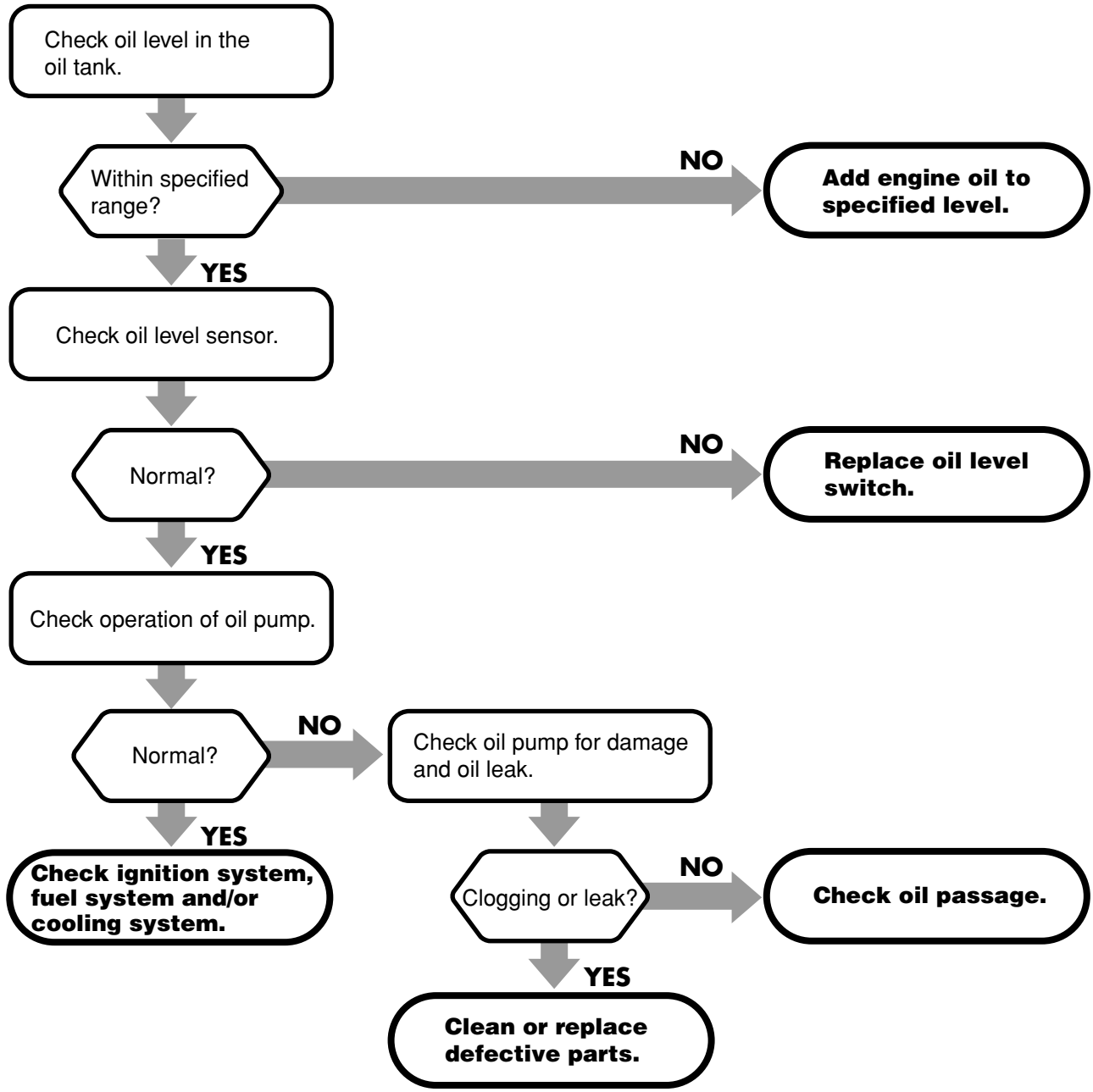


Fuel System

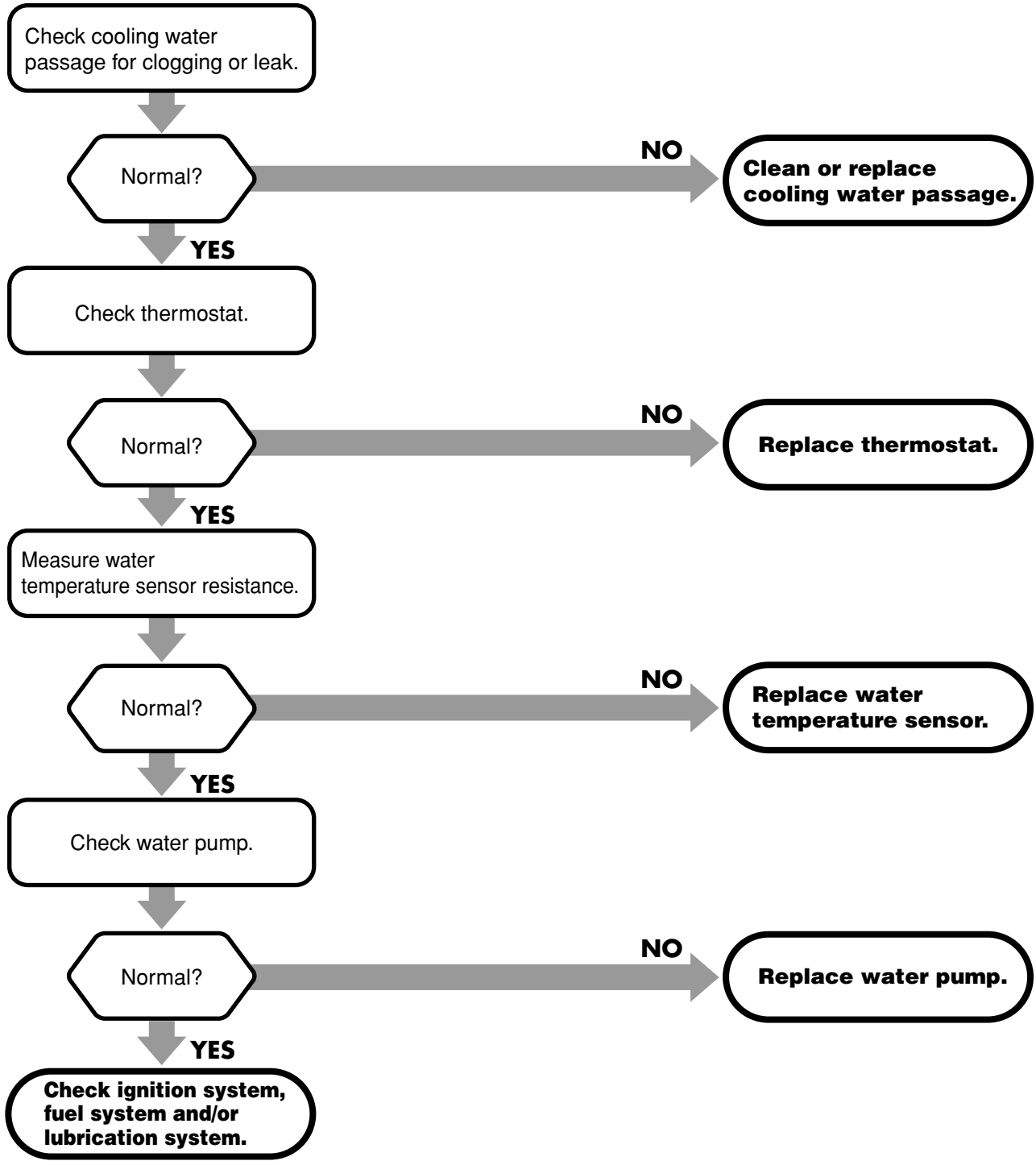

Check fuel filter for clogging and dirt, and hoses for leak.
Normal?
NO
Repair or replace defective parts.
YES
Measure fuel pressure.
Out of specified range?
NO
Check fuel injector clogging and resistance.
Normal?
NO
Replace fuel injector.
YES
Check ignition system, lubrication system and/or cooling system.
YES
Check air rail for leak and damage.
Normal?
NO
Replace air rail.
YES
Check fuel feed pump (FFP).
Normal?
NO
Replace fuel feed pump (FFP).
YES
Go to next page.



