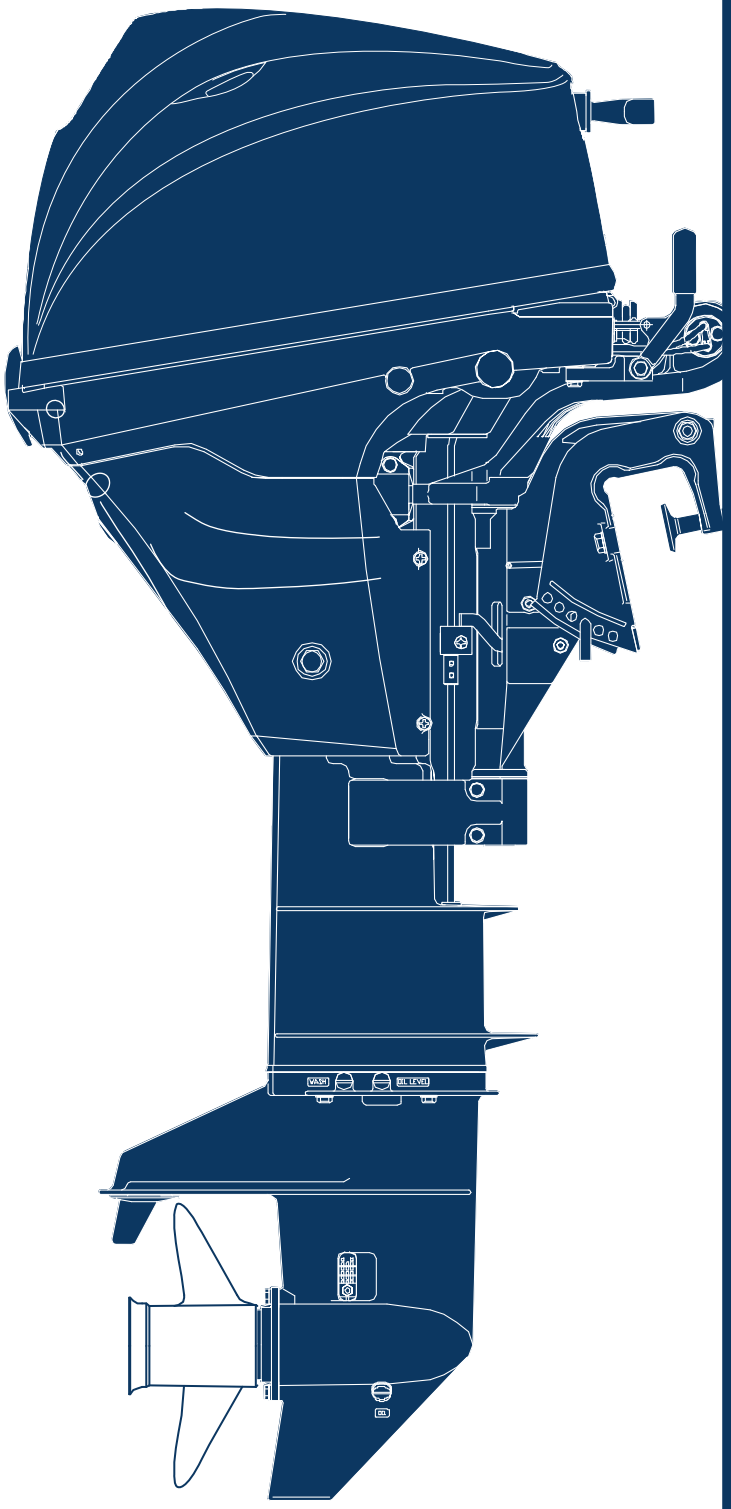
SERVICE MANUAL

TOHATSU



4 Stroke
MFS 8/9.8B Models

OB No.003-21056-2
16-04 NB

Introduction

Before reading this manual

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

Safety Information

Safety Statements

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

Attention:

About 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 repairs.

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 understand the tools needed.

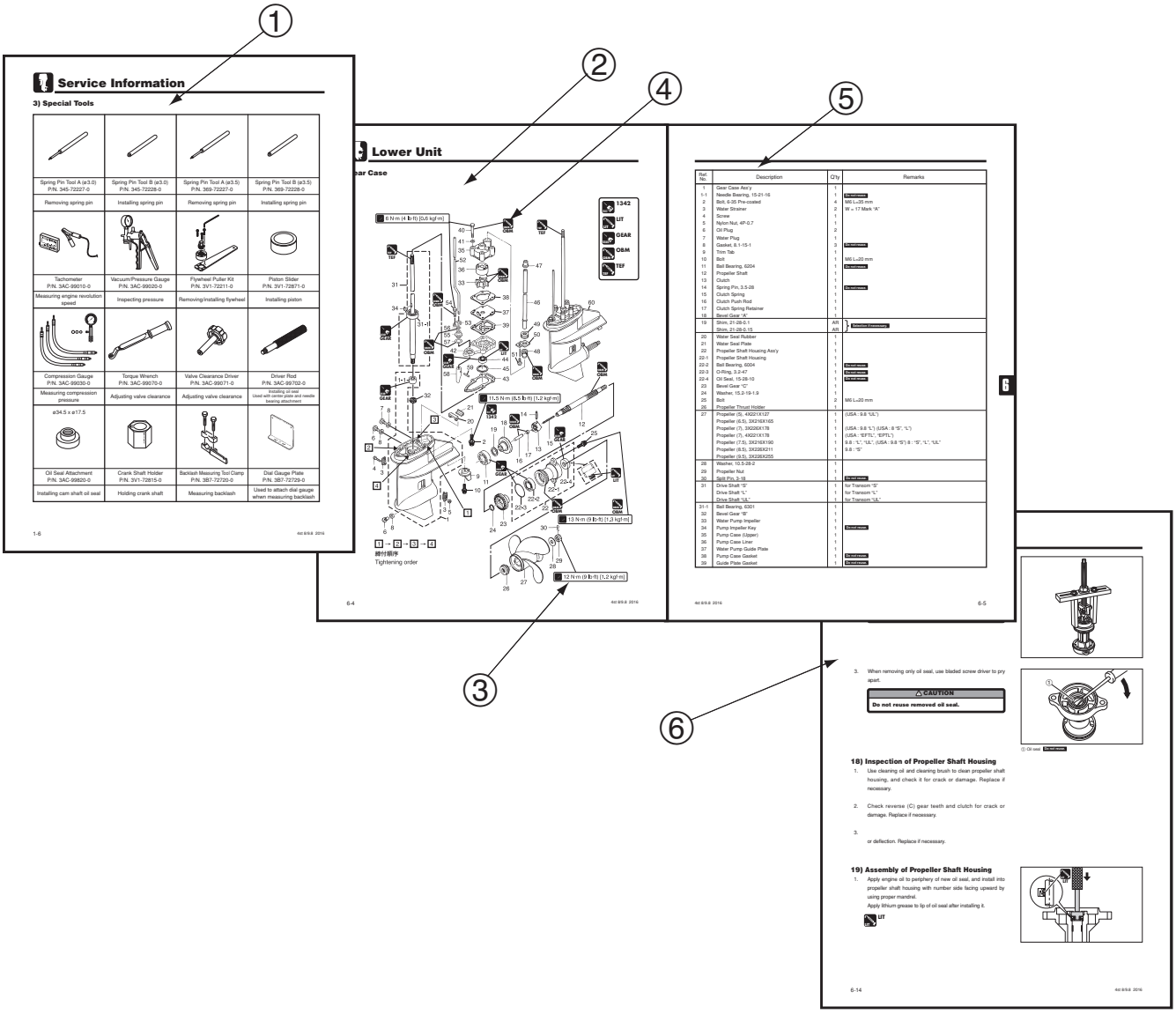
② Parts that are serviced in each chapter and their details are presented by using a component composition diagram.

③ Fastening torques are described in the component composition diagram and in the body text and are critical points of the applicable repair.

④ Pictograms indicate that there is an important 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 quantity 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 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/cm^2 = 0.0980665 MPa)

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

Example : <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 would be used in the world, various physical units were established later, resulting in branching the metric system in different unit systems.

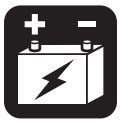
The new unit system is called "International System of Units" because it was established for the purpose of unifying the different unit systems.

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) passed 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 service.

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

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

4 stroke Engine Oil 	Gear Oil 	ATF DEXRON III 	Waterproof Grease 
Low Temperature Resistant Lithium Grease 	Teflon® Grease TEFLON 	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 	

1.Service Information

2.Service Data

3.Maintenance

4.Fuel System

5.Power Unit

6.Lower Unit

7.Bracket

8.Electrical System

9.Troubleshooting

10.Wiring Diagram

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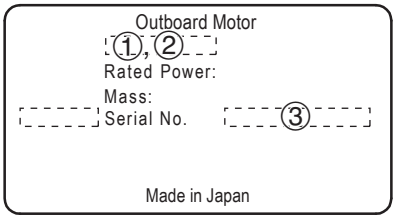
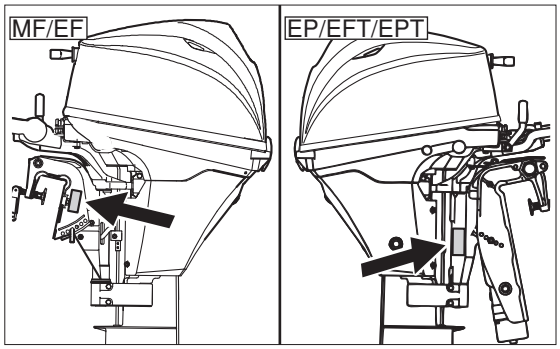
1
Service Information

1. Identification (Engine Serial Number)

Engine serial number is stamped on the Clamp Bracket or Swivel Bracket of outboard motor body.

① Model Type
② Model Name
③ Serial Number

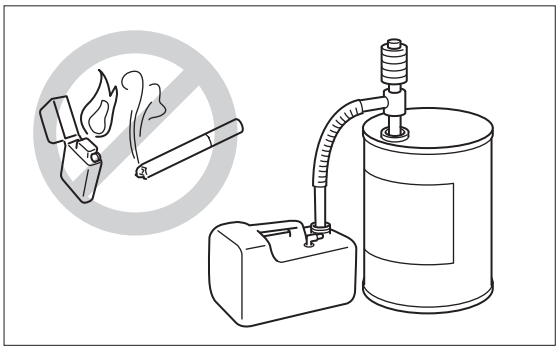




2. Work Safety

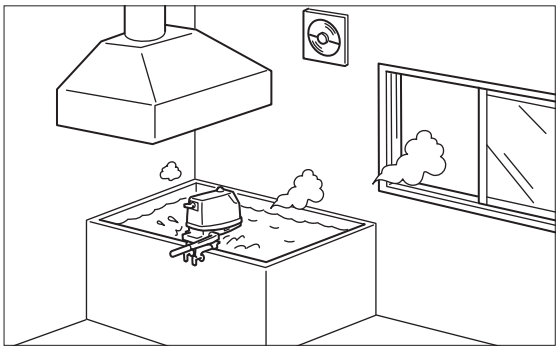
1) Fire Prevention

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



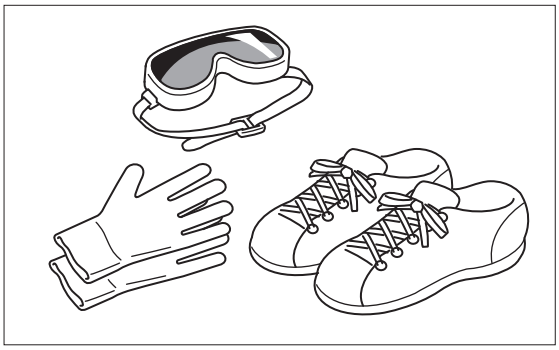
2) Ventilation

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



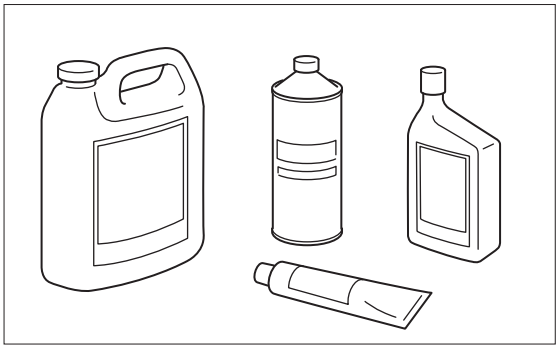
3) Protection

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



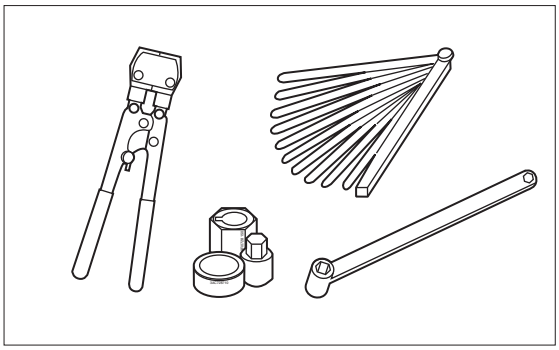
4) Genuine Parts

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



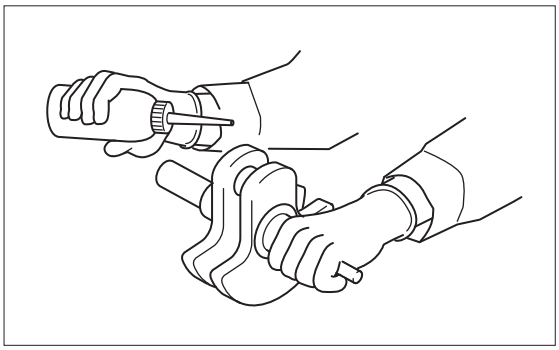
5) Tools

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



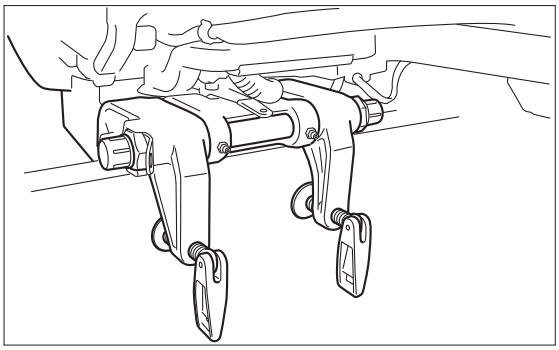
6) Recommendations on Service

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



7) Cautions in Disassembling and Assembling Components

(1) Secure outboard motor to dedicated stand firmly.

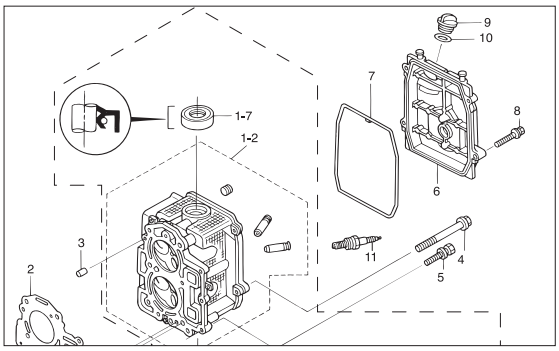


(2) Take special care not to scratch painted surfaces or mating surfaces of cylinder and crankcase.

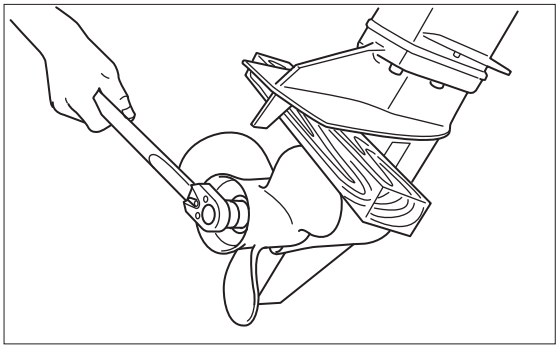
(3) Replace parts such as packings, gaskets, O rings, oil seals, spring pins or split pins with new ones after they are removed. Replace deformed snap rings with new ones.

(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.

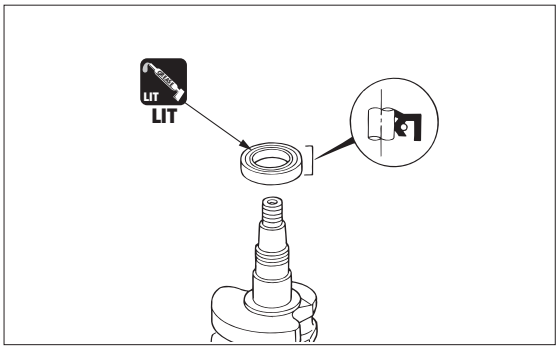


(6) When reassembling parts, use their mating marks. For parts without mating marks, simple marking makes reassembling easier. Use applicable parts list for reference.



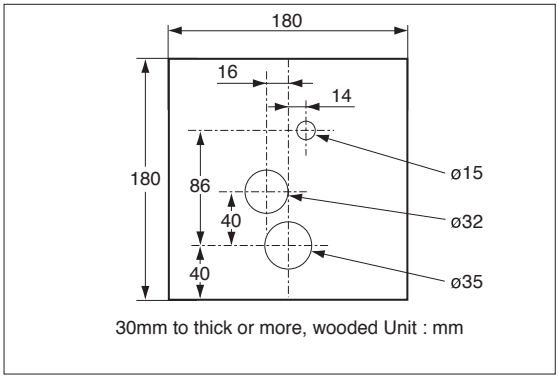
(7) Clean individual parts that have been removed, and check their condition.

(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.



30mm to thick or more, wooded Unit : mm

(11) When applying liquid sealant, take care to use sparingly. Excessive application may be oozed out, adversely affecting interior of the crankcase. Use adhesive after thoroughly reading the instructions.

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

3. Tools and Instruments

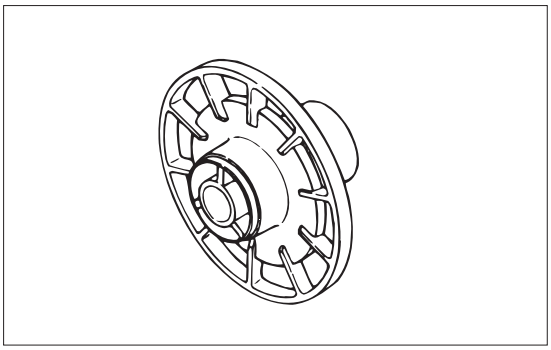
1) Test Propeller

P/N. 3B2-64110-1

Outer diameter : 164mm

Width : 12mm

Rotational speed at WOT (Wide Open Throttle) (r/min)
5,000~6,000



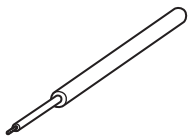
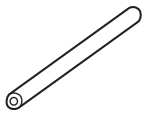
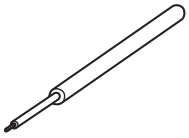
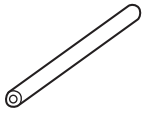
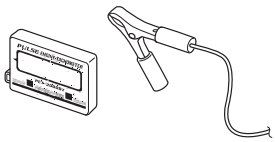
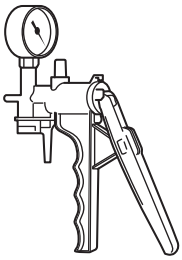
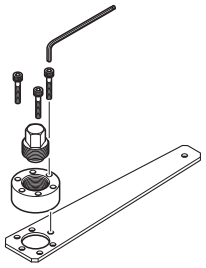
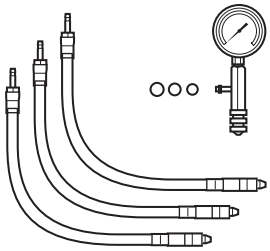
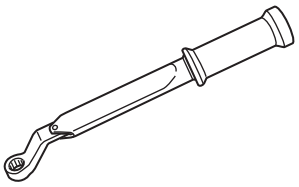
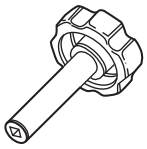
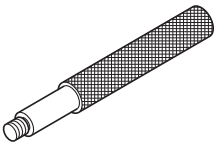
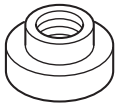
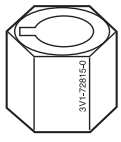
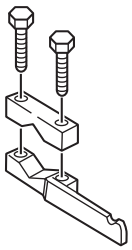
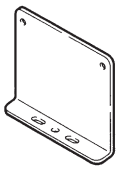
2) Measuring Instruments

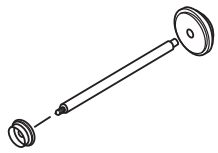
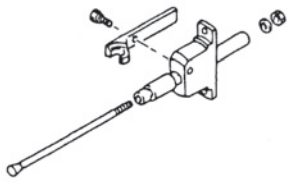
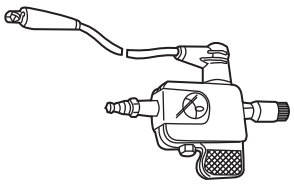
For the following measuring instruments, use commercially available ones.

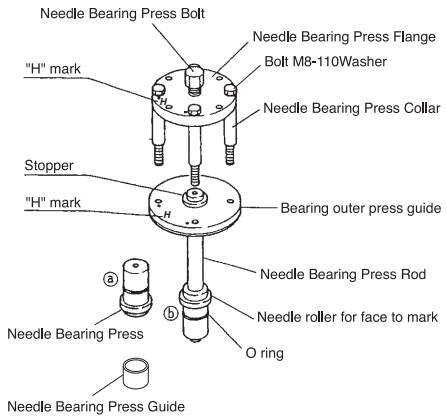
Circuit tester	(Resistance : 1Ω, 10Ω, 10 kΩ, AC voltage : 30 to 300V, DC voltage : 30V, Internal voltage 3V or less)
Vernier calipers	(M1 type, 300 mm)
Micrometer	(minimum graduation of 0.01, outer, 0 to 25 mm, 25 to 50 mm, 50 to 75 mm)
Cylinder gauge	(4 to 6 mm, 10 to 25 mm, 25 to 30 mm, 50 to 75 mm)
Ring gauge	(ø5.5, ø16, ø25, ø30, ø61)
Dial gauge	(minimum graduation of 0.01)
Thickness gauge	(0.03 to 0.3 mm)
V block	
Surface plate	(500 mm x 500 mm)

Dial gauge magnet base or dial gauge stand

3) Special Tools

			
Spring Pin Tool A (ø3.0) P/N. 345-72227-0	Spring Pin Tool B (ø3.0) P/N. 345-72228-0	Spring Pin Tool A (ø3.5) P/N. 369-72227-0	Spring Pin Tool B (ø3.5) P/N. 369-72228-0
Removing spring pin	Installing spring pin	Removing spring pin	Installing spring pin
			
Tachometer P/N. 3AC-99010-0	Vacuum/Pressure Gauge P/N. 3AC-99020-0	Flywheel Puller Kit P/N. 3V1-72211-0	Piston Slider P/N. 3V1-72871-0
Measuring engine revolution speed	Inspecting pressure	Removing/installing flywheel	Installing piston
			
Compression Gauge P/N. 3AC-99030-0	Torque Wrench P/N. 3AC-99070-0	Valve Clearance Driver P/N. 3AC-99071-0	Driver Rod P/N. 3AC-99702-0
Measuring compression pressure	Adjusting valve clearance	Adjusting valve clearance	Installing oil seal Used with center plate and needle bearing attachment
ø34.5 x ø17.5 			
Oil Seal Attachment P/N. 3AC-99820-0	Crank Shaft Holder P/N. 3V1-72815-0	Backlash Measuring Tool Clamp P/N. 3B7-72720-0	Dial Gauge Plate P/N. 3B7-72729-0
Installing cam shaft oil seal	Holding crank shaft	Measuring backlash	Used to attach dial gauge when measuring backlash

		
Bearing Outer Press Kit P/N. 3B7-72739-1	Backlash Measuring Tool Kit P/N. 369-72740-0	Spark Tester P/N. 3F3-72540-0
Installing forward gear (A) bearing outer race	Measuring gap between forward and pinion gears (A and B gears)	Inspecting sparks



Needle bearing press Ass'y P/N. 3AC-72900-1
Installing/attaching drive shaft needle bearing

4. Pre-delivery Inspection

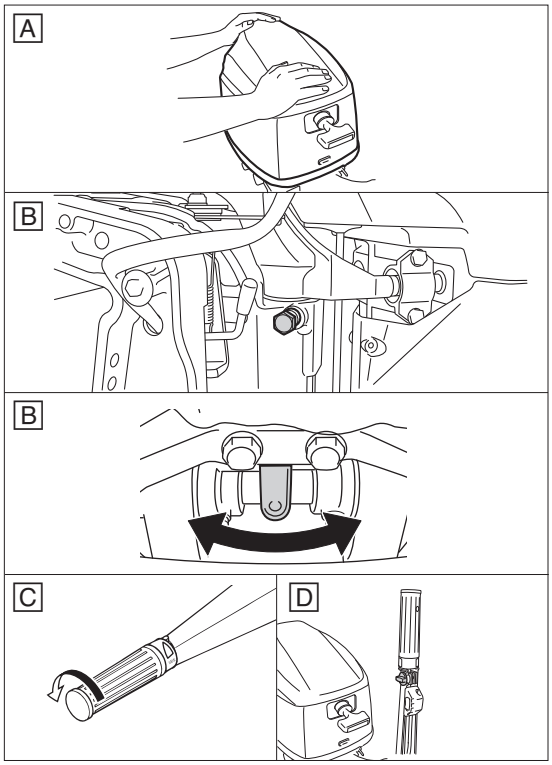
1) Steering Handle

A Check installations for clattering and play.

B Adjust steering friction.

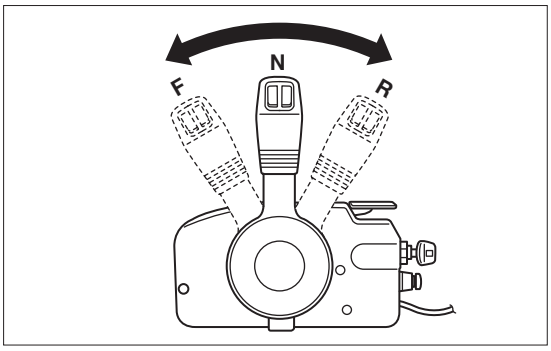
C Check throttle grip for movement. (full open/full close).

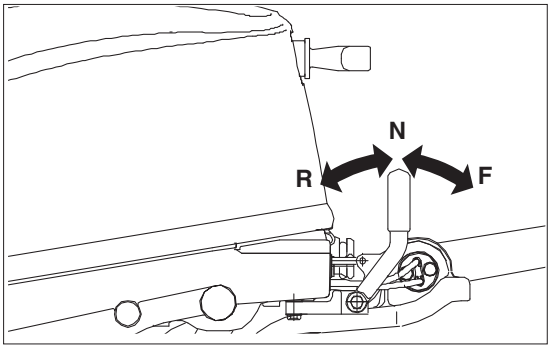
D Adjust throttle friction.



2) Gear Shift

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





3) Engine Oil

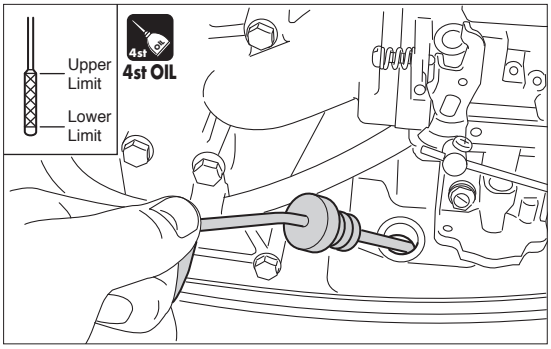
Fill engine with engine oil.

4 Stroke Engine Oil :
0.8 L (0.85 US.qt)

Use oil level gauge to check oil quantity.

⚠ CAUTION

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

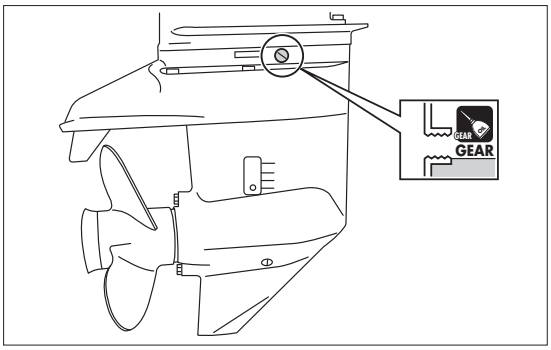


4) Gear Oil

Check quantity of gear oil.