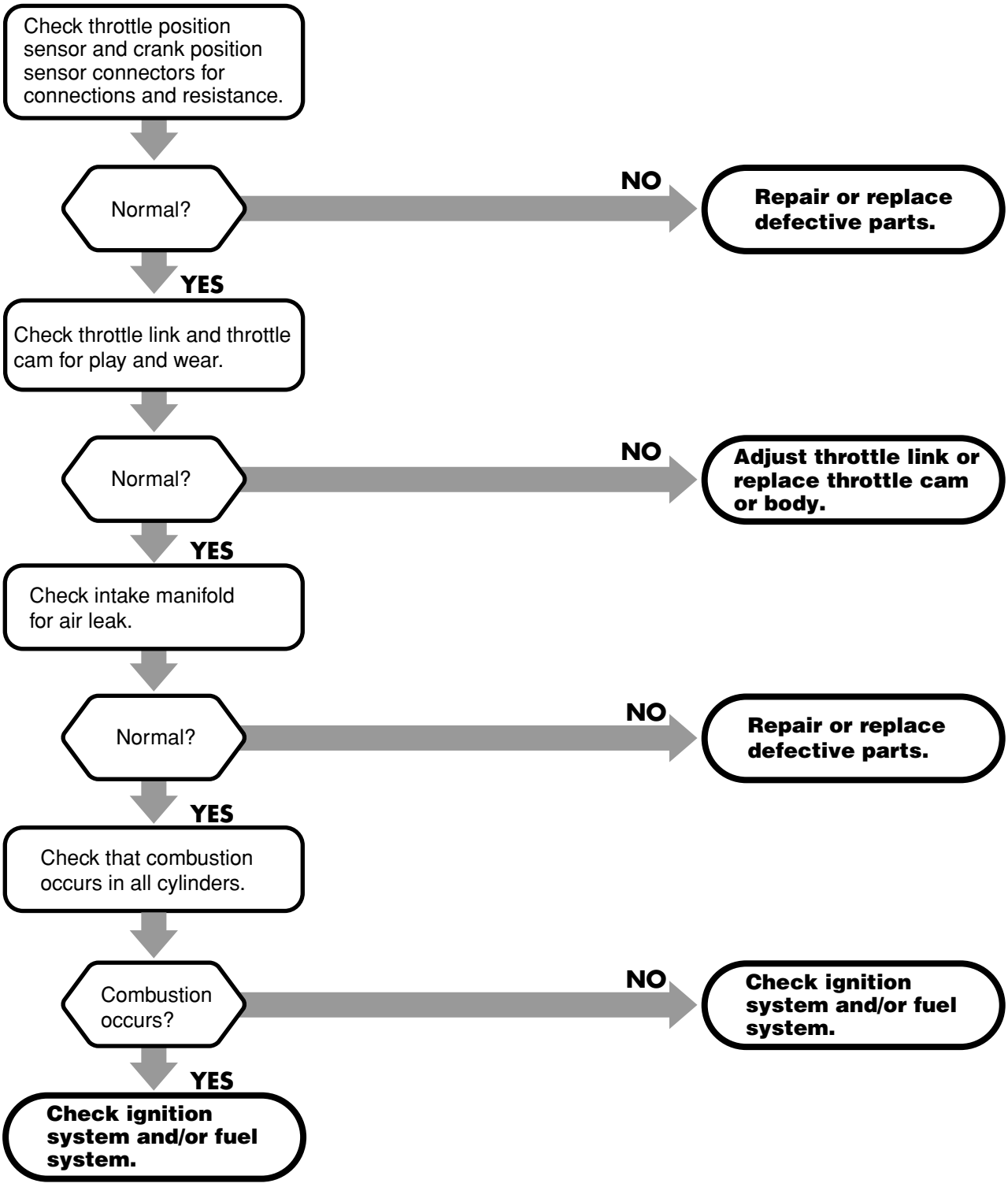
Lubrication system



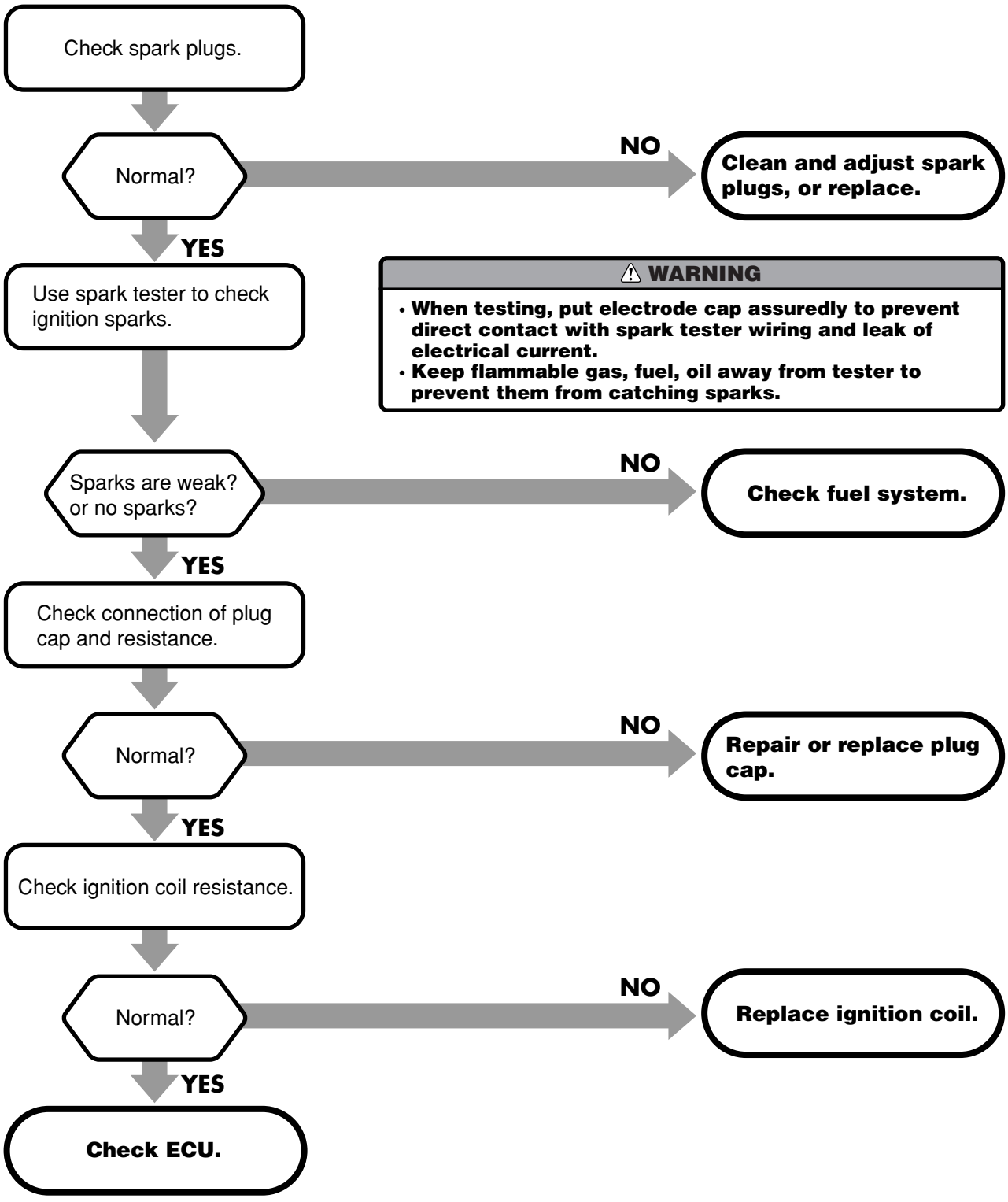
Cooling System

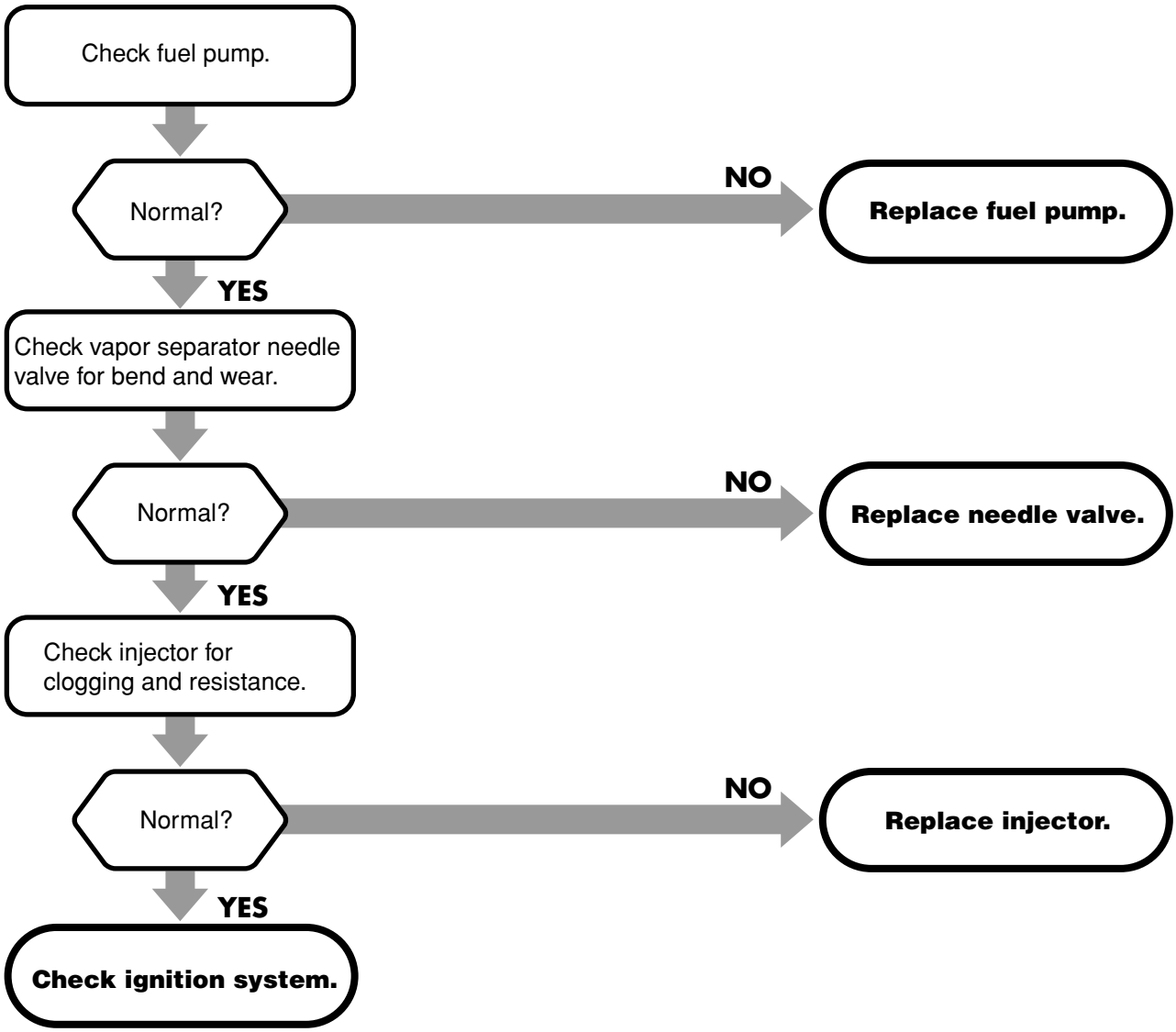


State 3 **Engine rotation is unstable or surging occurs in low speed range.**



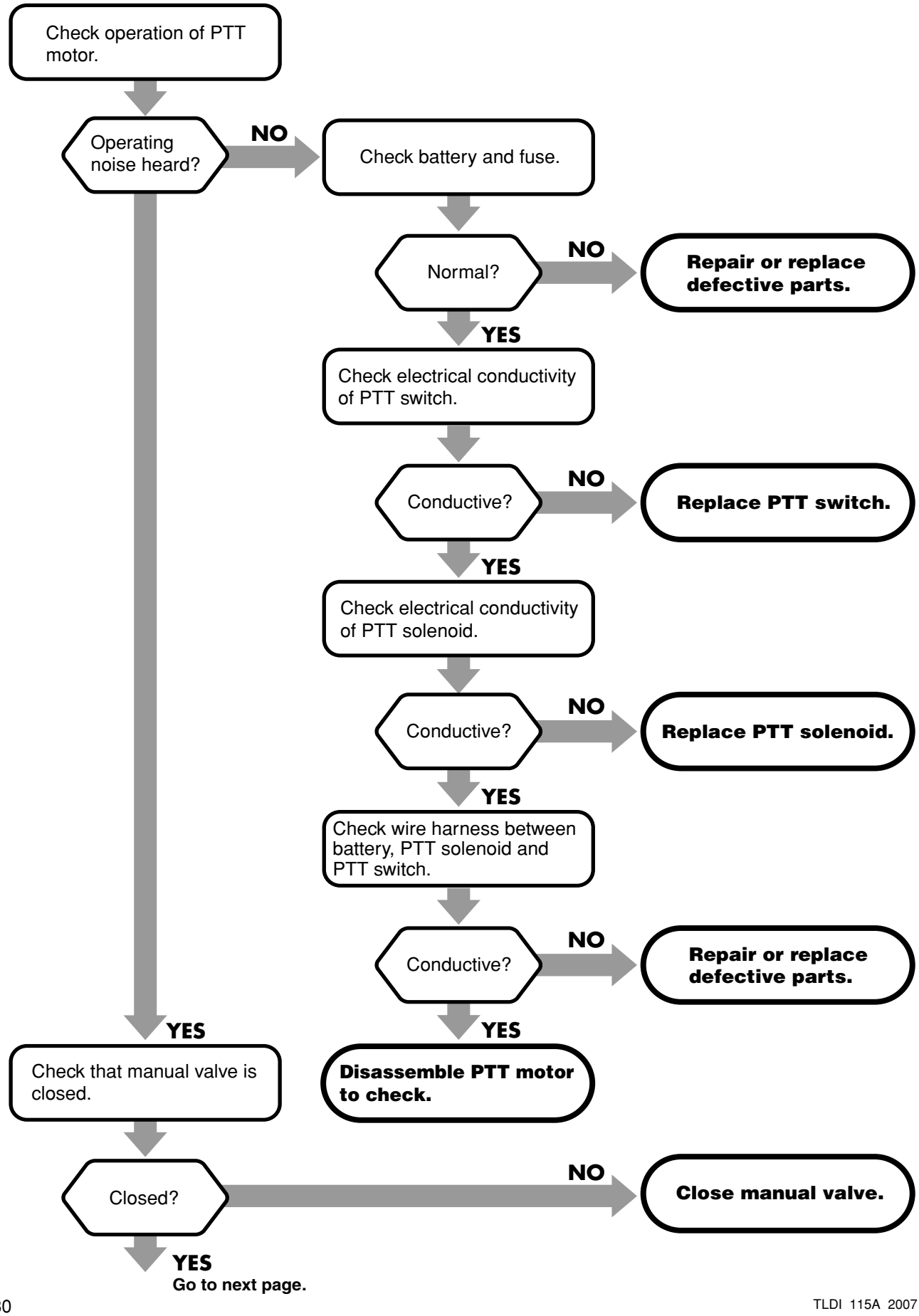
Ignition System

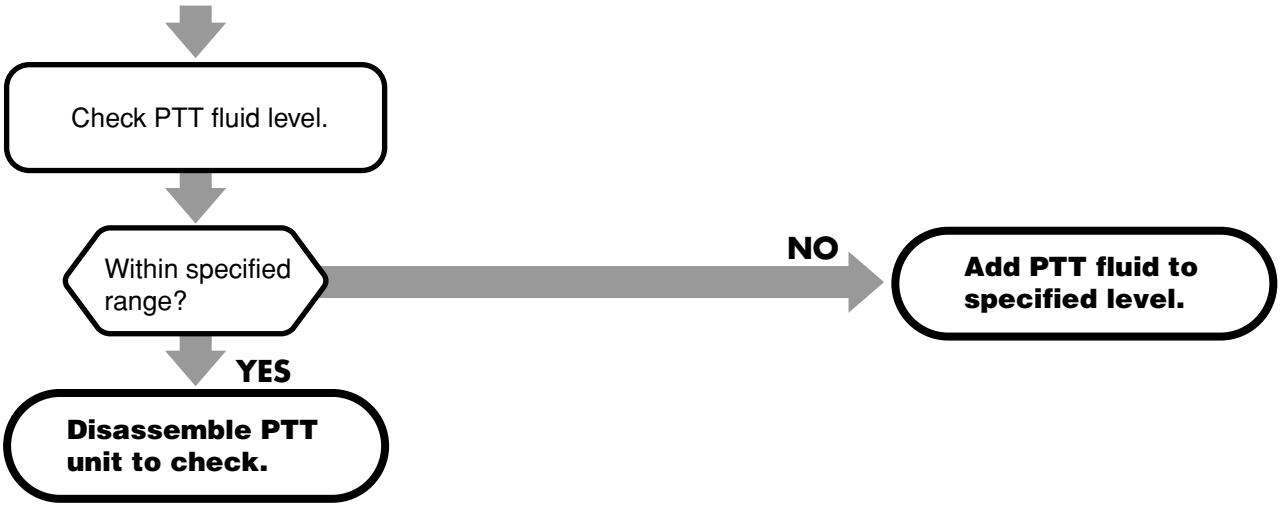



Check fuel pump.
Normal?
NO
Replace fuel pump.
YES
Check vapor separator needle valve for bend and wear.
Normal?
NO
Replace needle valve.
YES
Check injector for clogging and resistance.
Normal?
NO
Replace injector.
YES
Check ignition system.