Gear Oil :
320 cm³ (10.8 fl.oz)

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

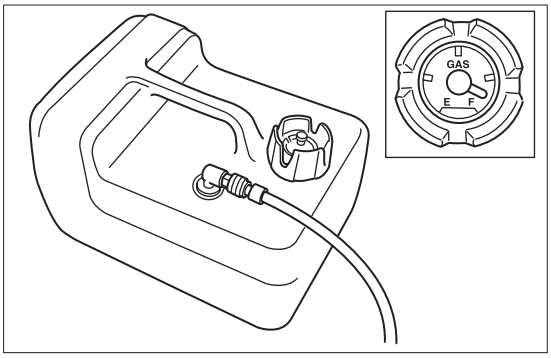


5) Fuel Line

Check that fuel tank contains sufficient amount of gasoline, fuel line is connected and is free of leak.

⚠ CAUTION

Since this is a four stroke engine model, do not use fuel mixed with engine oil. Use of fuel mixed with engine oil will cause engine trouble.

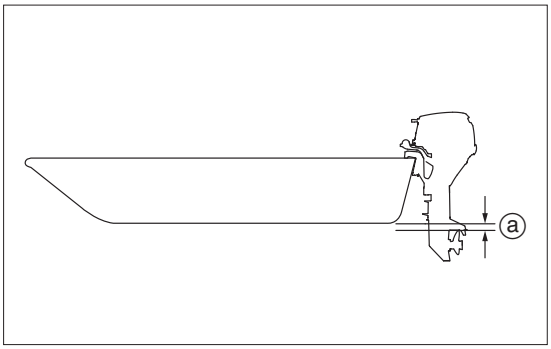


6) Rigging

Check that clamp bracket is fixed securely to hull. Check location of anti-ventilation plate relative to boat bottom, and, if necessary, adjust to prevent decrease in propulsive force and engine overheating.

Test-run to determine the best installation height.

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

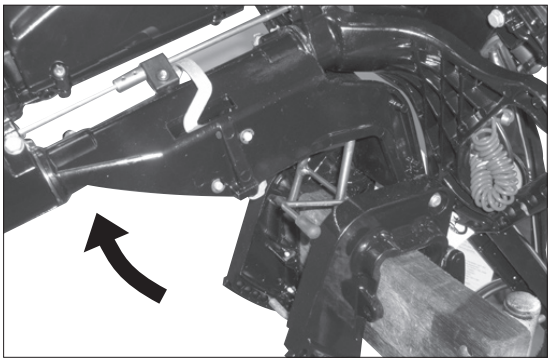


ⓐ5~25 mm (0.2~1.0 in)

7) Manual Tilt

1. Check that outboard motor tilts up/down smoothly.

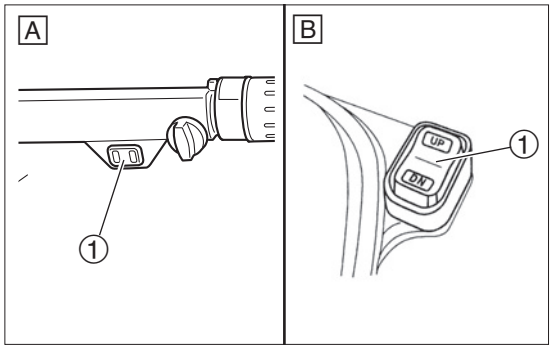
2. Fully tilt up outboard motor to check that sustaining mechanism operates automatically.



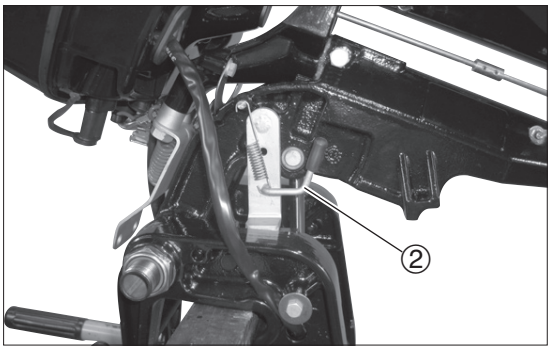
8) Inspection of PT unit

1. Connect battery cables.

2. Push PT switch “UP” to check that outboard motor fully tilts up.
   A Tiller Handle Model
   B Remote Control Model

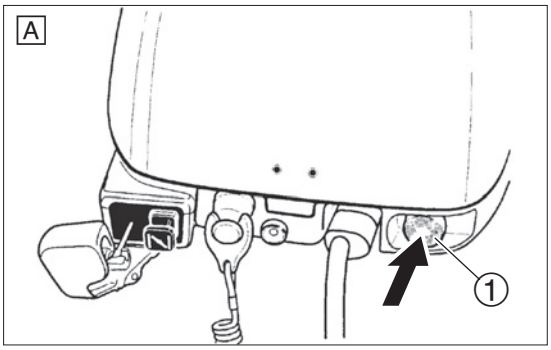


3. Check that tilt stopper ② functions normally.
4. Push PT switch “DN” to check that outboard motor fully tilts down.

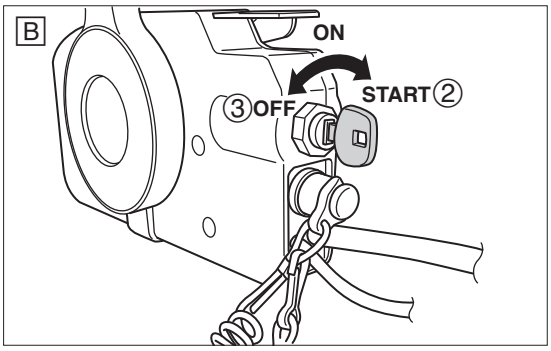


9) Inspection of Starting Switch and Stop Switch

1. Press start switch ① or turn main switch to START ② to check that engine starts.
   Ⓐ Tiller Handle Model — Push and hold to stop
   Ⓑ Remote Control Model

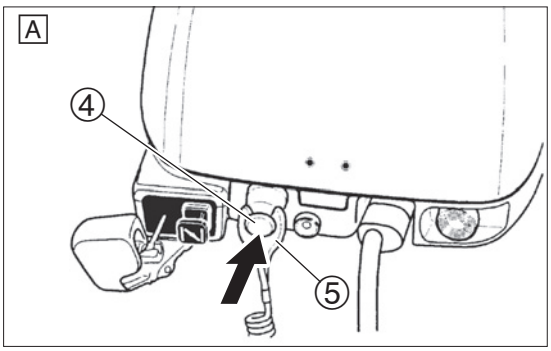


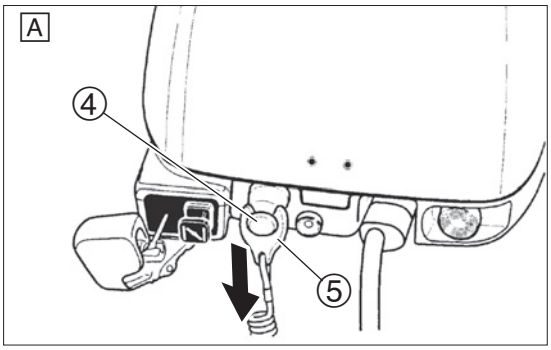
2. Turn main switch to OFF ③ to check that engine stops. (Ⓑ)



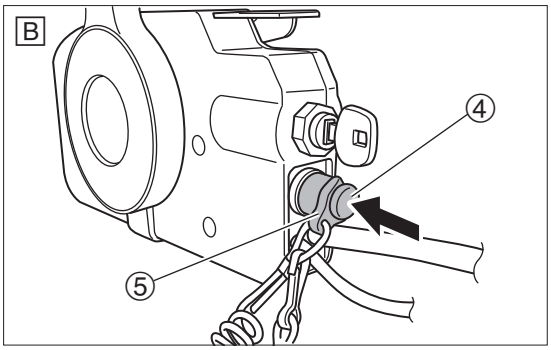
3. Press stop switch ④ hard or pull out lockplate ⑤ from stop switch ④ to check that engine stops.

   Ⓐ Tiller Handle Model



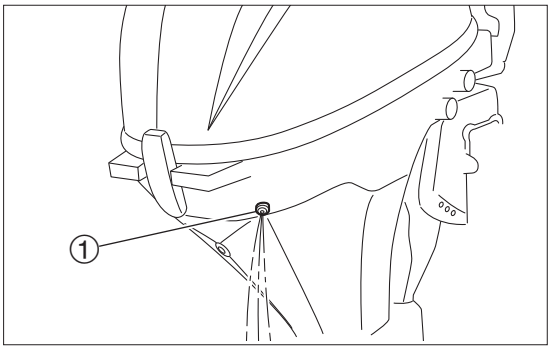


B Remote Control Model



10) Cooling Water Check Port

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

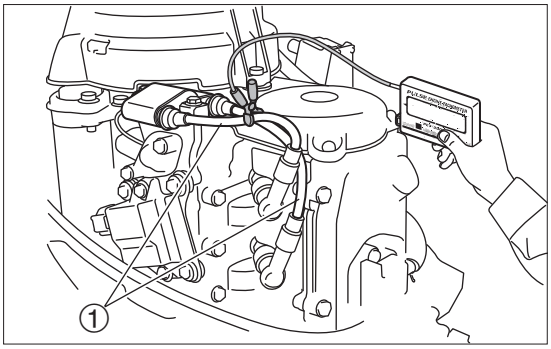


11) Idling

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

Idle Speed :
950 r/min

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



①High tension cord

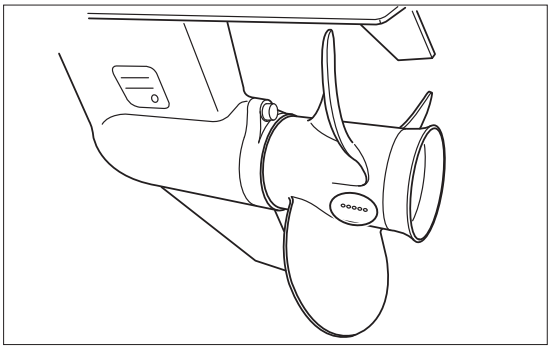
12) Propeller Selection

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

Range of operating engine speed at WOT :
5,000~6,000r/min

⚠ CAUTION

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



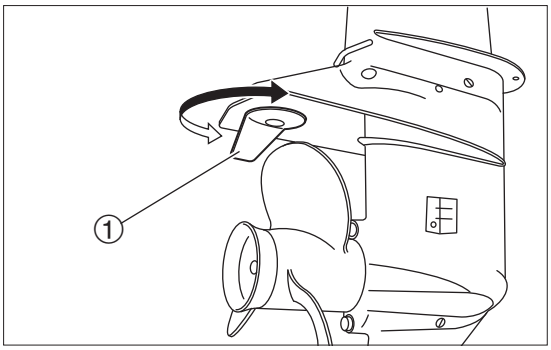
	Marking	Propeller size (diameter X pitch)		
		No. of blades	inch	mm
Light load boat	9.5	3	8.9×10	226×255
	8.5	3	8.9×8.3	226×211
	7.5	3	8.5×7.5	216×190
	7.0	3	8.9×7.0	226×178
Heavy load boat	6.5	3	8.5×6.5	216×165
Light load boat	7.0	4	8.7×7.0	221×178
Heavy load boat	5.0	4	8.7×5.0	221×127

13) Trim Tab

Adjustment of trim tab angle

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

Trim tab bolt :
6 N·m (5 lb·ft) 0.6 kg

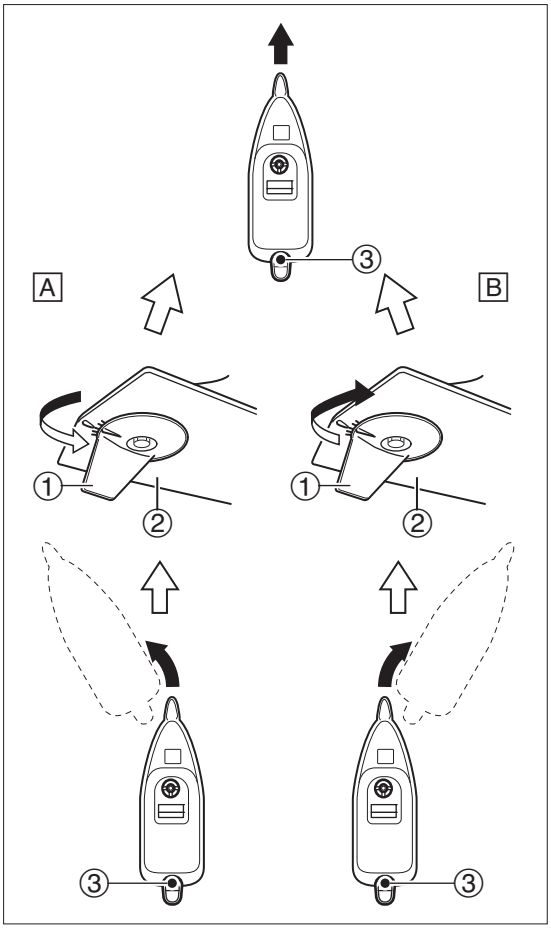


Example of trim tab angle adjustment

Ⓐ 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

Ⓑ If it is necessary to steer to starboard 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-cavitation 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 and cylinder, piston rings, piston pins, crank shaft, connecting rods, and intake and exhaust valves.

Break-in Operation…10 hours

Time	0	10 minutes	2 hours	3 hours	10 hours
Operation	Dead Slow or Idling	1/2 of WOT or less at approximately 3,000 r/min	3/4 of WOT or less at approximately 4,000 r/min	3/4 of WOT at approximately 4,000 r/min	Regular Operation
	Running at the slowest possible speed		WOT run for approximately 1 minute can be included every 10 minutes of run.	Short period WOT run can be included.	

6. Test Run

1. Start engine and check if gear shift can be moved smoothly.

2. After completing warm-up operation, check idling revolution speed.

Idling Revolution Speed : - Neutral
950 r/min

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

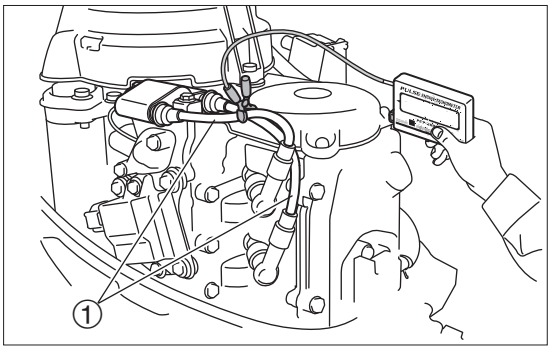
3. Shift gear into forward (F) and run dead slow for approximately 10 minutes.