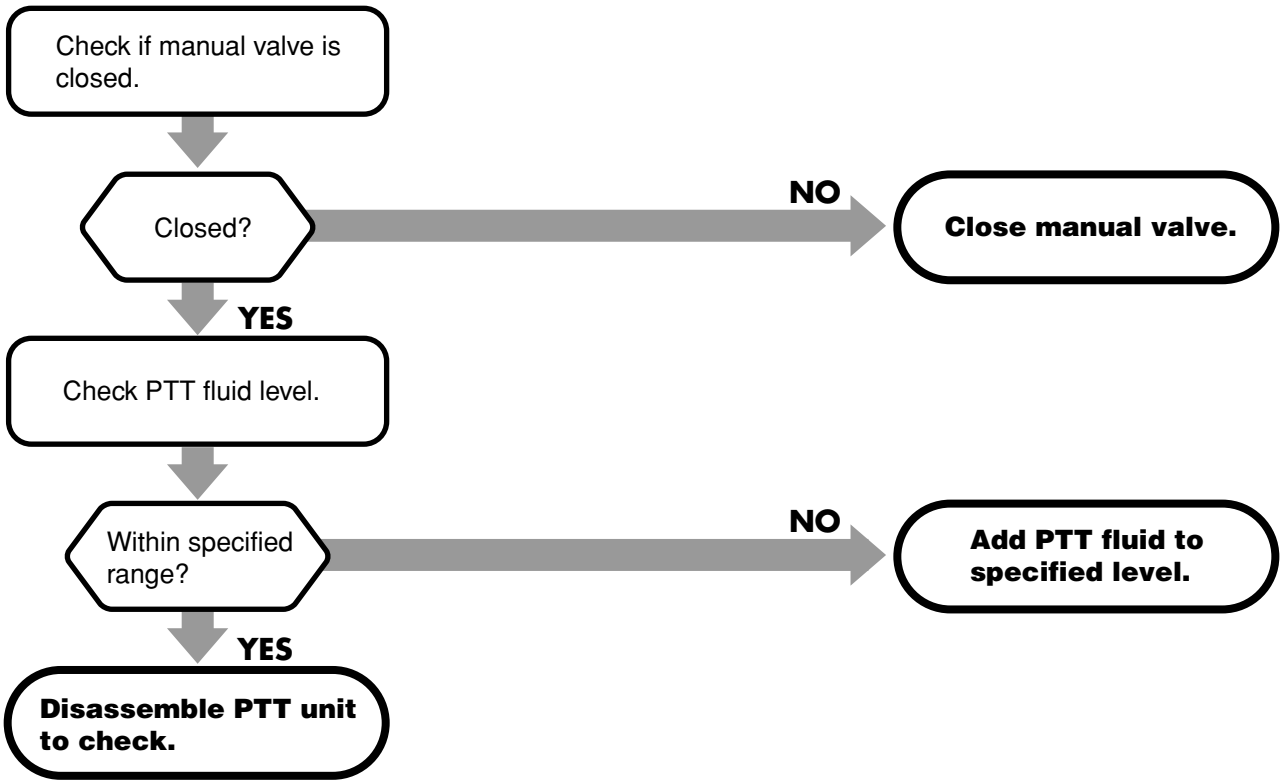
PTT Unit

State 1 **PTT unit will not operate.**





State 2 **PTT is not capable of sustaining outboard motor.**

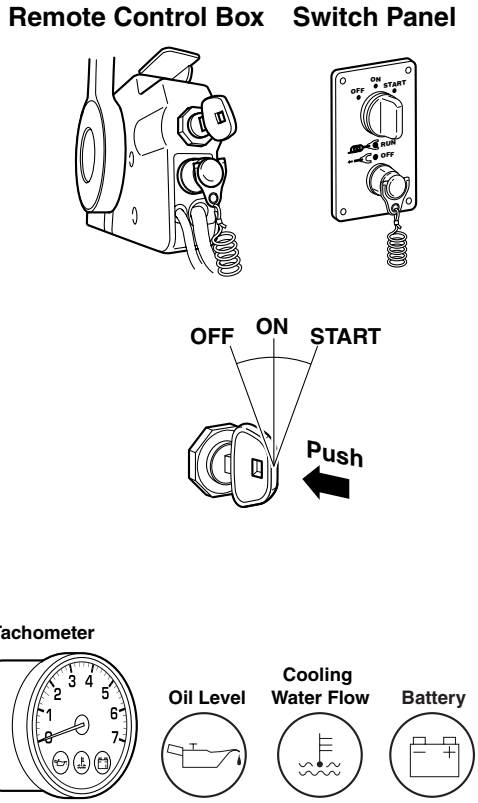


2. Self-Diagnosis Function of TLDI

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".

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.

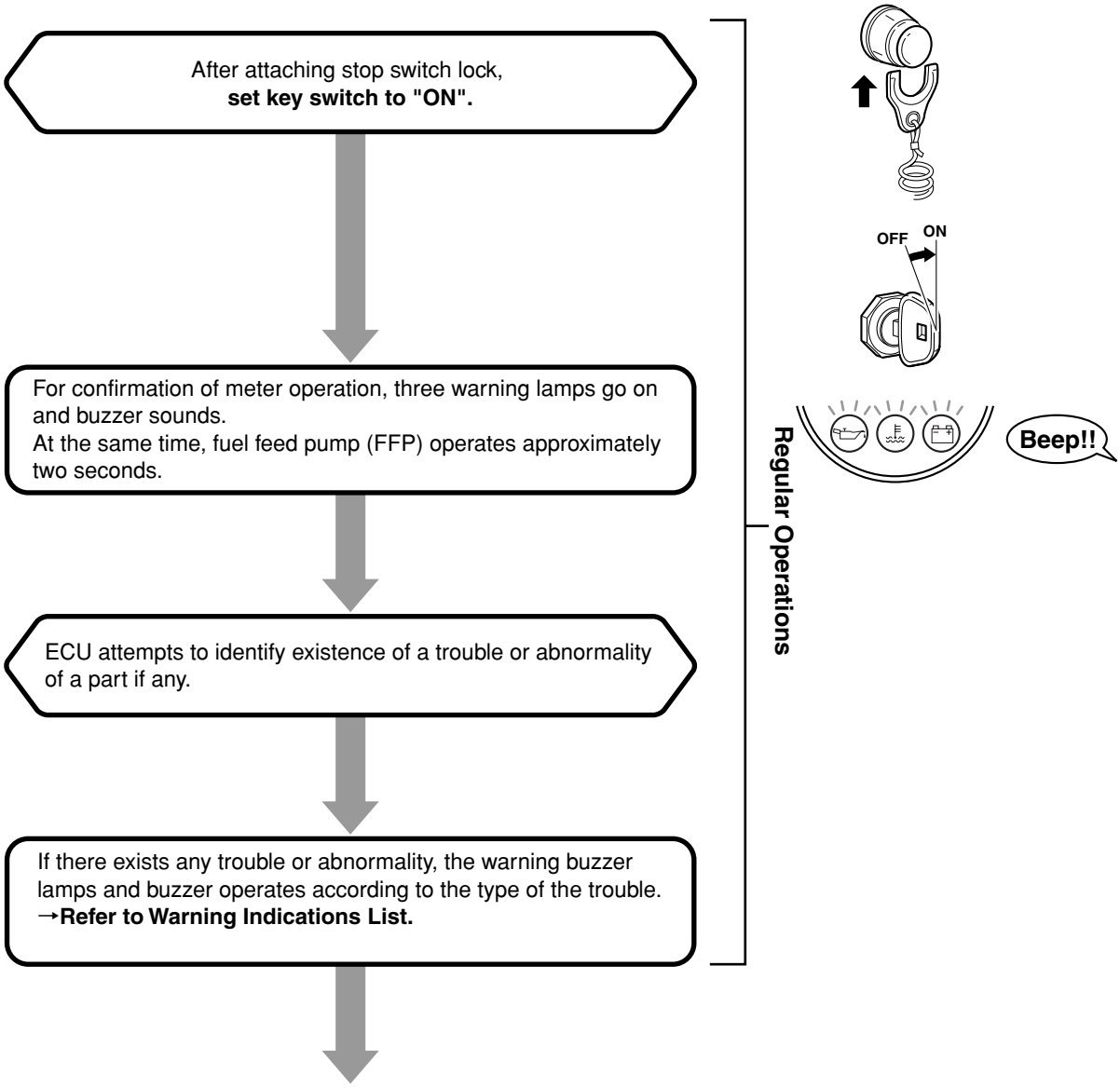
Beep···Two seconds
Beep···0.3 second
Beep, Beep, Beep···Three times in every two minutes
Continuous sounding

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.

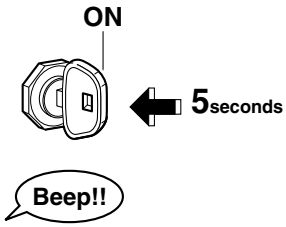
2) Operation Procedure of Self-Diagnosis Function

* 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".



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.

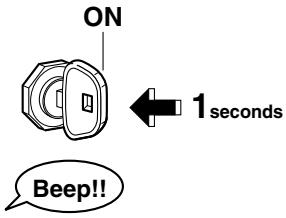


Self-Diagnisos Mode 1[Tachometer Operation Test]
After the pointer returns to "zero", the process goes to mode 2 automatically.



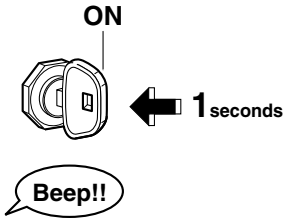
Self-Diagnisos Mode 2[Indication of engine operation hours]
A combination of tachometer indication and three warning lamps represents engine operation hours.
→Refer to Operating Hours Indication List.

Set the key to "ON", and push it in (for approximately 1 seconds) until the buzzer sounds to proceed to mode 3.



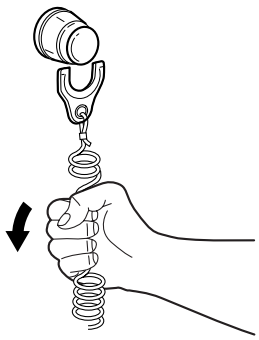
Self-Diagnisos Mode 3[Indication of fault location(s) and fault history]
After the buzzer "Beeps" once, a combination of tachometer indication and three warning lamps represents the first fault location and fault history.
→Take action(s) by referring to the fault indication list.

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.)



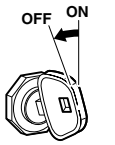
Self-Diagnisos Mode 4 [Deletion of fault history]
In any of the states in the self-diagnosis mode 3, the fault history is deleted by removing stop switch lock plate and pushing in key for approximately 3 seconds. At this moment, the buzzer "Beeps" three times.

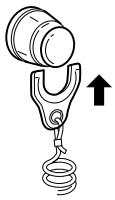
Note: The operating hours is not deleted.





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".

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	-
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	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.
Battery voltage abnormally high	Approx. 20V or over	
TPS(*2) Idling position faulty		
TPS malfunction	TPS1 and TPS2	
TPS malfunction	TPS1 or TPS2	*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
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		

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.

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	Off Does not go on even when the wiring is broken or a component malfunctions. →Refer to *1.	Refer to *2.
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		
4,000	Off	#4 Air injector malfunction		
4,000	On	#4 Fuel injector malfunction		
4,000	Flashing	#4 Ignition coil malfunction		
500	Off	Oil level low	Lighting of the lamp means that oil level is low.	Lighting means that oil level was once low.
500	On	Battery voltage low	Lighting means that battery voltage is low.	Lighting of the lamp means that battery voltage was once low.
500	Flashing	Battery voltage abnormally low		
4,500	Flashing	Oil pump malfunction	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.
5,000	Off	CPS (*3) malfunction		
5,000	On	#1TPS (*4) Idle position incorrect	Lighting of the lamp means that TPS initial setting is incorrect.	Lighting of the lamp means that TPS initial setting was once incorrect.
5,000	Flashing	#2TPS Idle position incorrect		
5,500	Off	#1TPS malfunction	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.
5,500	On	#1TPS Power voltage high		
5,500	Flashing	#1TPS Power voltage low		
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 of 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.

Malfunction / Failure Indication		Description of Problem	Fault Log	
			Fault	Fault Log (Yes)
 Tachometer Indication (r/min)	 Indicator A		 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.

6) Resetting TPS Initial Values

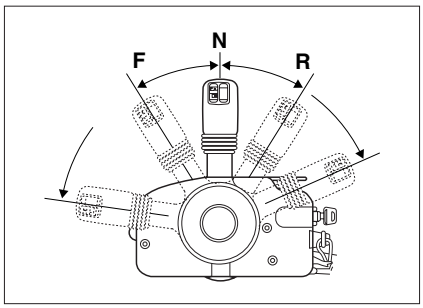
Use the following proseedures to reset the ECU and TPS idling position in case where setf-diagnosing indicates idling position errors for TPS1 and TPS2.

① When either the TPS or ECU is replaced or control cabels 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.

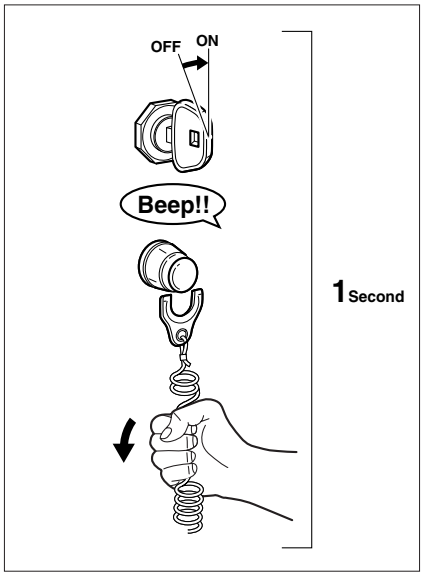
Rset Procedure

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.

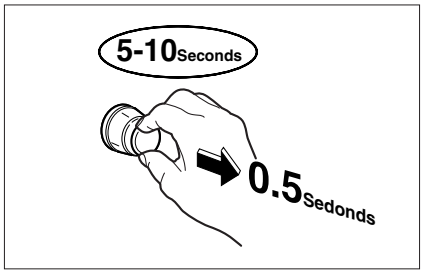


2. Perform the following procedures with the throttle in the fully closed position. (Refer to the figure below.)

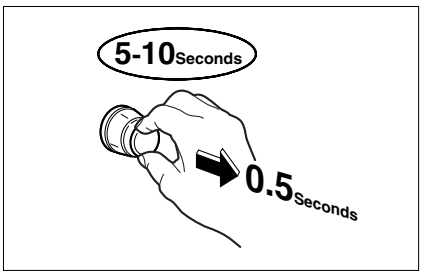
① set the key switch to the On position. Disconnect the stop lock switch with in one second after the beep stops sounding.



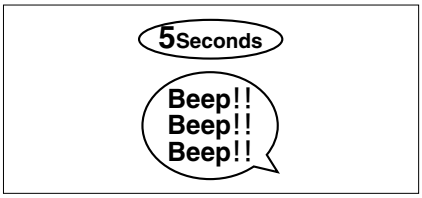
② Wait about 5 to 10 seconds, Pull the red knob on the stop switch and immediately release the switch.



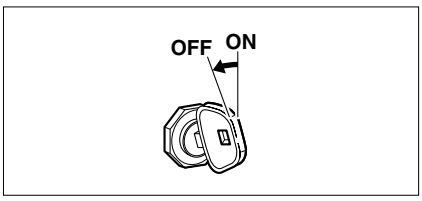
③ Wait another 5 to 10 seconds, again pull the red knob on the stop switch for about 0.5 seconds, then release the switch.