Dead Slow Revolution Speed :
900 r/min

4. Run at 2,000 r/min or half of WOT or less for initial 2 hours, then at 3,000 r/min or 3/4 of WOT or less 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.

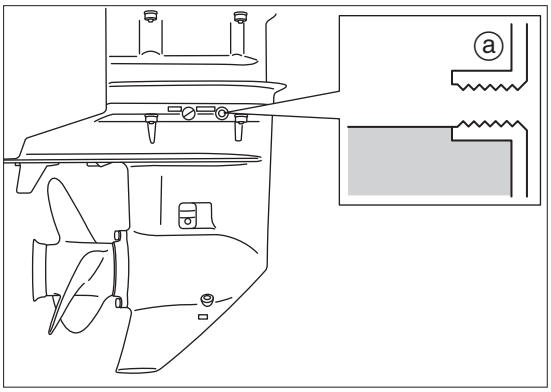


①High tension cord

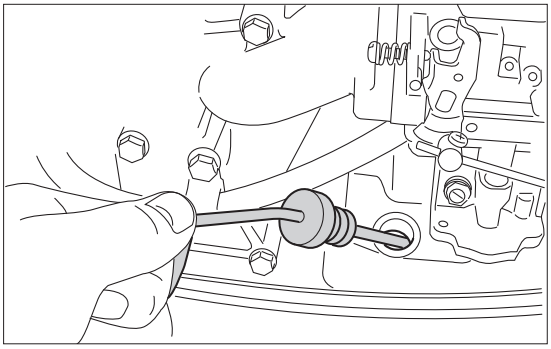
7. Checks After Test Run

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

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

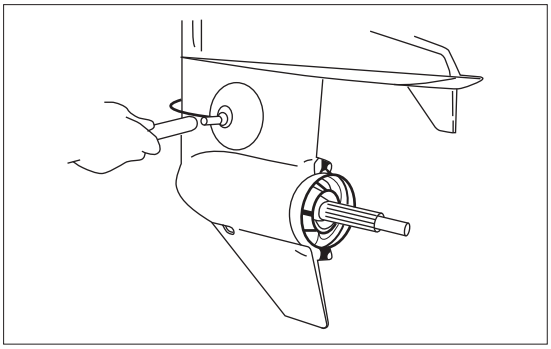


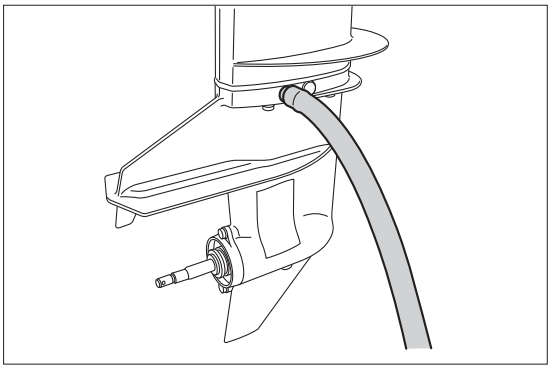
2. Check that no fuel leaks in the cowl.



3. Check that no oil and water leak in the cowl and no water is present in engine oil.

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

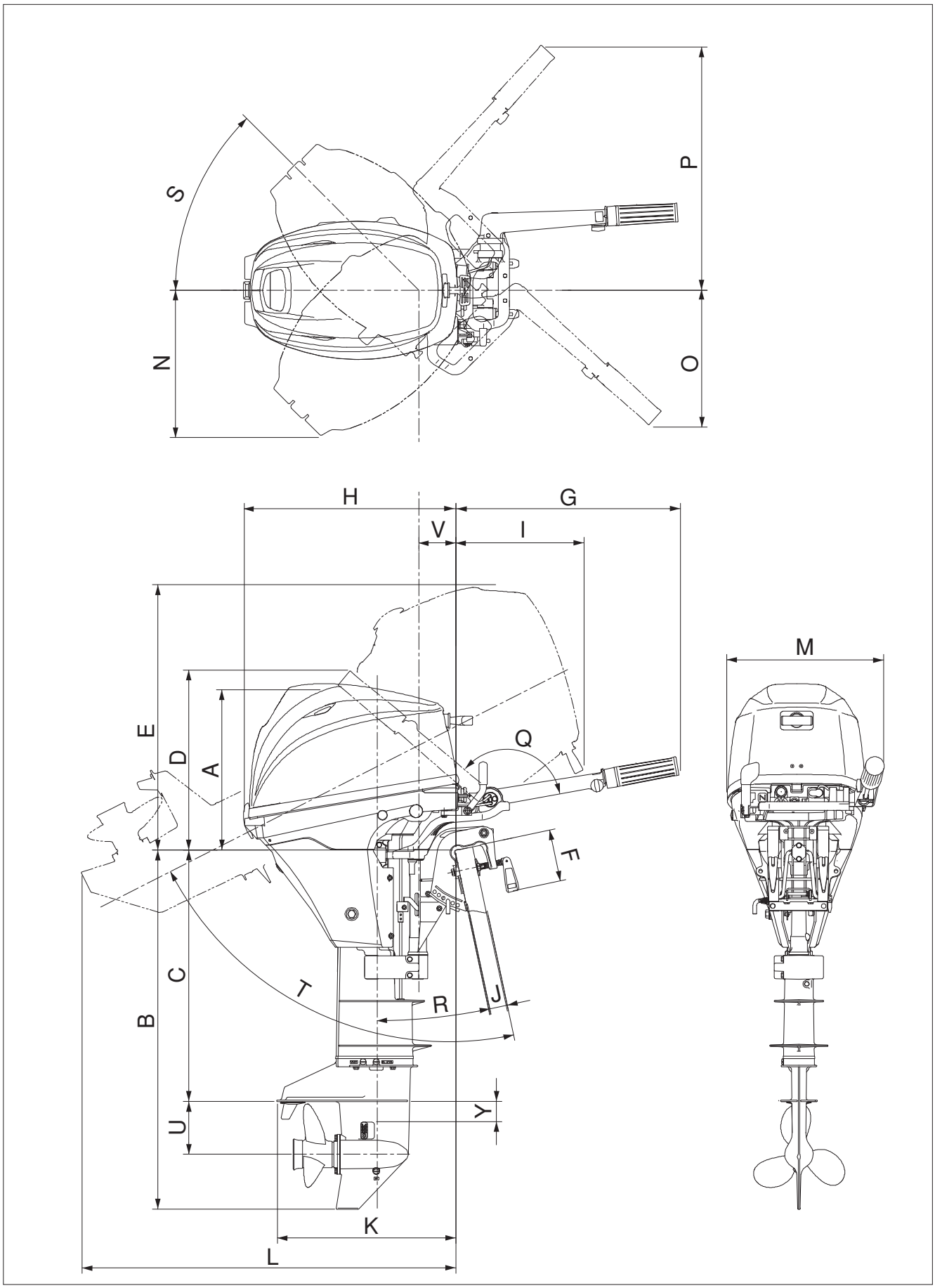




2
Service Data

1. Outline Dimensions

1) Engine Outer Dimensions



MF/EF/EFT

Item	Type		Unit	MFS8/9.8B	
				mm	in
A			mm/in	373	14.7
B	S		mm/in	677	26.7
	L		mm/in	804	31.7
	UL		mm/in	931	36.7
C	S		mm/in	435	17.3
	L		mm/in	562	22.3
	UL		mm/in	689	27.1
D			mm/in	402	15.8
E	MF/EF		mm/in	594	23.4
	EFT		mm/in	607	23.9
F	MF/EF		mm/in	116	4.57
	EFT		mm/in	133	5.24
G	MF/EF		mm/in	502	19.8
	EFT		mm/in	486	19.1
H	MF/EF		mm/in	473	18.6
	EFT		mm/in	489	19.3
I	MF/EF		mm/in	286	11.3
	EFT		mm/in	279	7.05
J	MF/EF		mm/in	30-55	1.18-2.17
	EFT		mm/in	30-70	1.18-2.76
K	MF/EF		mm/in	399	15.7
	EFT		mm/in	415	16.3
L	S	MF/EF	mm/in	709	27.9
		EFT	mm/in	730	28.7
	L	MF/EF	mm/in	836	32.9
		EFT	mm/in	843	33.2
	UL	MF/EF	mm/in	963	37.9
		EFT	mm/in	956	37.6
M			mm/in	354	13.9
N			mm/in	329	12.9
O			mm/in	306	12.0
P			mm/in	544	21.4
Q			deg.	130°	
R			deg.	12°	
S			deg.	45°	
T			deg.	75°	
U			mm/in	118	4.65
V	MF/EF		mm/in	83	3.27
	EFT		mm/in	99	3.89
Y			mm/in	46	1.81
Trim angle (Position)	MF/EF		deg.	4°-24° (6)	
	EFT			4°-20° (5)	

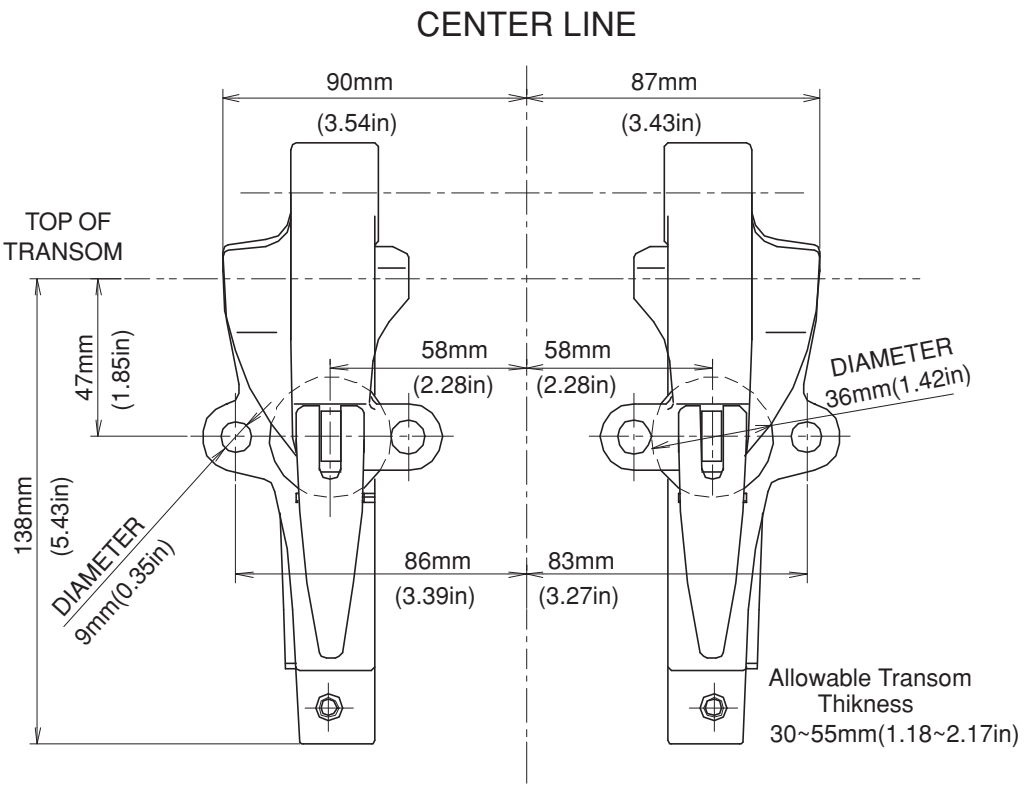
EP/EPT

Item	Type		Unit	MFS8/9.8B	
				mm	in
A			mm/in	373	14.7
B	S		mm/in	677	26.7
	L		mm/in	804	31.7
	UL		mm/in	931	36.7
C	S		mm/in	435	17.3
	L		mm/in	562	22.3
	UL		mm/in	689	27.1
E	EP		mm/in	577	22.7
	EPT		mm/in	607	23.9
F	EP		mm/in	127	5.0
	EPT		mm/in	133	5.24
G	EP		mm/in	132	5.2
	EPT		mm/in	101	3.98
H	EP		mm/in	458	18.0
	EPT		mm/in	489	19.3
I	EP		mm/in	286	11.3
	EPT		mm/in	279	12.0
J	EP		mm/in	30-63.5	1.18-2.5
	EPT		mm/in	30-70	1.18-2.76
K	EP		mm/in	384	15.7
	EPT		mm/in	415	16.3
L	S	EP	mm/in	713	28.1
		EPT	mm/in	730	28.7
	L	EP	mm/in	824	32.4
		EPT	mm/in	843	33.2
	UL	EP	mm/in	935	36.8
		EPT	mm/in	956	37.6
M			mm/in	320	12.6
N	EP		mm/in	287	12.3
	EPT		mm/in	329	12.9
O	EP		mm/in	175	6.88
	EPT		mm/in	179	7.05
P	EP		mm/in	135	5.32
	EPT		mm/in	159	6.26
R	EP		deg.	13°	
	EPT		deg.	12°	
S	EP		deg.	35°	
	EPT		deg.	45°	
T	EP		deg.	73°	
	EPT		deg.	75°	
U			mm/in	118	4.65
V	EP		mm/in	68	2.68
	EPT		mm/in	99	3.89
Y			mm/in	46	1.81
Trim angle (Position)	EP		deg.	7°-18° (3)	
	EPT			4°-20° (5)	