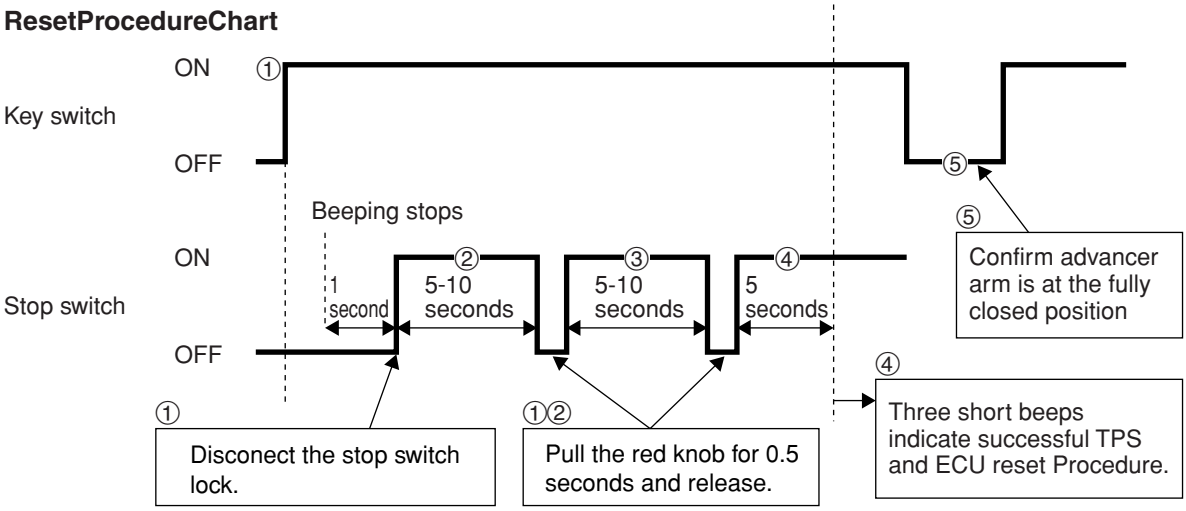
④ Resetting of TPS and ECU is completed when the buzzer "Beeps" three times approximately 5 seconds after the knob of stop switch is returned to original position.



⑤ Next, set the key switch to the Off position, comfirm that the throttle (advancer arm) is at the fully closed position, then turn the key switch to the On position.



ResetProcedureChart



9

10

Rigging



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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 : ⓐ

Single Machine Installation (Remove Control Models)

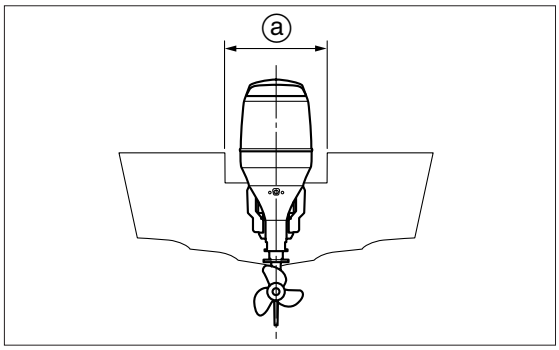
848 mm (33.39 in.)

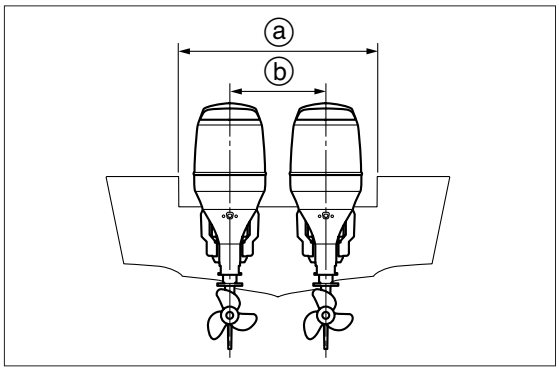
Twin Machine Installation 1,518mm (59.76 in.)

Minimum center-to-center distance for twin installation : ⓑ

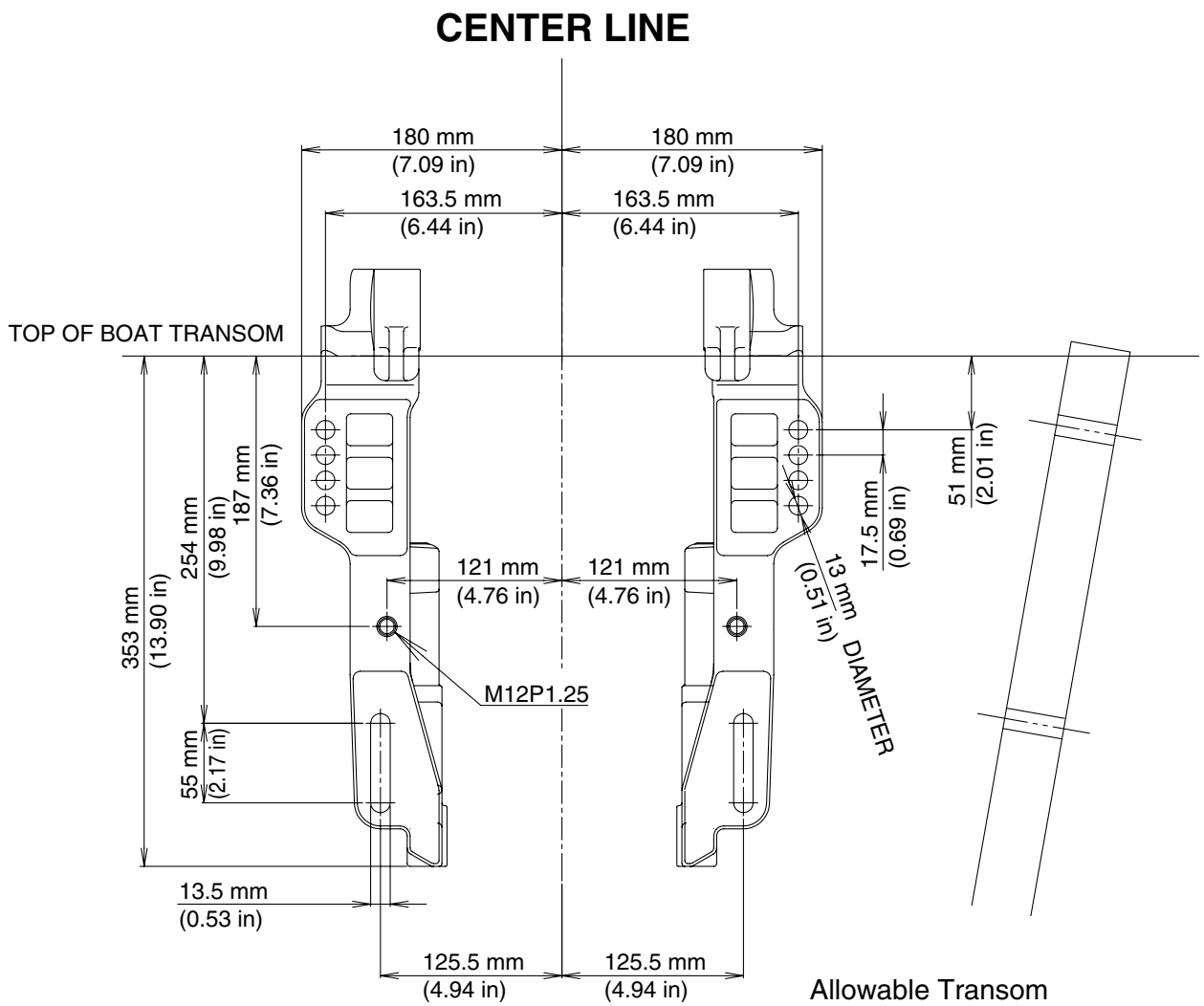
700 - 890 mm (27.55 - 35.04 in.)

Installation of an outboard motor(s) at higher position(s) can cause engine overheating and/or damages to gear case components.





3) Clamp Dimensions

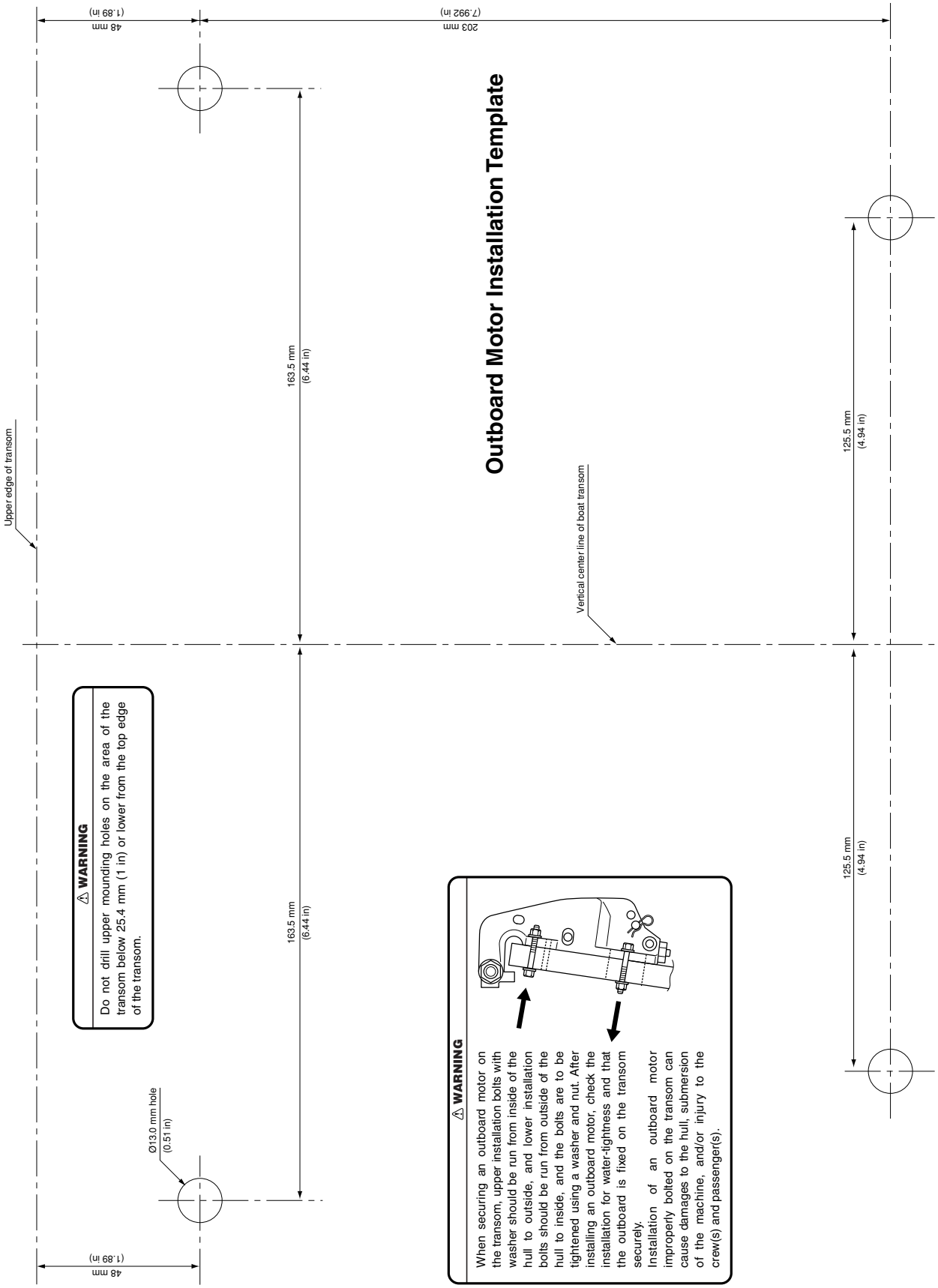


Allowable Transom Thickness
31 - 70mm (1.22 - 2.76 in)

10

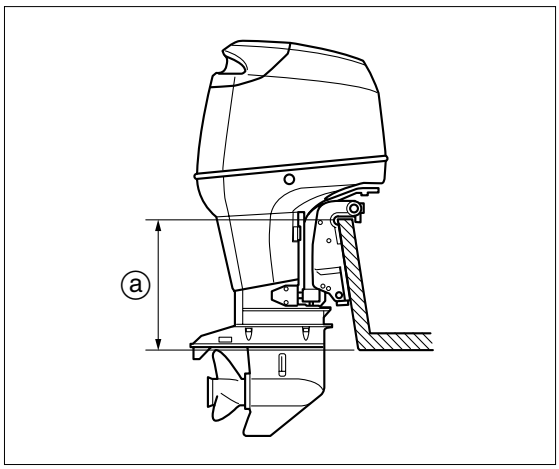
Transom Dimensions and Drilling Template (An example)

* Full scale transom dimensions and drilling template is shown at the end of this manual.



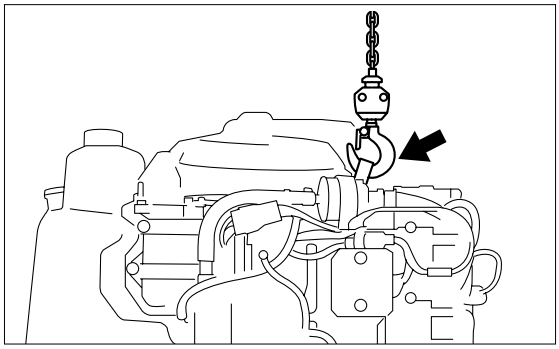
Installation of an outboard motor at higher position can cause the matters described below.
1) Lower steering torque
2) Higher top speed
3) More stable boat attitude
4) Propeller can easily run above water surface (over-revs) during planning or when the boat is heavily loaded.

ⓐ : Outboard installation height is the distance from the boat's bottom to upper edge of outboard motor transom bracket.



4) Hanging Outboard Motor

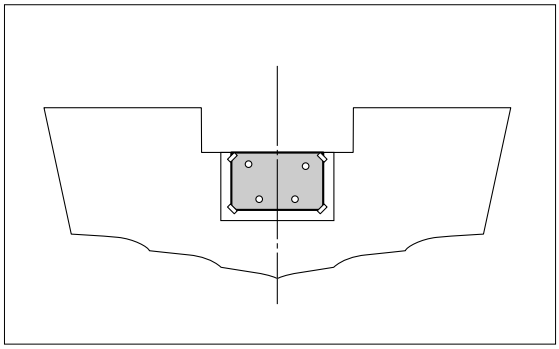
Use hanger installed on the engine.



5) Installation of Outboard Motor

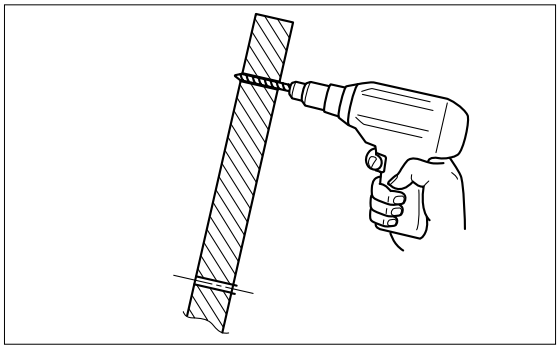
1. Put the outboard motor installation template on the transom.

Align center line of template with center line of transom accurately.



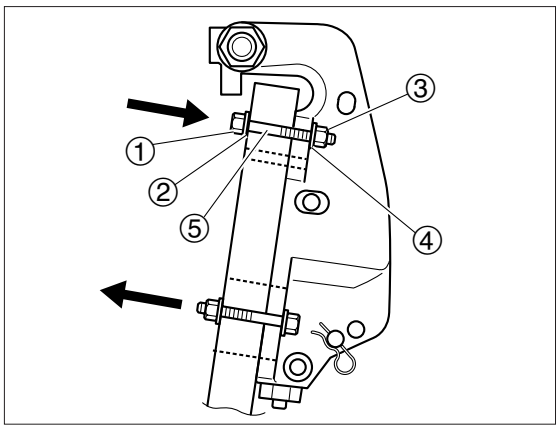
2. Mark up the transom with four 13 mm (0.53 in) mounting holes and drill.

Drill at right angle to transom surface to align the transom holes with outboard motor's transom bracket holes accurately.



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.)
   ④ : 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 Genium 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^2].

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.

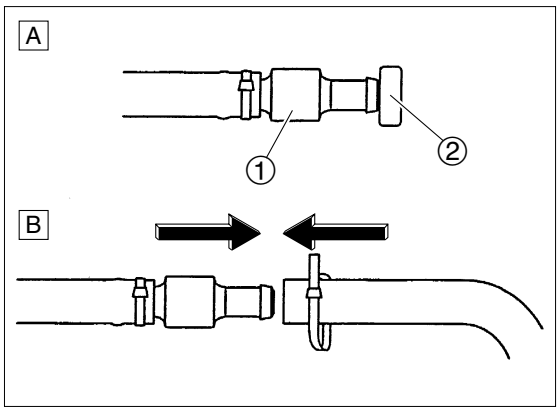
5) Connection of Fuel Hose

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.

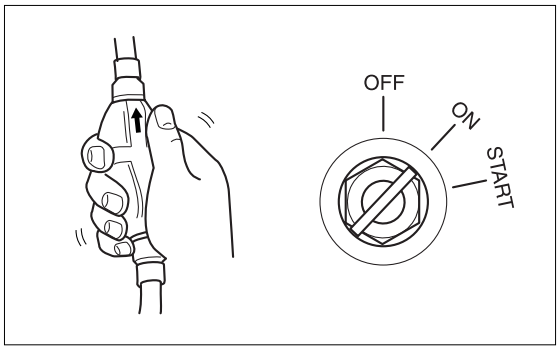
For fuel hose, use independent fuel line / fuel tank pick up for individual engines, and use fuel hose of minimum inner diameter of 8mm (0.315 in, 5/16 in).



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.

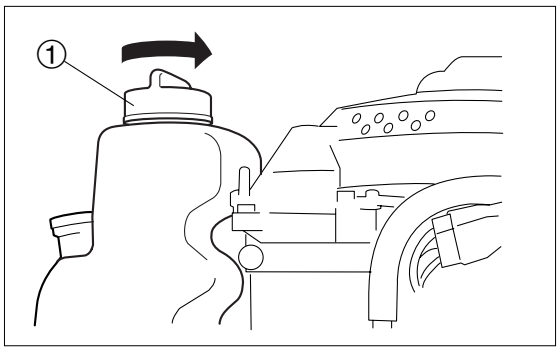
1. Squeeze priming bulb of fuel hose until it becomes stiff.
2. Set key switch to "ON" position for three seconds to operate electric fuel pump.
3. Return key switch to "OFF" position and squeeze priming bulb again until it becomes stiff. Set key switch to "ON" position for three seconds again. Repeat these steps until primary bulb of fuel hose becomes stiff.

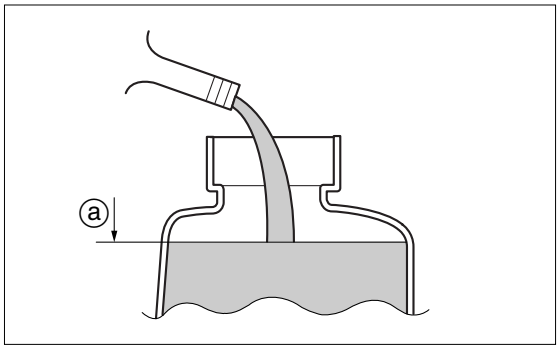


7) Filling Oil Tank

Note: Oil tank capacity is 6.7L (1.77gal).

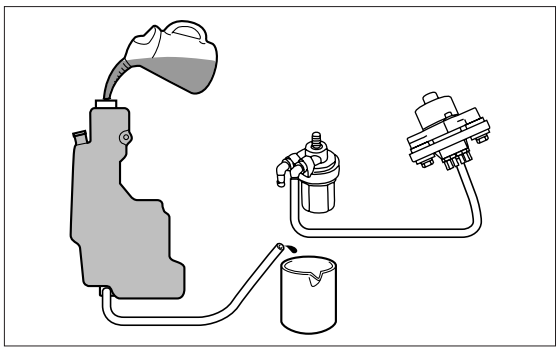
1. Remove top cowl, and then turn oil tank cap ① counter clockwise to remove.
2. Pour specified quantity of engine oil into oil tank. Do not overfill. Oil level should be below filler neck ⓐ.
3. Put oil tank cap on the tank and tighten. Reinstall top cowl.
   ⓐ : Oil Upper Level 6.7L (1.77gal)





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

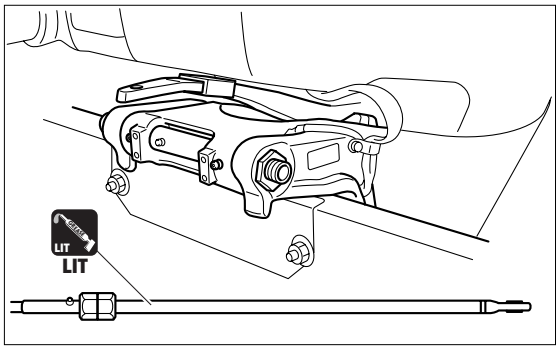
To prevent damaging to fuel pump, fill engine's fuel system with fuel. If not, the fuel pump operates without fuel during priming of oil pump.

4. Connections to Outboard Motor

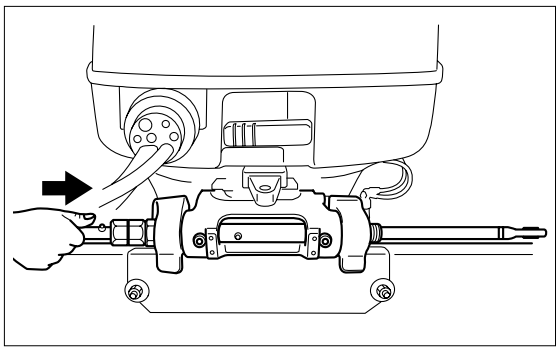
1) Steering Cable

Cable arranged on the starboard side

1. Apply thin coat of grease to entire area of cable end.



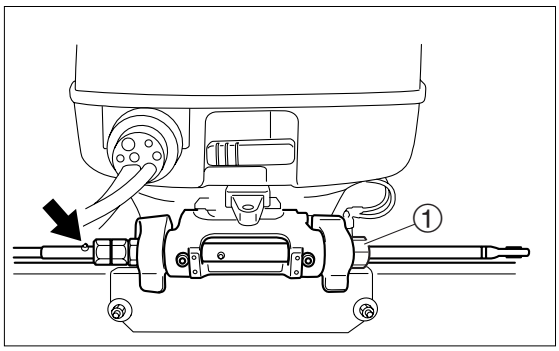
2. Run steering cable into tilt tube.



3. Tighten nut to specified torque.

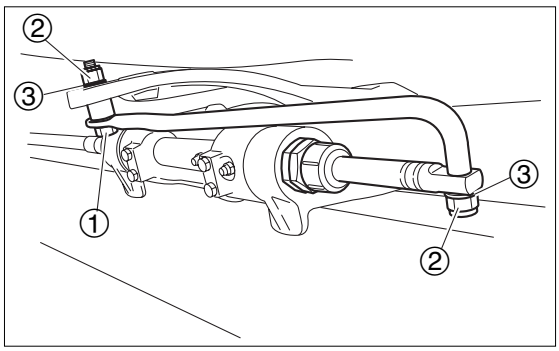
Nut :
48 N · m (35 lb · ft) [4.8 kgf · m]

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.

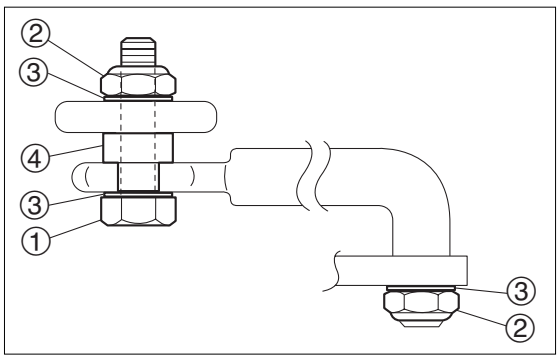
⚠ WARNING

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

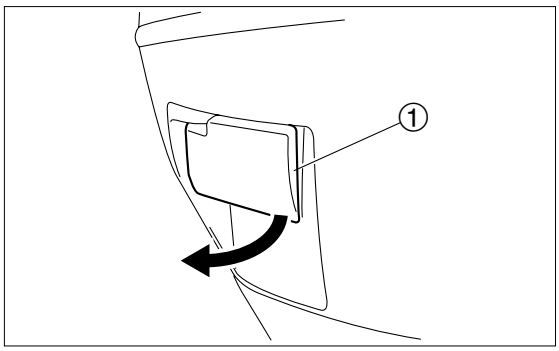
Drag Link Spacer ④ P/N. 3E0-84914-0

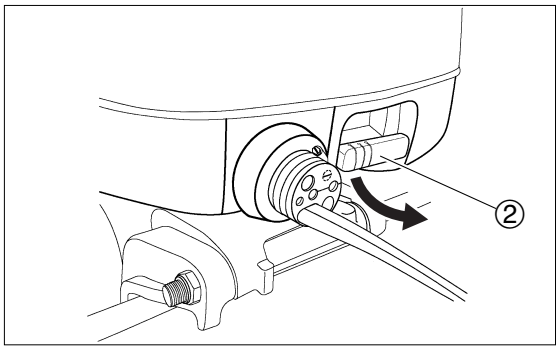


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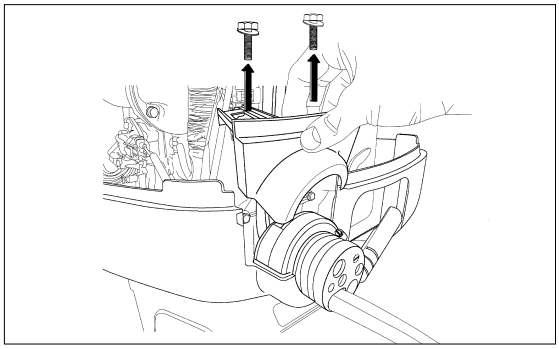
3) Installation of Remote Control Cable (Engine Side)

1. Turn upper motor cover hook levers ① and ② and remove upper motor cover.

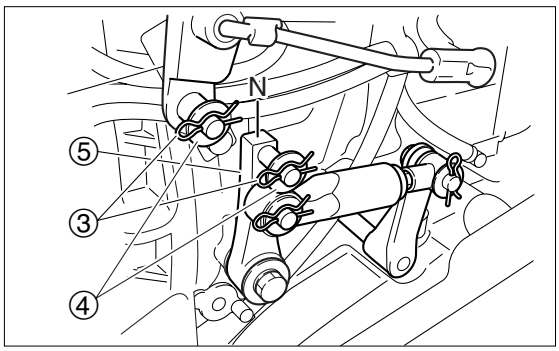




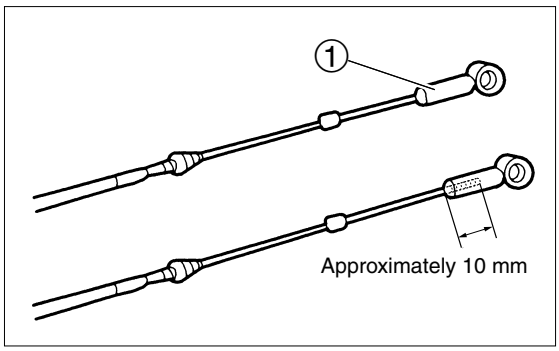
2. Remove cord clamp installation bolts and remove cord clamp and grommet.