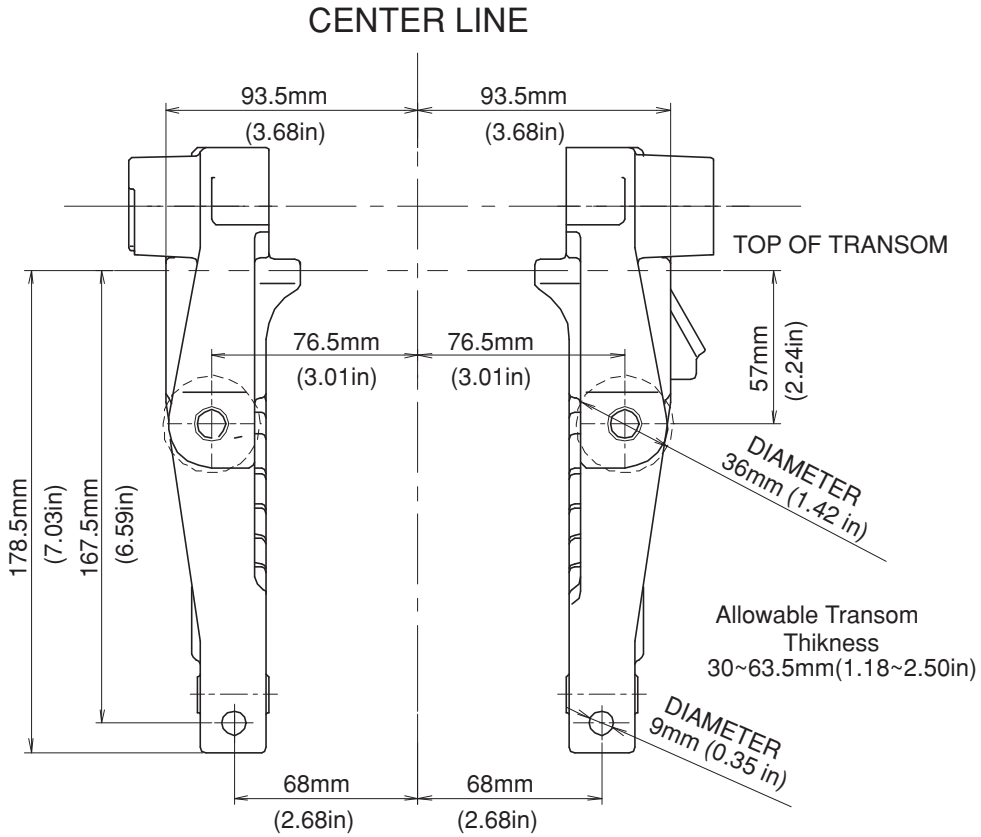
2) Transom Bolts

Mechanical Tilt Model

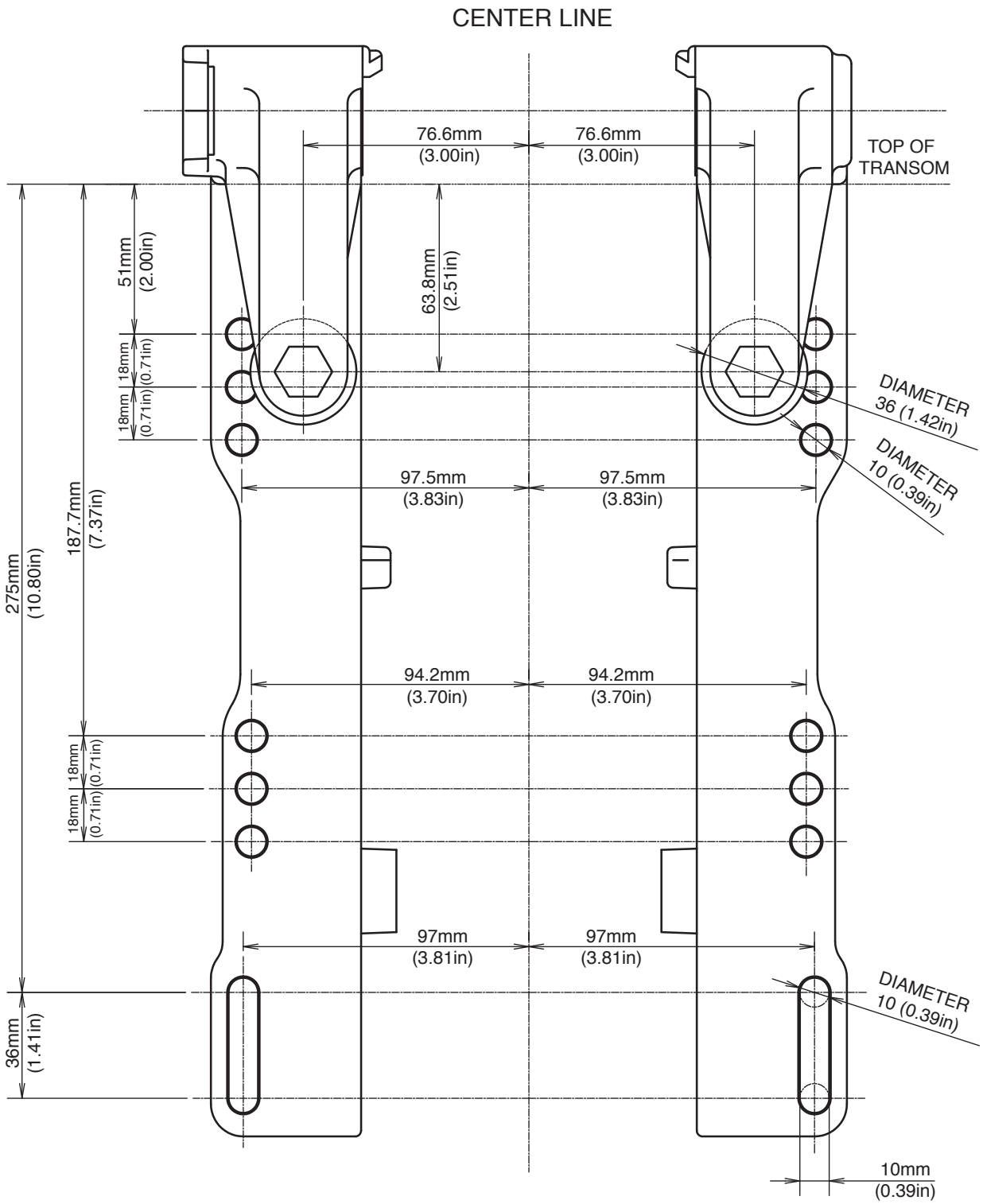
MF/EF



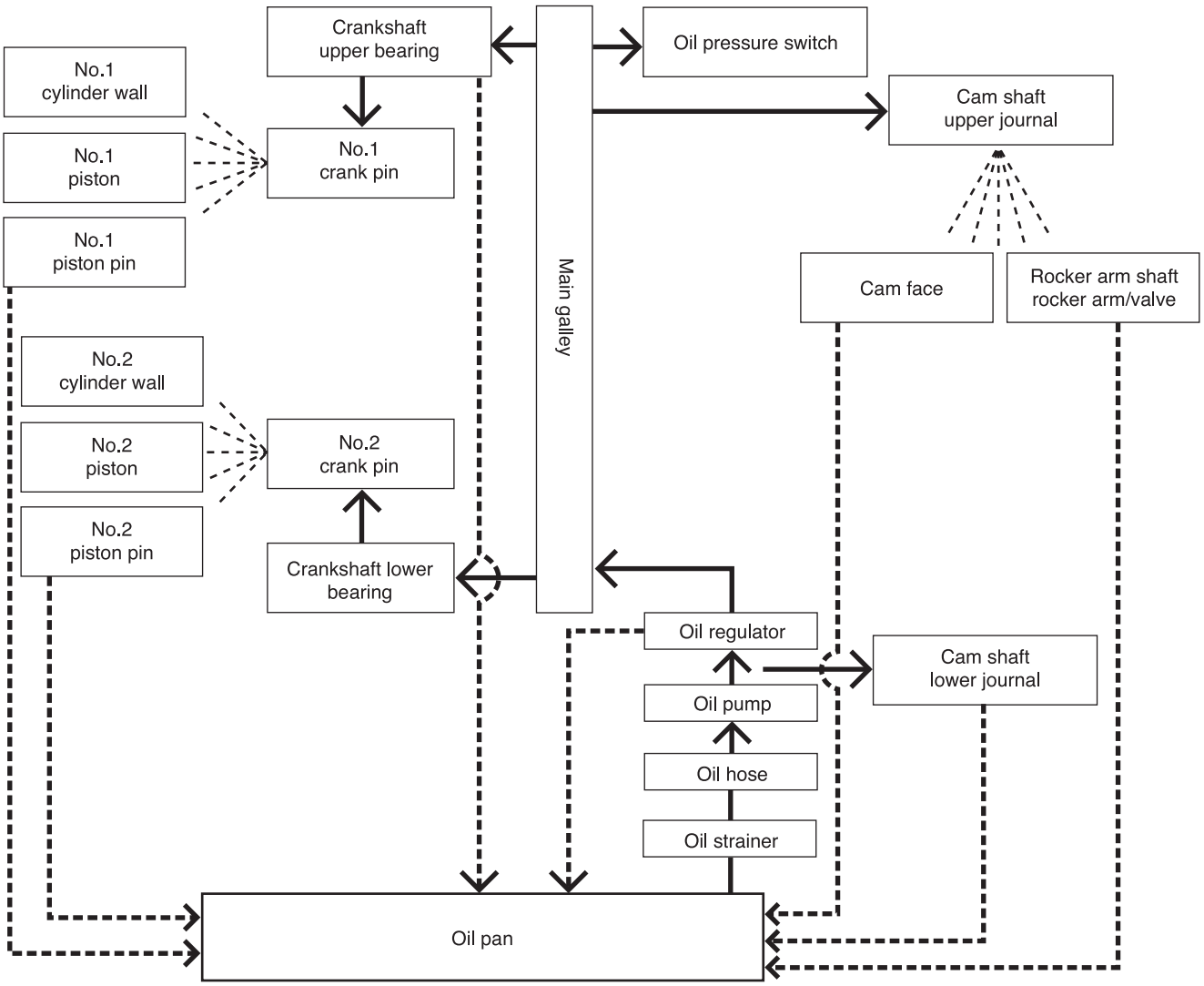
EP



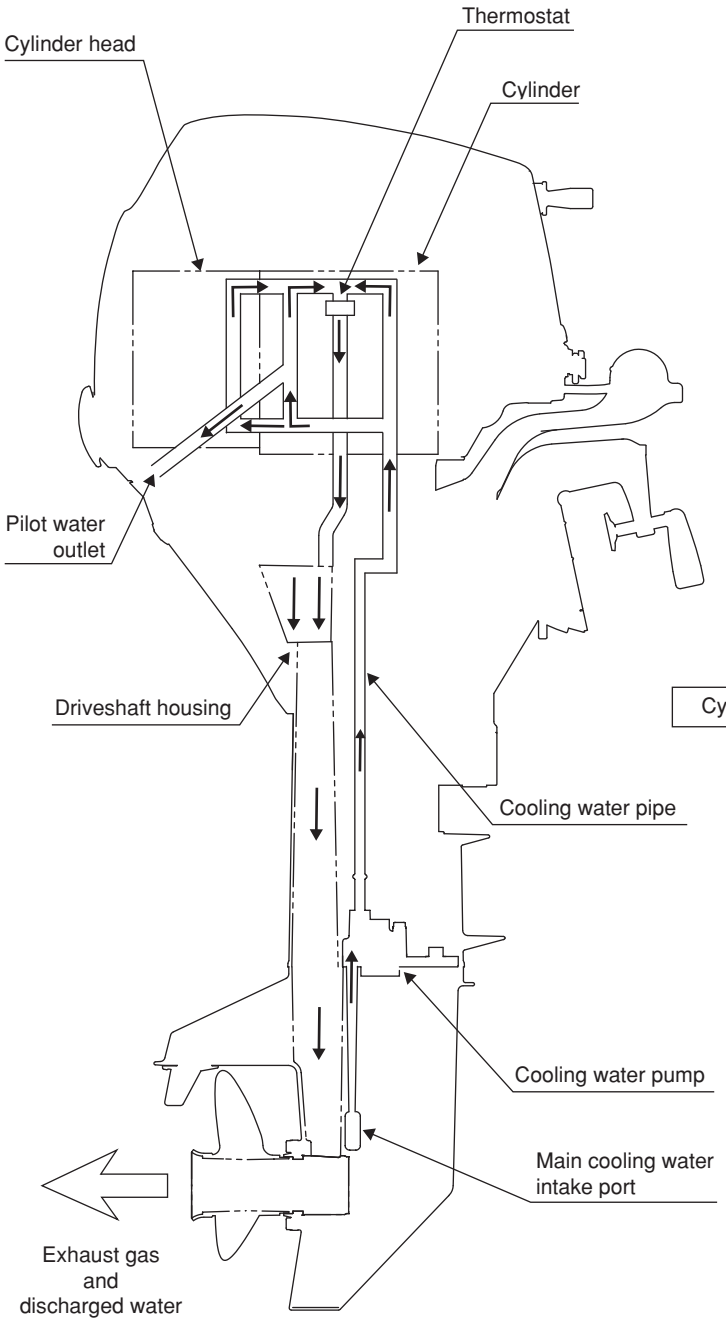
Power Tilt Model

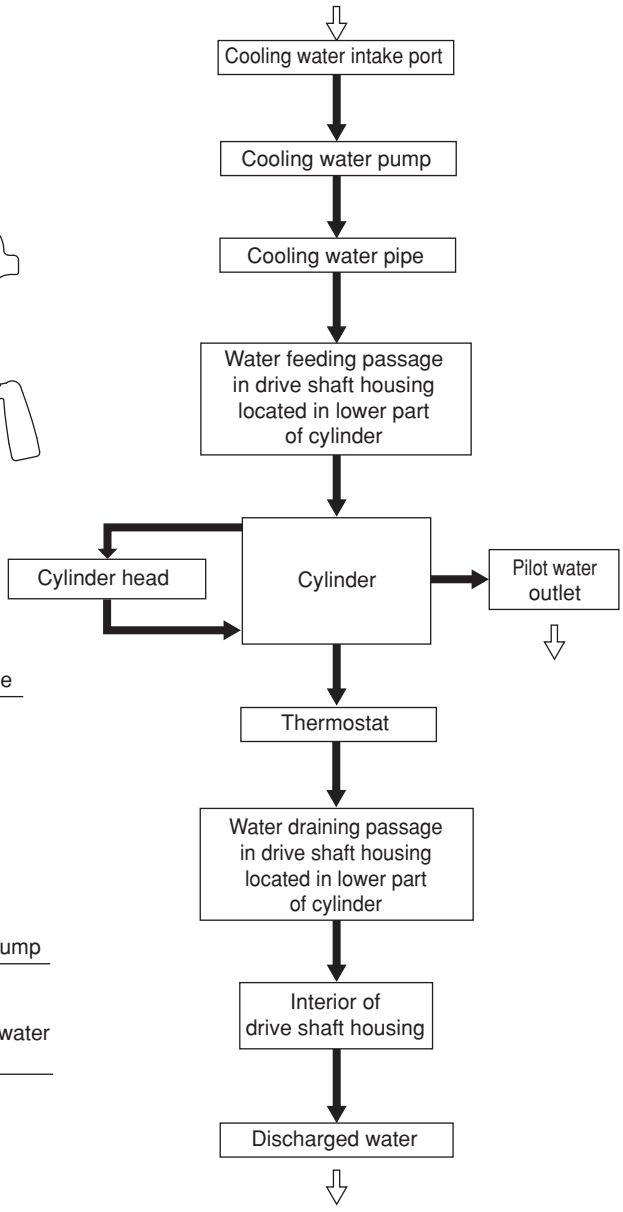


2. Engine Lubrication System Diagram



3. Cooling Water System Diagram





4. Specifications

Item		Unit	Model				
			MF	EF	EFT	EP	EPT

Dimensions

Overall length		mm (in)	975 (38.4)			590 (23.2)	
Overall width		mm (in)	354 (13.9)			320 (12.6)	
Overall height	S	mm (in)	1,050 (41.3)				
	L	mm (in)	1,177 (46.3)				
	UL	mm (in)	1,304 (51.3)				
Transom height	S	mm (in)	435 (17.3)				
	L	mm (in)	562 (22.3)				
	UL	mm (in)	689 (27.1)				

Weight

	S	kg	37.0	40.0	46.5	40.0	46.0
		(lb)	(81.5)	(88.0)	(102.5)	(88.0)	(101.4)
	L	kg	38.0	41.0	47.5	41.0	47.0
		(lb)	(84.0)	(90.5)	(104.7)	(90.5)	(103.6)
	UL	kg	39.5	42.5	49.0	42.5	48.5
		(lb)	(87.0)	(93.5)	(108.0)	(93.5)	(106.9)

Performance

Maximum output	kW (PS)	8B : 5.9 (8) 9.8B : 7.2 (9.8)
Maximum fuel consumption	L/hr (G)	8B : 3.2 (0.85) 9.8B : 3.8 (1.00)
Wide open throttle operating r/min range	r/min	5,000 – 6,000
Idling (Neutral: [N])	r/min	950
Trolling (Forward: [F])	r/min	900

Item	Unit	Model				
		MF	EF	EFT	EP	EPT

Power unit

Engine type		4 stroke		
No. of cylinders		2		
Total displacement	cm³(cu.in)	209 (13)		
Valve system		OHC Crossflow		
Bore x Stroke	mm(in)	55 X 44 (2.17 X 1.73)		
Compression ratio		8.7		
Shift operation		Front shift (manual)		Remote control
Starting system		Recoil starter	Recoil starter & starter motor	
Lubrication system		Wet sump (trochoid pump)		
Cooling system		Cooling water (rubber impeller)		
Exhaust system		Thru-hub exhaust system		
Ignition system		Flywheel magneto (CD ignition)		
Ignition timing		BTDC – BTDC35°		
Spark plug		NGK DCPR6E		
Alternator output		12V – 80W		
Fuel feed system		Carburetor (Horizontal butterfly system)		

Fuel and oil

Type of fuel			Unleaded regular octane gasoline (Research octane number 90 or more)		
Fuel tank capacity		L (G)	12 (3.17) [Remote tank]		
Starting fuel enrichment system			Choke valve (Manual)	Choke valve (Electrical)	
Fuel pump			Mechanical (plunger pump)		
Engine oil	Type		4 stroke engine (motor) oil		
	Grade	API	SE, SF, SG, SH, SJ, SL, SM		
		SAE	10W-30, 10W-40		
		NMMA	FWC certification 10W-30/40		
	Amount of oil	L(US qt)	0.8 (0.85)		
Gear oil	Type		Hypoid gear oil		
	Grade *1	API	GL-4, GL-5		
	Grade *1	SAE	80W-90 #90		
	Amount of oil	cm³(fl · oz)	320 (10.8)		

*1 Both API and SAE requirements are to be met.

Lower unit

Gear shift		F-N-R
Gear ratio		2.08 (13 : 27)
Type of gear		Spiral bevel gear
Type of clutch		Dog clutch
Propeller shaft driving		Spline
Propeller rotation (direction)		Clockwise as viewed from stern at forward shift (F)

Item	Unit	Model				
		MF	EF	EFT	EP	EPT

Propeller

MFS8B	S	Mark	7.5			
	L	Mark	7.5			
	UL	Mark	7.5	–	7.5	–
MFS8B	S	Mark	7	–	7	–
[For North America]	L	Mark	7	7 (*2)	7	7 (*2)
MFS9.8B	S	Mark	8.5			
	L	Mark	7.5			
	UL	Mark	7.5	–	7.5	–
MFS9.8B	S	Mark	7.5			
[For North America]	L	Mark	7	7 (*2)	7	7 (*2)
	UL	Mark	5 (*2)			

*2 4 Blade propeller

Bracket

No. of trim steps		No. of steps	6	5	3	5
Trim angle (transom 12°)	*3	Degrees	4 – 24°	4 – 20°	7 – 18°	4 – 20°
Shallow water drive angle (transom 12°)	*3	Degrees	32.5°	Adjustable	24 – 40°	Adjustable
Maximum tilt angle	*4	Degrees	75°	75°	73°	75°
Steering angle	*5	Degrees	90°	90°	70°	90°
Maximum allowable transomboard thickness		mm(in)	30 – 55 (1.18 – 2.17)	30 – 70 (1.18 – 2.76)	30 – 63.5 (1.18 – 2.50)	30 – 70 (1.18 – 2.76)

*3 Angle from horizontal line when transom is 12°.
*4 Tilt operating range
*5 Steering right-left operating range

Warning system

Engine over-rev protection			Controls engine speed to approx. 6,250 r/min or lower (high speed ESG)
Engine oil pressure reduction protection	*6		Controls engine speed to approx. 3,000 r/min or lower (low speed ESG). Warning lamp are turned on.
Confirmation of operation of warning system			Only lamp operates (5 seconds).

*6 To cancel this warning system, engine should be stopped and then restarted.

Optional parts

Propeller [Mark] (No. of blades x Diameter x Pitch) [in/mm]	Mark	9.5	(3x8.9x10)	(3x226x255)
		8.5	(3x8.9x8.3)	(3x226x211)
		7.5	(3x8.5x7.5)	(3x216x190)
		7.0	(3x8.9x7.0)	(3x226x178)
		6.5	(3x8.5x6.5)	(3x216x165)
		7.0	(4x8.7x7.0)	(4x221x178)
		5.0	(4x8.7x5.0)	(4x221x127)
Tachometer	No. of poles	6		
Remote control cable	Feet	Cable length : 5-30 ft		

5. Maintenance Data

	Part name	Item	Standard value
Engine parts	Cylinder head	Carbon deposition on combustion chamber wall	
		Deformation of mating faces and flaws	
		Corrosion of mating faces	
		Plugging of cooling water passages	
	Cylinder	Deposition on water jacket interior walls	
		Wear of bore : Measure bore by using cylinder gauge.	55.00mm (2.1654in)
		Seizure, cylinder liner damage, or wear	
		Deformation and damage of cylinder head mating faces	
		Engine anode	
	Piston	Outer diameter Measure outer diameter at 7mm (0.28in) above lower end of piston skirt. · Piston clearance	54.96mm (2.1638in) 0.020 – 0.055mm (0.00079 – 0.00217in)
		Carbon deposition on piston crown and in ring grooves	
		Flaws on sliding faces	
		Measure side clearance between piston ring and ring groove.	Top ring 0.04 – 0.08mm (0.0016 – 0.0031in) Second ring 0.03 – 0.07mm (0.0012 – 0.0028in) Oil ring 0.05 – 0.15mm (0.0019 – 0.0059in)
		Measure piston pin bore. Piston pin clearance	 0.002 – 0.012mm (0.00008 – 0.00047in)
	Piston pin	Outer diameter	14.00mm (0.5512in)
	Piston rings	Ring end gap (Note : Measure ring end gap at the top or bottom cylinder bore that is worn little if ring gauge is not available.)	
		Top ring	Top ring 0.15 – 0.30mm (0.0059 – 0.0118in)
		Second ring	Second ring 0.35 – 0.45mm (0.0138 – 0.0177in)
		Oil ring	Oil ring 0.20 – 0.70mm (0.0079 – 0.0276in)
	Connecting rod	Small end bore	14.01mm (0.5516in)
		Big end oil clearance	0.015 – 0.041mm (0.00059 – 0.00161in)
		Big end side clearance	0.10 – 0.25mm (0.0039 – 0.0098in)
	Crankshaft	Crankshaft runout: Support crankshaft at journals of both ends by using V block.	To be less than 0.05mm (0.0020in) at both ends.
		Crank pin outer diameter	26.98mm (1.0622in)
		Main journal outer diameter	29.99mm (1.1807in)
		Metal bearing oil clearance	0.012 – 0.044mm (0.00047 – 0.00173in)
		Crankshaft side clearance	0.1 – 0.3mm (0.0039 – 0.0118in)

Serviceable limit	Action to be taken
	Clean to remove.
0.1mm (0.004in)	Correct. (Use #240 to 400 waterproof sand paper put of the surface plate to correct. Use #600 to finish.)
	Correct or replace if possible.
	Clean to remove.
	Clean to remove.
55.06mm (2.1677in)	If serviceable limit is exceeded, replace, or bore to ø55.5±0.01mm and hone, and replace pistons and piston rings with oversize parts.
	If serviceable limit is exceeded, replace, or bore to ø55.5±0.01mm and hone, and replace pistons and piston rings with oversize parts.
0.1mm (0.004in)	Correct. (Use #240 to 400 waterproof sand paper put of the surface plate to correct. Use #600 to finish.)
	Replace if severely worn (worn to 1/3 of original size).
54.90mm (2.1614in) 0.150mm (0.00591in)	Replace if under lower limit. Replace if over upper limit.
	Clean to remove.
	Use waterproof sand paper of No. 400 to 600 to correct if possible, or replace.
Top ring 0.10mm (0.0039in) Second ring 0.09mm (0.0035in) Oil ring 0.18mm (0.0071in)	Replace if over upper limit. Replace if over upper limit. Replace oil ring when top ring or second ring is replaced.
0.040mm (0.00157in)	Replace if over upper limit.
13.97mm (0.55in)	Replace if under lower limit.
Top ring 0.50mm (0.0197in) Second ring 0.70mm (0.0276in)	Replace if the gap is over specified limit only if cylinder liner wear is less than specified limit. Replace oil ring when top ring or second ring is replaced.
14.04mm (0.5526in)	Replace if over upper limit.
0.060mm (0.00236in)	Replace if over upper limit.
0.60mm (0.0236in)	Replace if over upper limit.
0.05mm (0.0020in)	Replace if over upper limit.
26.95mm (1.061in)	Replace if under lower limit.
29.97mm (1.1799in)	Replace if under lower limit.
0.06mm (0.00236in)	Replace if over upper limit.
0.6mm (0.024in)	Replace if over upper limit.

	Part name	Item	Standard value
Engine parts	Intake valve Exhaust valve	Valve clearance IN : Intake	0.13 – 0.17mm (0.0051 – 0.0067in)
		EX : Exhaust	0.18 – 0.22mm (0.0071 – 0.0087in)
		Valve stem outer diameter IN : Intake	5.48mm (0.2157in)
		EX : Exhaust	5.46mm (0.2150in)
		Valve guide inner diameter IN : Intake	5.51mm (0.2169in)
		EX : Exhaust	5.51mm (0.2169in)
		Clearance between valve IN : Intake	0.008 – 0.040mm (0.00031 – 0.00157in)
		guide and valve stem EX : Exhaust	0.025 – 0.057mm (0.00098 – 0.00224in)
		Width of area contacting IN : Intake	1.0mm (0.04in)
		with valve seat EX : Exhaust	1.0mm (0.04in)
	Valve spring	Free length	38.3mm (1.51in)
	Cam shaft	Cam height (both IN and EX)	23.63mm (0.9303in)
		Journal outer diameter	Pulley side 17.98mm (0.7079in)
			Oil pump side 15.97mm (0.6287in)
		Clearance with holder (journal)	0.02-0.05mm (0.0008 – 0.0020in)
	Rocker arm and shaft	Rocker arm inner diameter	13.01mm (0.5122in)
		Shaft outer diameter	12.99mm (0.5114in)
		Shaft clearance	0.006 – 0.035mm (0.00024 – 0.00138in)
	Timing belt	Appearance	
	Engine block	Compression pressure (Reference value)	0.88MPa (9.0kg/cm^2) (128psi)/500r/min±10%

			F8 B		F9.8 B	
			MF/EF	EP	MF/EF	EP
Fuel and lubrication parts	Carburetor	Setting mark	3V1FB	3V1PB	3V2FB	3V2PB
		Venturi bore	12 (0.4724)		17 (0.6693)	
		Throttle bore mm (in)	23 (0.9055)			
		Main jet (MJ) mm (in)	#76		#92	
		Main air jet (MAJ)	#150		#135	
		Main nozzle bore (MN) mm (in)	ø2.3 (0.091)		ø2.6 (0.102)	
		Slow jet (SJ) mm (in)	#39		#39	
		Slow air jet (SAJ)	#90		#70	
		Throttle opening (at WOT) mm (in)	75°		75°	
		Pilot screw (PS)	2-3/4		2	
		Fuel level (from flange face to float bottom) mm (in)	9.5 – 10.5 (0.374 – 0.1434)			
		Choke solenoid conductivity	—	Conductive	—	Conductive
		Idling speed	950			
		Trolling speed r/min	900			
	Oil pump	Pump body bore r/min	—			
		Clearance between outer rotor and body	—			
		Height of outer rotor	—			
		Side clearance between rotor and body	—			
		Clearance between outer and inner rotors	—			

Serviceable limit	Adjust to specified range Action to be taken
5.46mm (0.2150in)	Replace if under lower limit.
5.44mm (0.2142in) 5.55mm (0.2185in)	Replace if over upper limit.
5.57mm (0.2193in) 0.070mm (0.00276in)	Replace if over upper limit.
0.100mm (0.00394in) 2.0mm (0.08in)	Replace if over upper limit.
2.0mm (0.08in) 36.8mm (1.45in)	Replace if under lower limit.
23.38mm (0.9205in)	Replace if under lower limit.
Pulley side :17.95mm (0.7067in)	Replace if under lower limit.
Oil pump side :15.95mm (0.6280in) 0.09mm (0.0035in)	Replace if over upper limit.
13.05mm (0.5138in)	Replace if over upper limit.
12.94mm (0.5094in)	Replace if under lower limit.
0.060mm (0.00236in)	Replace if over upper limit.
Wear, damage, stretch	Replace if severely worn, damaged or stretch.
	Check that no pressure leaks through rotating parts, sliding parts and sealing parts.
	Replace if non-conductive.
29.04mm (1.1433in)	Replace if over upper limit.
0.36mm (0.0142in)	Replace if over upper limit.
9.96mm (0.3921in)	Replace if under lower limit.
0.11mm (0.0043in) (Wear of oil pump cover is included.)	Replace if over upper limit.
0.16mm (0.0063in)	Replace if over upper limit.