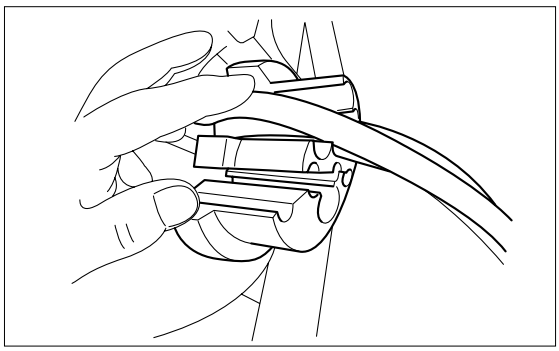
3. Remove "R" shaped pin ③ and washer ④ of throttle side and shift side, and set shift arm ⑤ to F, N, R positions and then to N.



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.

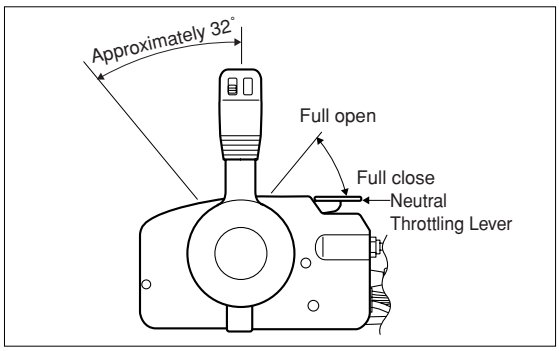


The screw-in distance of cable joint, 10 mm, is equivalent to approximately 9 threads.

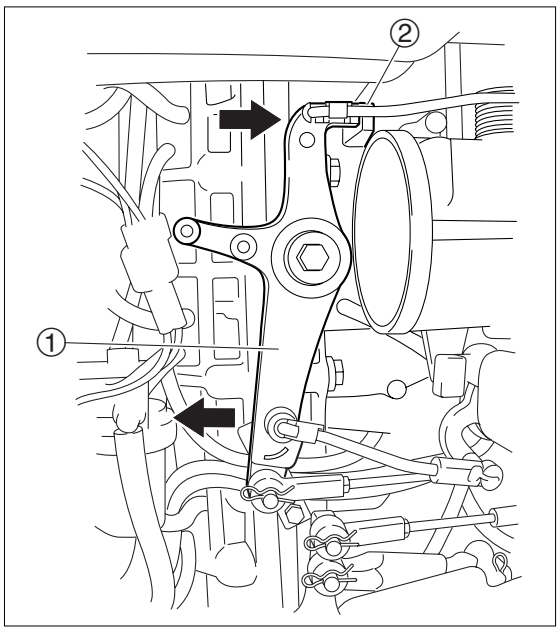


5. Shift cable is the one of which tip is moved when remote control lever is set to forward (F) side until it stops once (approx. 32 degrees).

6. Set remote control lever to neutral (N), and check that neutral throttling lever is at full close position.

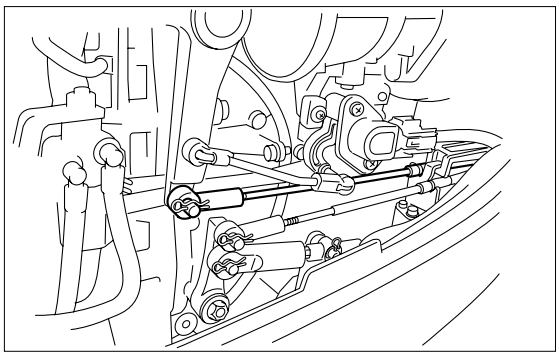


7. Set advancer arm to full close position.



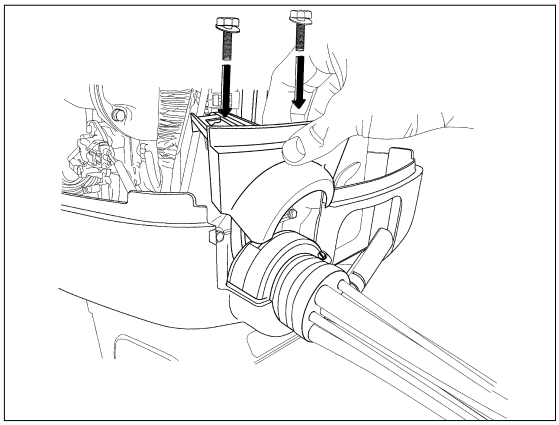
Check that advancer arm ① is surely in contact with full close side stopper ②.

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.

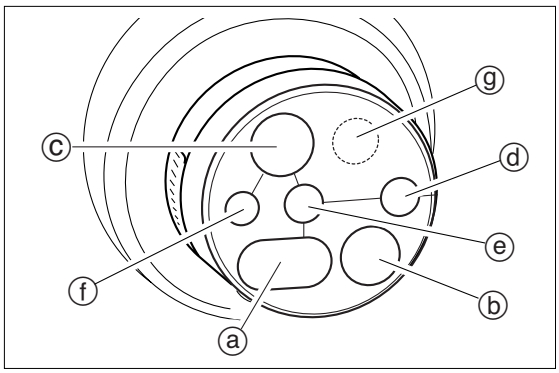


Check that shifting control lever forward (F) by approximately 32 degrees, where it is stopped once, makes the gear engage, and fully shifting the lever makes throttle valve fully open, and then, check that shifting the lever reverse (R) by approximately 32 degrees, where it is stopped once, makes the 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.



ⓐ Battery Cables
ⓑ Fuel Hose
ⓒ Cord Ass'y (B) (Remote Control Harness)
ⓓ Throttle Cable
ⓔ Shift Cable
ⓕ Meter Cord Ass'y
ⓖ 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.**

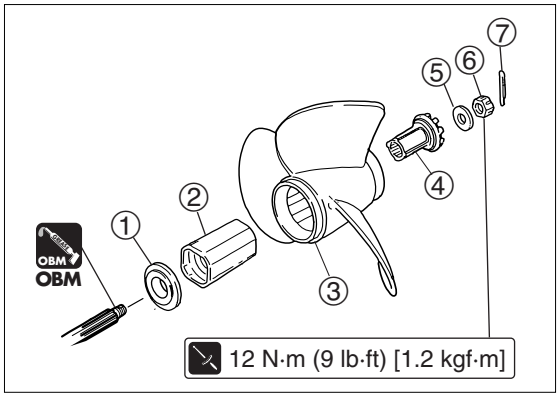
1. Set shift lever to neutral (N) position.
2. Remove spark plug caps from spark plugs.
3. Apply grease to propeller shaft.
4. Put propeller parts on the propeller shaft in the order as shown.
5. Put a piece of wood in between gear case and propeller, and thighten nut to specified torque.

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.

10

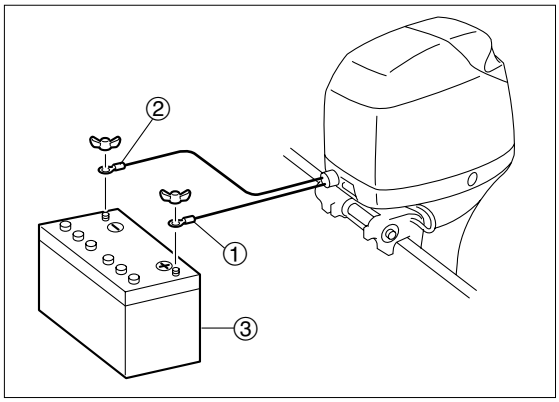
6. Electric System

1) Battery Capacity

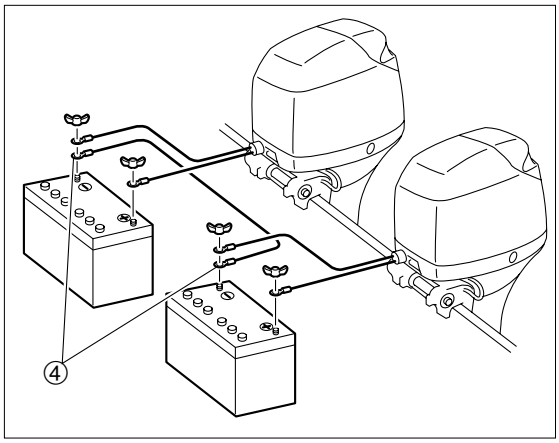
12V100 - 120AH
(800 - 1,000C.C.A)

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.

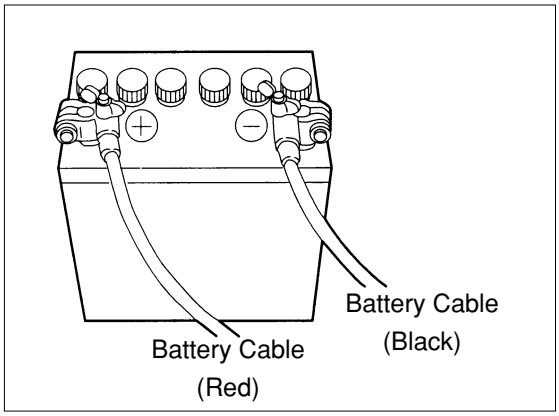


3) Installation of Battery (ies)

This outboard motor cannot be operated without using battery.
Use battery of 12V.100AH (12V.120AH for use in cold areas)

1. 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.

2. 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>

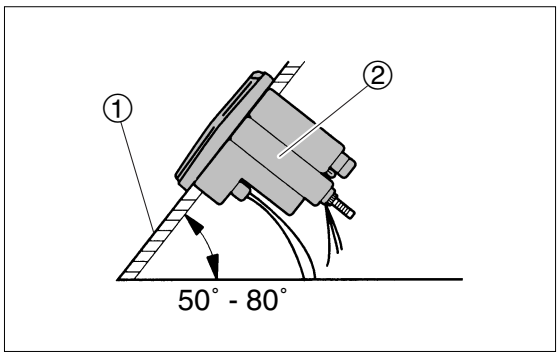
For this outboard motor, use the manufacturer's genuine parts and accessories.

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

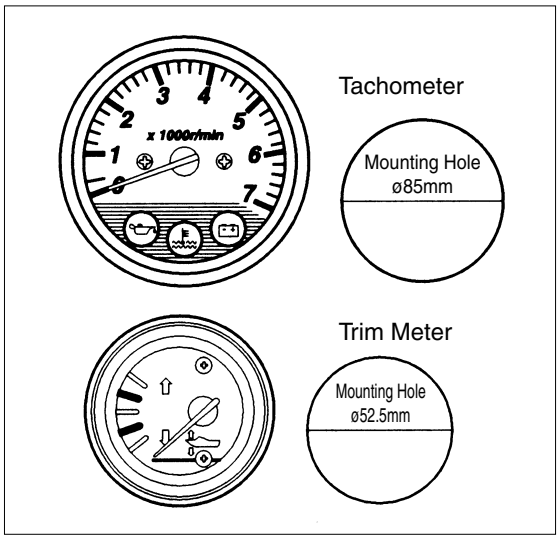
When installing meters, select a place on the dash board ① where operator can watch them easily and they are not exposed to water spray.

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>

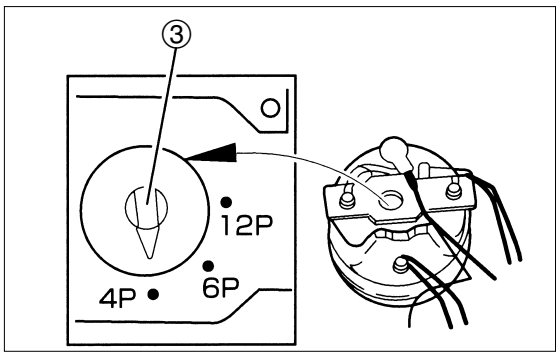
Install meters so that the angle is in between 50 to 80 degrees from horizontal plane.



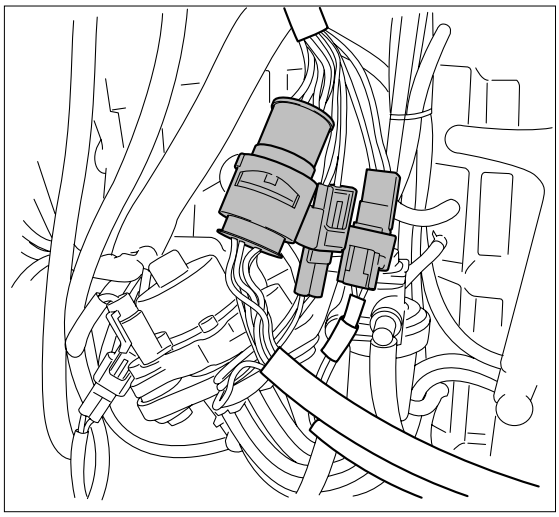
10

<Tachometer>

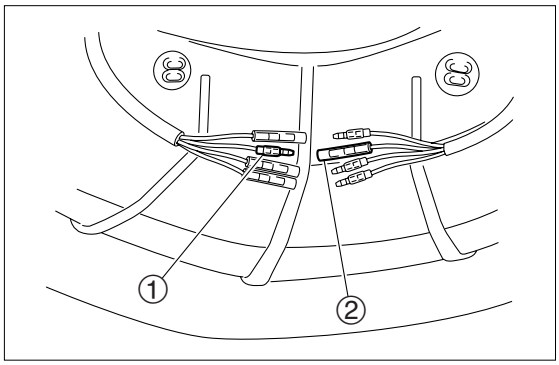
Set selector ③ to "4P" on the back of the meter.