	Part name	Item		Standard value
Electrical parts	Magneto	Ignition timing		TDC - BTDC 35°
		Spark performance (Use genuine spark tester to measure.)	(@500r/min)	10mm (0.4in) or over
		Alternator output	(@5,000 r/min)	12V - 80W
		Stator coil resistance		
		Exciter coil	Black/Red - Blue	236 – 354Ω
		Charge coil	White - Yellow	0.58 – 0.86Ω
		Pulser coil (#1)	Red/White - Black	148 – 222Ω
	Ignition coil	Primary coil resistance	Ground - Orange	0.26 – 0.35Ω
		Secondary coil resistance [kΩ range]	High-tension cord - High-tension cord	6.8 – 10.2kΩ
		High speed ESG operating speed		Control to approximately 6,250r/min.
		Low speed ESG operating speed		Reduce to approximately 3,000r/min.
	Plug cap	Terminal-Terminal resistance [kΩ range]		3.0-7.0kΩ
	Spark plug	Plug type		DCPR6E [NGK]
		Spark gap		0.8-0.9mm (0.032-0.035in)
	C.D. unit	Terminal-Terminal resistance		(Refer to Chapter 8.)
	Rectifier (Except for MF model)	Terminal-Terminal resistance		(Refer to Chapter 8.)
	Starter motor	Battery		12V-40AH – 12V-70AH
		Output		12V 0.4kW
		Clutch		Overrunning clutch
		Brush length		7.5mm (0.295in)
		Commutator undercut		0.5 – 0.8mm (0.020 – 0.031in)
		Commutator outer diameter		20.0mm (0.787in)
	Fuse	Capacity		20A

Serviceable limit	Action to be taken
10mm (0.4in)	If below standard, replace, or check ignition coils, CD unit and spark plug caps.
	Replace if out of specified range
	Replace if out of specified range
	Replace if out of specified range
	Replace if out of specified range
1.2mm (0.047in)	Clean to remove carbon deposit and dirt. Adjust gap by moving side
	electrode. Replace if electrode is severely eroded.
	Replace if out of specified range.
	Replace if out of specified range.
4.0mm (0.157in)	Replace if under lower limit.
0.3mm (0.012in)	Replace if under lower limit.
19.7mm (0.776in)	Replace if under lower limit.

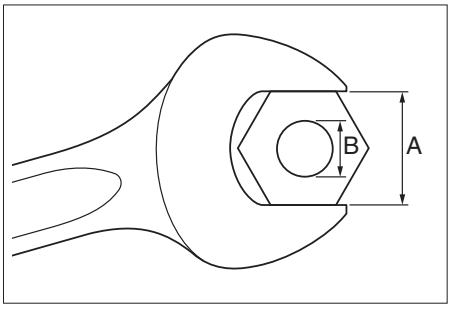
	Part name	Item	Standard value
Cooling system parts	Thermostat	Valve operation starting temperature (submerged)	60°C±1.5°C (140±3°F)
		Valve full open temperature (submerged)	75°C±1.5°C (167±3°F)
		Valve full open lift (submerged)	3.0mm (0.12in) or over
	Pump impeller	Wear, crack	
	Pump case (liner)	Wear	
	Guide plate	Wear	
Lower unit parts	Anode	Gear case anode, wear	
		Bracket anode, wear	
	Clutch spring		58mm (2.2835in)
	Propeller shaft	Wear and damage of bearing	
		Wear of oil seal	
	Bevel gear	Backlash between forward gear (A) and pinion (B)	0.05 – 0.15mm (0.0019 – 0.0059in)
		Refer to relevant section of this chapter.6	Dial gauge reading: 0.14 – 0.42mm
		Reverse gear (C) washer thickness	1.9mm (0.0748in)
	Propeller	Wear, bend, crack, nick	
Other parts	Oil seals	Wear, damage	

Serviceable limit	Action to be taken
Open even a little at ambient temperature	Replace if out of specified range.
Because thermostat operates with some time lag, measure the lift of open valve after maintaining at around 75°C(167°F) for approximately 5 minutes.	
3.0mm (0.12in)	Replace if under lower limit.
If the part is worn, cracked or damaged at the outer ends or at upper of lower lip	Replace pump case liner and guide plate as a set.
	Replace if severely worn.
	Replace if severely worn.
	Replace if severely worn.
	Replace if severely worn.
55.5mm (2.185in)	Replace if under lower limit.
	Replace if severely worn, damaged or stretch.
	Replace if severely worn, damaged or stretch.
0.3mm or over (0.0118in or over)	Adjust or replace.
Dial gauge reading: 0.84mm or over (0.33in or over) 1.75mm or less (0.0689in or less)	Replace.
Damaged	Replace if out of specified range.
Lip is deteriorated, degraded, or damaged, or the tightening margin is reduced to 0.5mm (0.020in) or less by wear.	Replace if out of specified range.

6. Tightening Torque Specifications

	Tightening location	Wrench A	Thread B x +Pitch	Type of fastener	Tightening torque		
					N·m	lb·ft	kg·m
Engine	Cylinder block – Cylinder head bolt	12	M8x1.25	Bolt	① 10	7	1.0
					② 30	22	3.0
		10	M6x1.0	Bolt	① 6	4	0.6
					② 10	7	1.0
	Cylinder block – Crankcase bolt	12	M8x1.25	Bolt	① 10	7	1.0
					②23.5	17	2.4
	Connecting rod	10	M7x1.0	Bolt	① 6	4	0.6
					② 12	9	1.2
	Tappet adjusting	10	M6x0.75	Nut	7	5	0.7
	Flywheel	19	M12x1.25	Nut	55	40	5.5
	Drive (timing) pulley	30	M22x1.0	Nut	50	36	5.0
	Driven (camshaft) pulley	10	M6x1.0	Bolt	11	8	1.1
	Oil pump	10	M6x1.0	Bolt	① 4	3	0.4
					② 9	7	0.9
	Oil pressure switch	24	PT 1/8	—	8	6	0.8
	Plunger	19	M16x1.5	—	30	22	3.0
	Intake manifold	10	M6x1.0	Bolt	① 4	3	0.4
					② 9	7	0.9
	Spark plug	16	M12x1.25	Bolt	18	13	1.8
	Starter motor	13	M8x1.25	Bolt	23.5	17	2.4
	Starter motor bracket	13	M8x1.25	Bolt	23.5	17	2.4
	Power unit mounting	12	M8x1.25	Bolt	12	9	1.2
					23.5	17	2.4
Bottom cowl	Main switch	19	M16x1.5	Nut	3.3	2.4	0.33
	Lanyard stop switch	19	M16x1.5	Nut	2.3	1.7	0.23
	Neutral switch	17	M16x1.5	Nut	3.5	2.5	0.35
Bracket & Drive shaft housing	Bracket bolt nut (MF/EF)	13	M8x1.25	Nylon nut	14	10	1.4
	Bracket bolt nut (EP/EFT/EPT)	32	7/8-14UNF	Nylon nut	25	18	2.5
	Mount Rubber (upper)	10	M6x1.0	Bolt	9	7	0.9
	Steering bracket	—	M8x1.25	Stud bolt	14	10	1.4
	Grease nipple	8	M6x1.0	—	3	2	0.3
	Exhaust plug	—	PT 1/8	—	5	4	0.5
	Engine oil drain plug	16	M14x1.5	Bolt	23.5	17	2.4
PT unit	Tilt cylinder pin installing bolt (Upper)	10	M6x1.0	Bolt	13	9	1.3
	Retaining screw	13	M8x1.25	Bolt	13	9	1.3
	Pump installing screw	—	—	Bolt	5	4	0.5
	Motor ass'y installing screw	—	—	Bolt	5	4	0.5
	Reservoir tank cap	17	—	Bolt	1.5	1.1	0.15
	Manual valve	—	—	—	2	1.5	0.2
Lower unit	Gear case mounting	10	M6x1.0	Bolt	11.5	8.5	1.2
	Extension housing	10	M6x1.0	Bolt	11.5	8.5	1.2
	Propeller nut	17	M10x1.25	Nut	12	9	1.2

	Tightening location	Wrench A	Thread B x +Pitch	Type of fastener	Tightening torque		
					N•m	lb•ft	kg•m
Standard torque	M4 bolt and nut		M4 x 0.7	Bolt and nut	1.5	1.1	0.15
	M5 bolt and nut		M5 x 0.8	Bolt and nut	4	3	0.4
	M6 bolt and nut		M6 x 1.0	Bolt and nut	6	4	0.6
	M8 bolt and nut		M8 x 1.25	Bolt and nut	13	9	1.3
	M10 bolt and nut		M10 x 1.25	Bolt and nut	27	20	2.7



7. Sealant and Lubricant

Apply to			Screw locking agent	Gasket sealing agent	Instantaneous adhesive	Adhesive	Cold resistant lithium grease LIT	Water resistant grease OBM	Teflon grease TEF	Silicone grease SOC	4 stroke engine oil	Tohatsu genuine gear oil	PT fluid	Remarks
			Three-Bond	LOC-TITE	Three-Bond	Konishi				Shin-Etsu Chemical				
			1342	518	1741	G17	Centax L2	FM-53 1	LM-90 2	KS-64			ATF	
Engine block	Cylinder head	Camshaft (cam lobe, and fuel pump driving section)									○			Bearings and cams
		Oil seal (cam shaft)					○							Lip
											○			Periphery, at press fitting
		Rocker arm									○			Bearings and slippers
		Rocker arm shaft									○			Periphery
		Rocker arm spring									○			Whole area
		Washers (rocker arm)									○			Whole area
		Valves (INT,EX)									○			Stem and stem end
		Valve springs									○			Whole area
		Valve springs seat									○			Whole area
		Retainer, cotter									○			Whole area
		Valve stem seals (INT,EX)									○			Lip and inside
		Tappet adjusting screws									○			Whole area
		Oil pump									○			Approx. 2cc from bearing and intake port (undisassemblable)
		Fuel pump									○			Tip of plunger
		O ring (fuel pump)									○			
		O ring (filler cap)									○			
		Bolt (cam pulley)	○											Thread (when bolt is reused)
	Cylinder block, crank case	Cylinder liner									○			Inner wall
		Pistons									○			Ring grooves and periphery
		Piston rings									○			Whole area
		Piston pins									○			Periphery
		Connecting rods									○			Big and small end bores
		Crankshaft									○			Sliding surface
		Crank metal									○			Both surface
		Oil seal (crankshaft)					○							Lip
		Mating faces of cylinder block and crank case		○										Mating surfaces
		Plunger ass'y									○			Inside (approx. 1mℓ, disassemblable)
	Starter case	Starter case					○							Sliding face
		Starter spring					○							Whole area
		Ratchet					○							Sliding face
		Friction plate					○							Sliding face
		Reel					○							Sliding face
		Bolt (reel)	○											Thread
		Starter seal rubber			○									when sticking

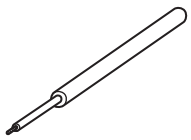
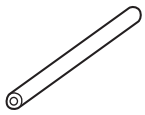
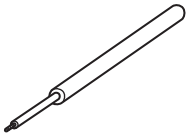
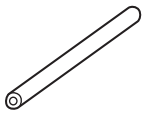
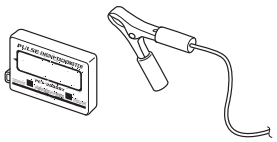
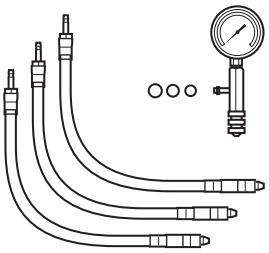
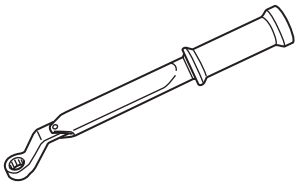
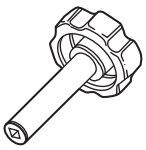
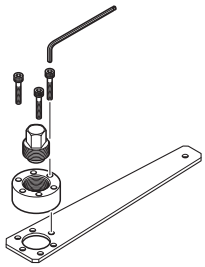
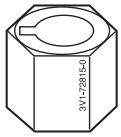
Apply to			Screw locking agent	Gasket sealing agent	Instantaneous adhesive	Adhesive	Cold resistant lithium grease LIT	Water resistant grease OBM	Teflon grease TEF	Silicone grease SOC	4 stroke engine oil	Tohatsu genuine gear oil	PT fluid	Remarks
			Three-Bond	LOC-TITE	Three-Bond	Konishi				Shin-Etsu Chemical				
			1342	518	1741	G17	Centax L2	FM-53 1	LM-90 2	KS-64			ATF	
Engine block	Electrical components	Spark plug cap								○				Spark plug bore
						○								High tension cord bore
		Oil pressure switch	○											Thread
										○				Terminal
		Starter motor								○				Terminal
								○						Apply lightly to pinion
		Starter solenoid								○				Terminal
		Choke solenoid bracket					○							Plate caulking (pin)
		Choke solenoid plunger					○							Apply thinly to the periphery.
		Bolt (C.D. unit)	○											at reusing bolts
Lower Unit	Shift system	Shift lever						○						Bearing
		Seal ring (shift lever)						○						Lip
		Shift rod lever						○						Sliding face、shift rod bore
		Screw (shift rod lever)	○											Thread
	Drive shaft housing	Oil seal (drive shaft housing)							○					Apply 3 grams to lip, and to exterior of oil seal after installing drive shaft.
											○			Periphery, at press fitting
		Tapered plug 1/8	○											Thread
		Bolt (idle port cover)	○											Thread
	Drive shaft	Drive shaft (spline)							○					Crankshaft side spline
		Ball bearing										○		at press fitting
		Needle bearing inner										○		at press fitting
	Gear case	Oil seal (lower pump case)					○							Lip
												○		Periphery, at press fitting
		Pump case liner						○						Impeller sliding surface
		Water pipe seal (lower)										○		Inside
		O ring (cam rod bushing)										○		
		Bolt (cam rod bushing)						○						Thread (at reusing bolts)
		Bolt (pump case)						○						Thread
		Ball bearing										○		at press fitting
		Needle bearing										○		at press fitting
		Bolt (gesr case)	○											at reusing bolts
		Bolt (extension housing)	○											at reusing bolts