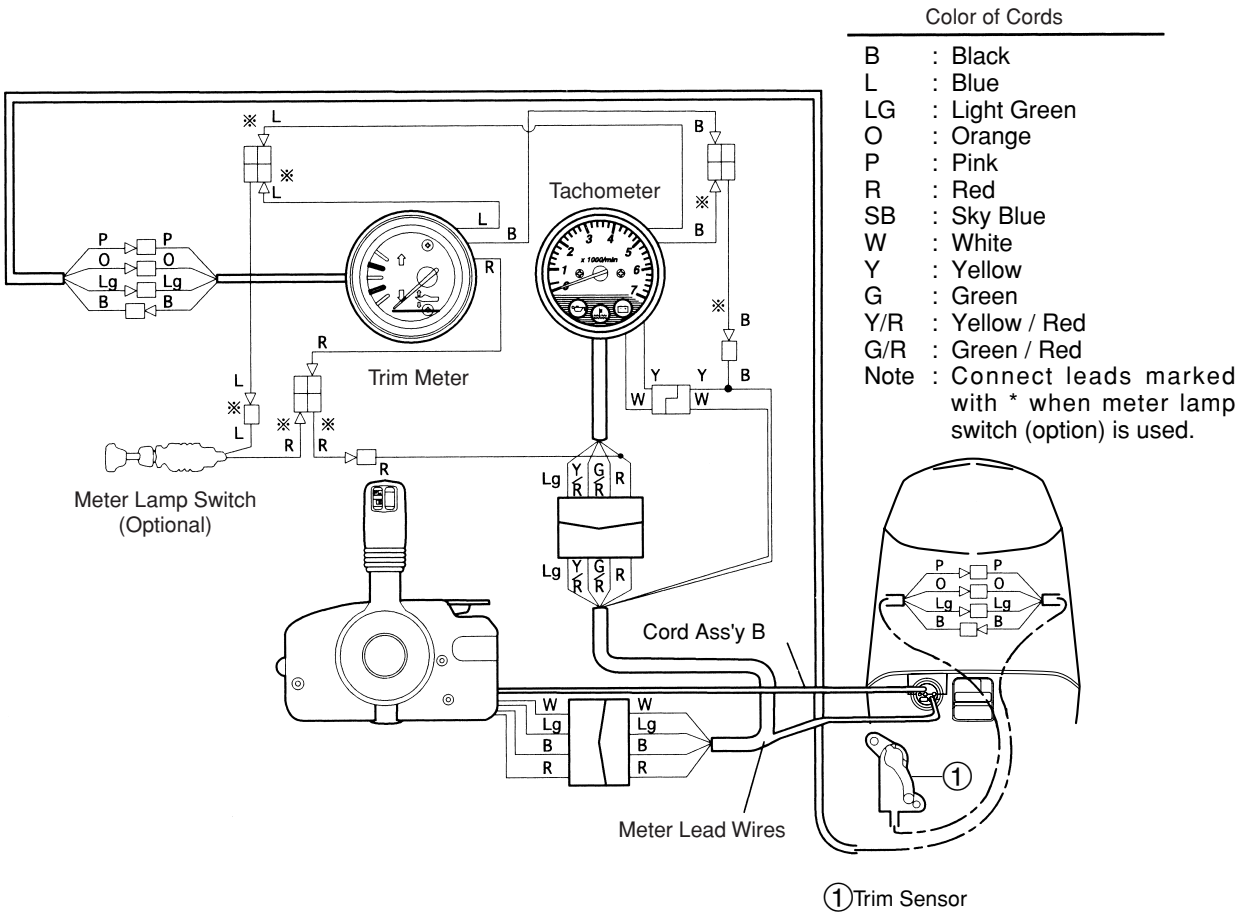
1. Connect cord ass'y B and meter lead wire to cord ass'y A.



2. Connect trim sensor ① with trim sensor extension cord ②.



3) Wiring Remote Control and Meter Leads



MEMO

MEMO

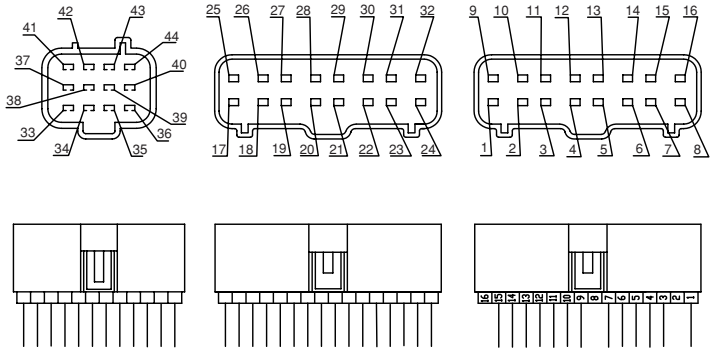
11

Wiring Diagram



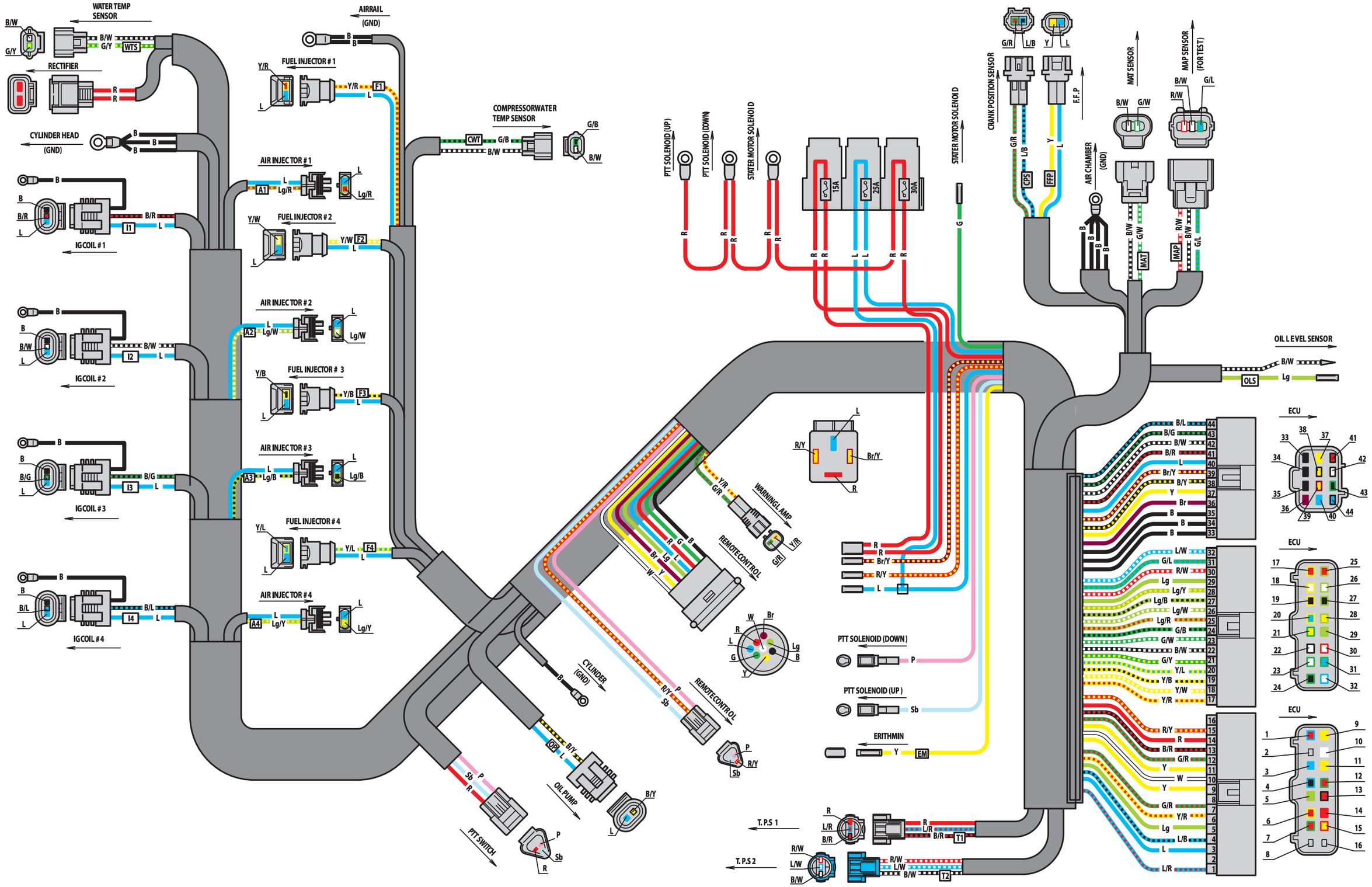
TLDI Wire Harness Terminals and Connections ····· 11-2
Main Harness Diagram ····· 11-3
115A EPTO Electrical Circuit ····· 11-5
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Outboard Motor Installation Template ··· 11-11

TLDI Wire Harness Terminals and Connections



NO	Component	Lead Wire Color	
1	TPS1	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	#4 Fuel Injector	Y/L	Yellow/Blue
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	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	#4 Air Injector	Lg/Y	Light Green/Yellow
29	Oil Level Sensor	Lg	Light Green
30	Power Source (TPS2, MAP)	R/W	Red/White
31	MAP Sensor	G/L	Green/Blue
32	TPS2	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	#4 Ignition Coil	B/L	Black/Blue

Main Harness Diagram



115A 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 Swtich
7	Water Temp. Sensor	33	Tacho Meter
8	Crank Position Sensor	34	Meter Lead Wire
9	ECU	35	Trim Sendor
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	44	Assist Cord Black
19	FFP	45	Assist Cord Blue
20	FFP Cord	46	Oil Pump Ass'y
21	Battery Cable	47	MAP Sensor
22	Starter Cord	48	Air Compressor Water Temp. Sensor
23	Earth Cord	49	MAT Sensor
24	Cord Ass'y A	50	EM Cord (Engine Monitor)
25	Ground Cord		
26	Lower Motor Cover		

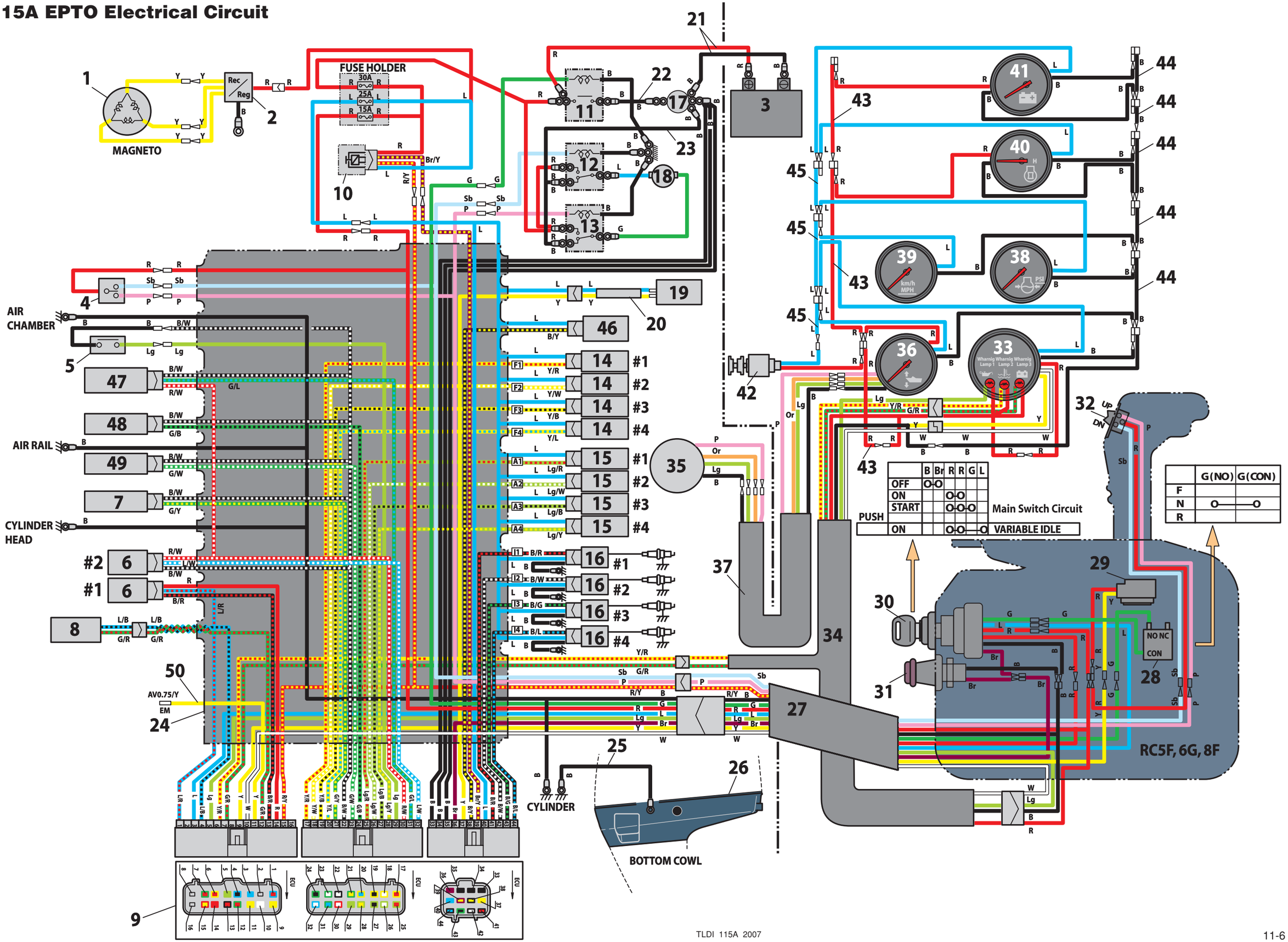
* PTT···Power Trim & Tilt

Cord Color

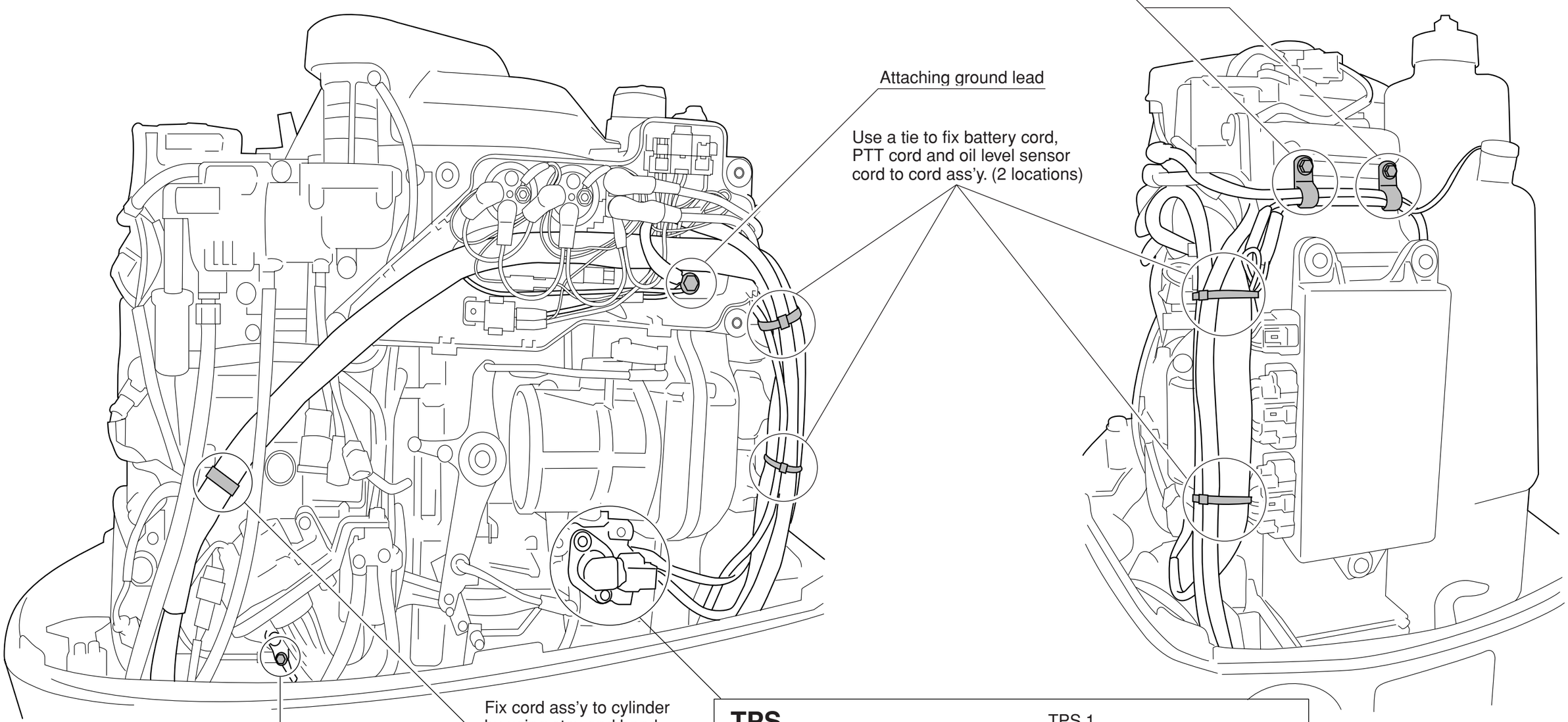
B	Black
Br	Brown
G	Green
L	Blue
Lg	Light Green
Or	Orange
P	Pink
R	Red
Sb	Sky Blue
W	White
Y	Yellow

Note: "/" means cords with striped colors.

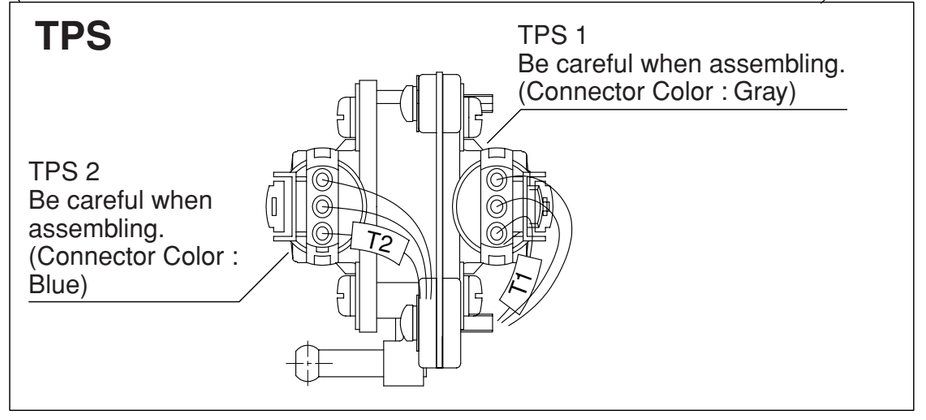
115A EPTO Electrical Circuit



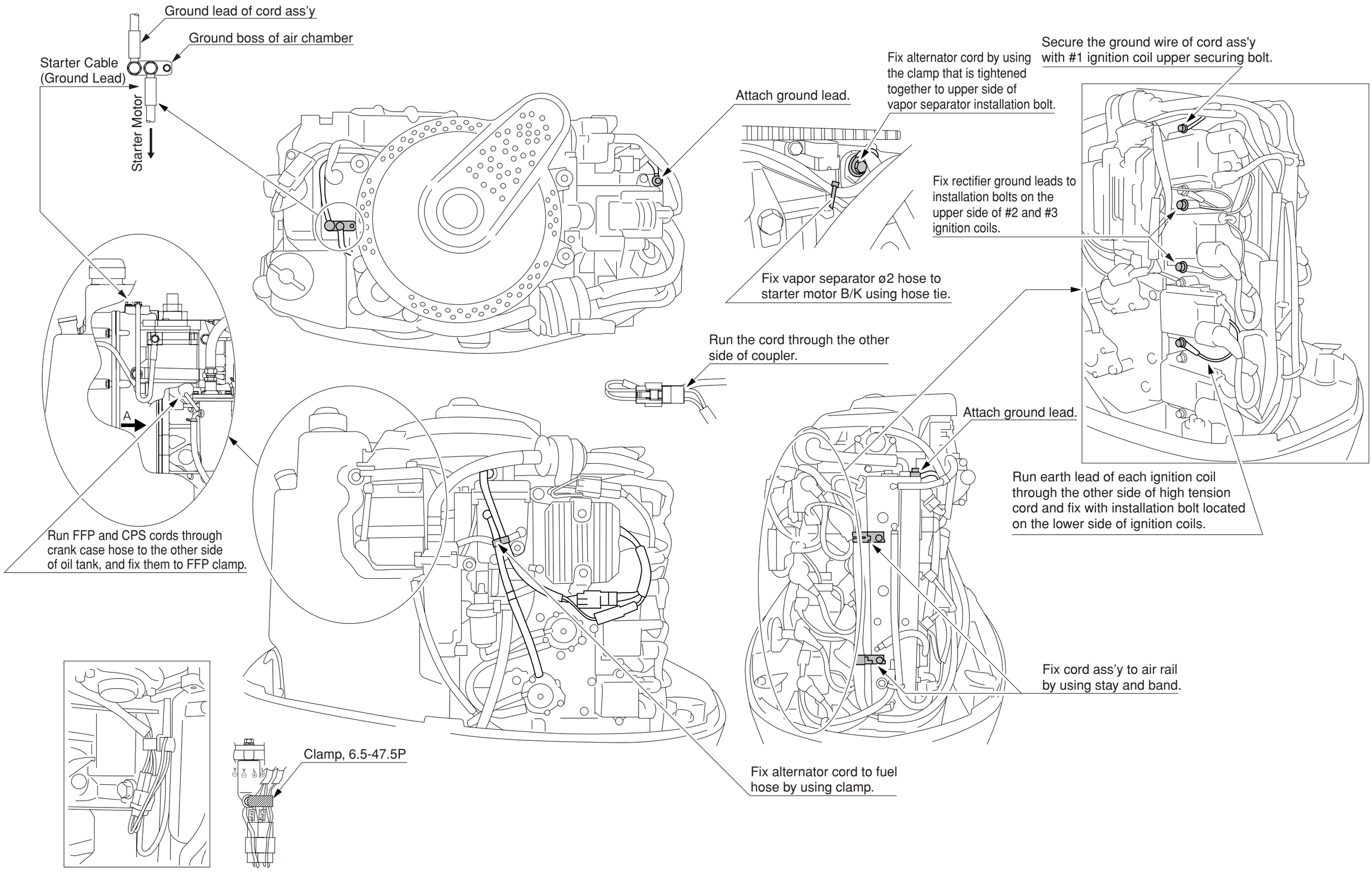
Electrical Wiring Assembling Instruction Diagram -1



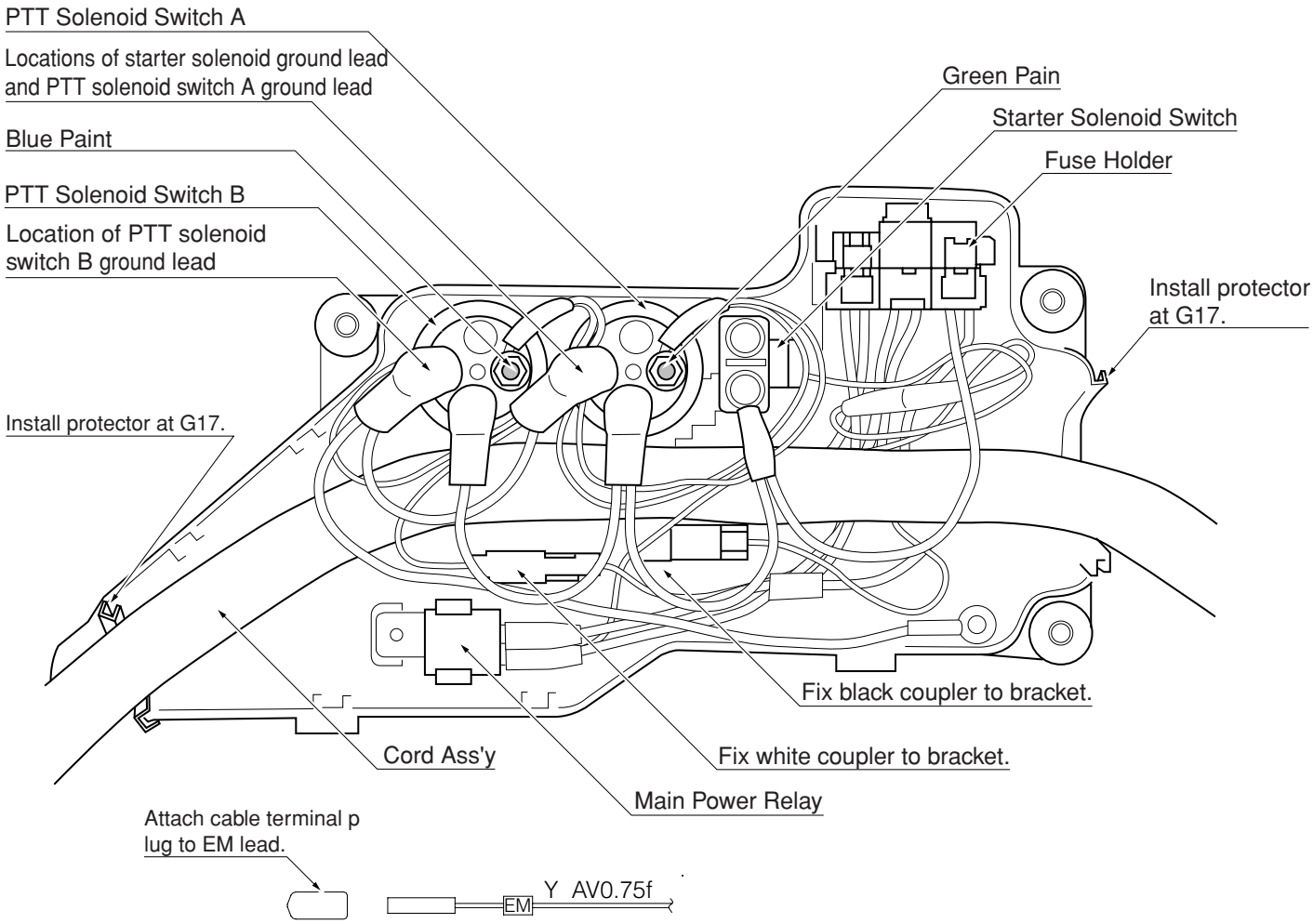
TPS



Electrical Wiring Assembling Instruction Diagram -2



Electrical Wiring Assembling Instruction Diagram -3



Outboard Motor Installation Template

Upper edge of transom

48 mm
(1.89 in)

Ø13.0 mm hole
(0.51 in)

⚠ WARNING

Do not drill upper mounding holes on the area of the transom below 25.4 mm (1 in) or lower from the top edge of the transom.

163.5 mm
(6.44 in)

163.5 mm
(6.44 in)

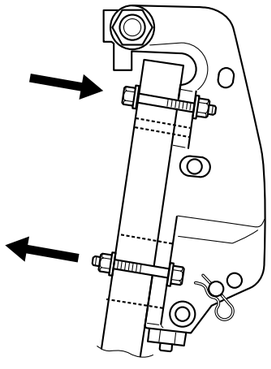
48 mm
(1.89 in)

203 mm
(7.992 in)

⚠ WARNING

When securing an outboard motor on the transom, upper installation bolts with washer should be run from inside of the hull to outside, and lower installation bolts should be run from outside of the hull to inside, and the bolts are to be tightened using a washer and nut. After installing an outboard motor, check the installation for water-tightness and that the outboard is fixed on the transom securely.

Installation of an outboard motor improperly bolted on the transom can cause damages to the hull, submersion of the machine, and/or injury to the crew(s) and passenger(s).



Vertical center line of boat transom

125.5 mm
(4.94 in)

125.5 mm
(4.94 in)

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TOHATSU
Outboards

SERVICE MANUAL

TLDI

MD 115A Models

TOHATSU CORPORATION

Address : 5-4,3-chome,Azusawa,Itabashi-ku,
TOKYO,174-0051 JAPAN

Phone : TOKYO (03)3966-3117

FAX : TOKYO (03)3966-2951

URL : www.tohatsu.co.jp

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