Apply to			Screw locking agent	Gasket sealing agent	Instantaneous adhesive	Adhesive	Cold resistant lithium grease LIT	Water resistant grease OBM	Teflon grease TEF	Silicone grease SOC	4 stroke engine oil	Tohatsu genuine gear oil	PT fluid	Remarks
			Three-Bond	LOC-TITE	Three-Bond	Konishi				Shin-Etsu Chemical				
			1342	518	1741	G17	Centax L2	FM-53 1	LM-90 2	KS-64			ATF	
Lower Unit	Propeller shaft housing	Bolt (propeller shaft housing)						○						Thread
		O ring										○		
		Oil seal					○							Lip
												○		Periphery, at press fitting
		Propeller shaft						○						Spline
		Needle bearing										○		at press fitting
	Bracket	Clamp screw						○						Thread
		Swivel bracket (steering shaft bore)						○						Fill interior with grease.
		Swivel bracket (bracket bolt)						○						Sliding face
		Swivel bracket (tilt stopper mount)						○						Sliding face
		O ring (steering shaft)						○						at assembling
		Friction adjusting bolt						○						Thread
		Co-pilot bolt						○						Female side
		Stern bracket (EP, EPT)						○						Inner sliding surfaces
		Nut 7/8 (bracket bolt)	○											Fixed side nut
		Bolt (steering bracket)	○											at reusing bolts
		Bolt (distance piece) (EP, EPT)	○											Thread
		Mount rubber (upper) mounting bolt	○											Thread
	Tiller handle	Bushing (tiller handle)						○						Inner and outer surfaces
		Throttle shaft						○						Sliding face (except slide adjusting section)
		Throttle wire						○						Wire section
		Throttle shaft support	○											Thread
	Cowling	Bolt (cowl rutch rear)	○											Thread
Nipples			○											Press fit section
Amount of engine oil											○			0.8L when replaced,
Gear case												○		Oil capacity 320 cm^3
PT unit													○	

3

Maintenance

1. Special Tools

			
Spring Pin Tool A (ø3.0) P/N. 345-72227-0	Spring Pin Tool B (ø3.0) P/N. 345-72228-0	Spring Pin Tool A (ø3.5) P/N. 369-72227-0	Spring Pin Tool B (ø3.5) P/N. 369-72228-0
Removing spring pin	Installing spring pin	Removing spring pin	Installing spring pin
			
Tachometer P/N. 3AC-99010-0	Compression Gauge P/N. 3AC-99030-0	Torque Wrench P/N. 3AC-99070-0	Valve Clearance Driver P/N. 3AC-99071-0
Measuring engine revolution speed	Measuring compression pressure	Adjusting valve clearance	Adjusting valve clearance
			
Flywheel Puller Kit P/N. 3V1-72211-0	Crank Shaft Holder P/N. 3V1-72815-0		
Removing/installing flywheel	Holding crank shaft		

2. Inspection Schedule

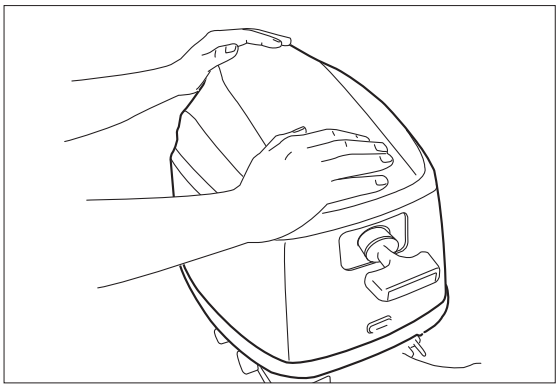
	Part to be inspected	Inspection period				Inspection item	Remarks
		Initial 20 hours or 1 month	50 hours or 3 months	100 hours or 6 months	200 hours or 1 year		
Fuel System	Carburetor			O	O	Disassembly, cleaning and inspection	
	Fuel Filter	O	O	O	O	Inspection	Replace
	Piping	O	O	O	O	Damage and leak from connections	
	Fuel Tank	O		O	O	Inspection dirt and water	Clean
Ignition System	Spark Plugs	O		O	O	Spark gap, cleaning	0.8 - 0.9mm
Starting System	Starter Rope	O	O	O	O	Wear	
	Starter Motor			O	O	Salt,battery cords	
	Battery	O	O	O	O	State of installation, electrolyte level, specific gravity	
Engine	Engine oil	O Replacement		O Replacement	O Replacement	Inspection slagged	0.8L
	Oil Strainer				O		Clean
	Valve Clearance	O			O	Inspection, Adjustment	
	Timing Belt			O	O	Wear, Damage, Elongation	
	Compression Pressure				O	Inspection	
	Anode			O	O	Corrosion, Wear	
	Thermostat			O	O		
Lower System	Propeller	O	O	O	O	Corrosion, closed condition, wear Bend, damage, wear of blades	
	Gear Oil	O Replacement	O	O Replacement	O Replacement	Replacement or replenishment of oil, leak of water	Tohatsu's genuine gear oil (GL5,SAE80 to 90)
	Anode		O	O	O	Corrosion, Wear	
	Water Strainer	O	O	O	O	Inspection slagged	Clean
	Water Pump Impeller		O	O	O	Wear, Crack	
Bolts and Nuts		O	O	O	O	Retighten.	
Throttle Wire				O	O	Inspection extended, wear	Replace
Remote Control Cable			O	O	O	Adjuse	
Sliding areas, rotating part, grease nipple		O	O	O	O	Applying grease, injecting grease	

Note : The manual recommends the engine be inspected after every 300 hours of operation.

3. Inspection Items

1) Inspection of Top Cowl

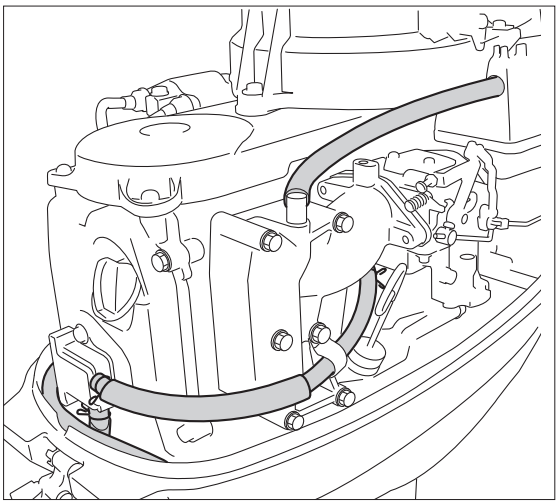
Push top cowl using both hands to check for looseness and state of closing.

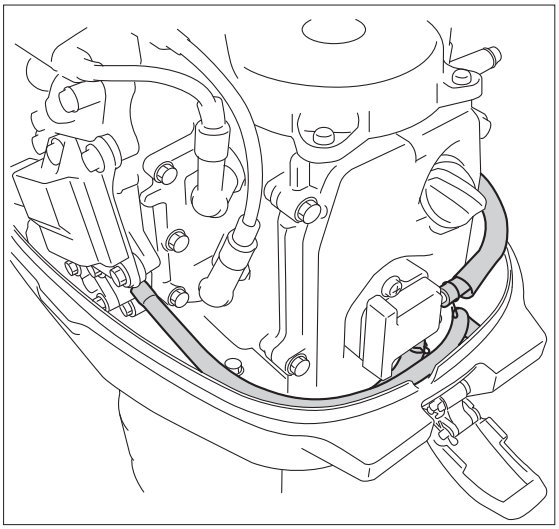


2) Fuel System

Check piping

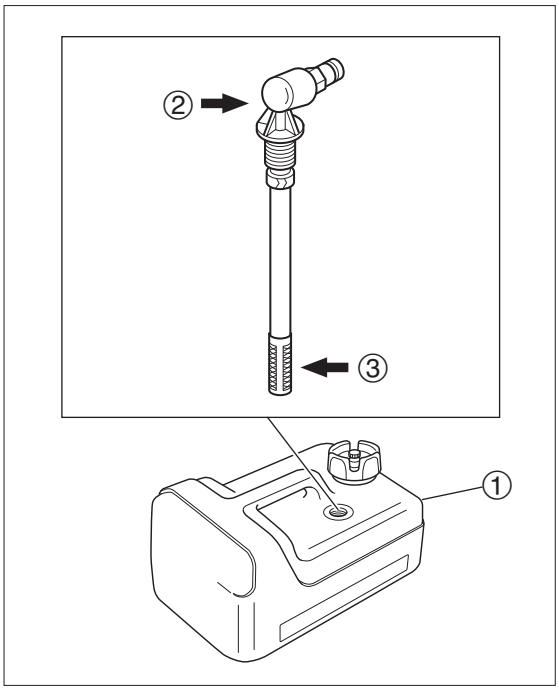
Check the fuel system piping for fuel leak, dirt, deterioration and damage, and replace or clean parts if necessary.





3) Inspection of Fuel Tank

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

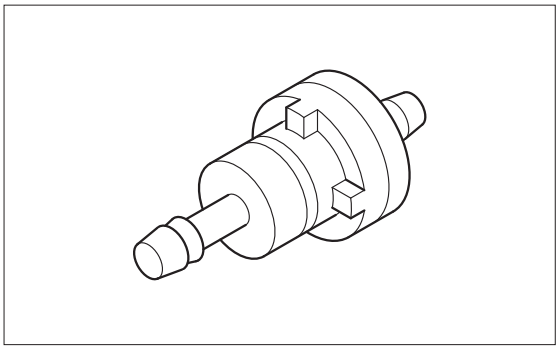


② Fuel pickup elbow
③ Filter

4) Inspection of Fuel Filter

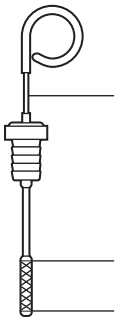
Check fuel filter for dirt, build up of fuel slag, and fuel filter for invasion of foreign matters and crack. Replace fuel filter if necessary.

Do not spill fuel when removing fuel filter.



5) Replacement of Engine Oil

1. Oil Level

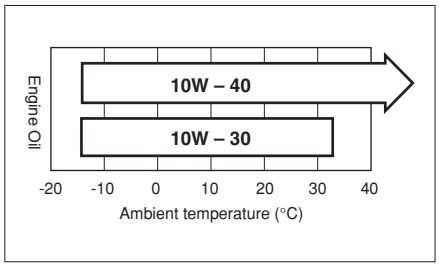


	Quantity of Oil for Full Replacement
Upper Limit	0.8L
Lower Limi	0.6L

2. Oil Specification

Engine Oil :
4 Stroke Engine Oil
API: SE, SF, SG, SH, SJ, SL, SM
SAE: 10W-30, 10W-40
NMMA : FC-W Certified 10W-30/40
Quantity of Engine Oil : 0.8L (0.84qt)

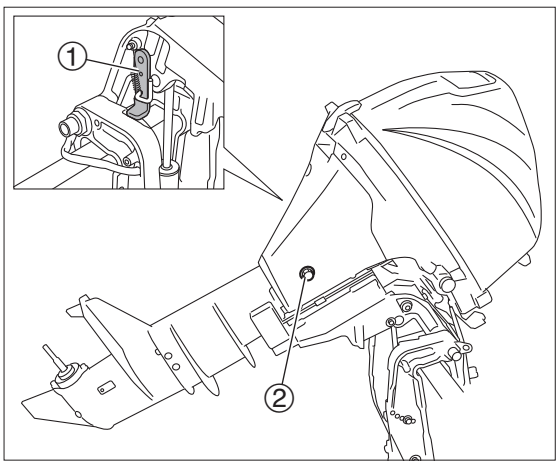
Use oil with viscosity that is suited to ambient air temperature of the operating region.

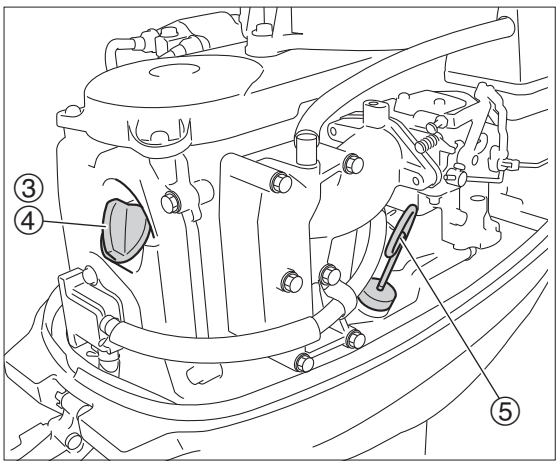


3. Engine Oil Replacement Procedure

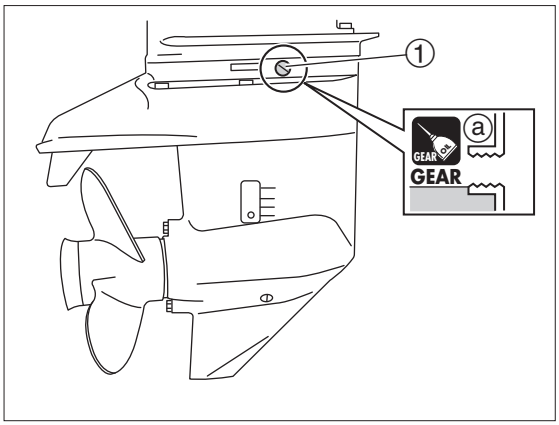
Use of engine oil containing dirt or water can significantly shorten the lives of rotating and sliding parts of engine.
Oil replacement procedure:

1. Stop engine, tilt-up outboard motor, and lock with tilt stopper ①.
2. Incline outboard motor so that drain bolt ② is directed downward.
3. Remove top cowl and then oil filler cap ③.
4. Place drain oil pan below drain bolt ②.
5. Remove drain bolt ② to drain oil.
6. Tighten drain bolt ②.
   Note: Apply engine oil to the washer (gasket) of drain bolt ②.
7. Disengage tilt lock and tilt down outboard motor.
8. Pour new engine oil into oil inlet ④ until oil level reaches upper limit mark of oil level gauge ⑤.
9. Attach oil filler cap ③ and oil level gauge ⑤, start and run engine for 5 minutes to warm up.
10. Stop engine and check oil level and oil leak after 5 minutes.





6) Inspection of Gear Oil Quantity



1. Tilt down outboard motor to make it vertical.

2. Remove upper oil plug ① and check level of gear oil in the gear case.

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

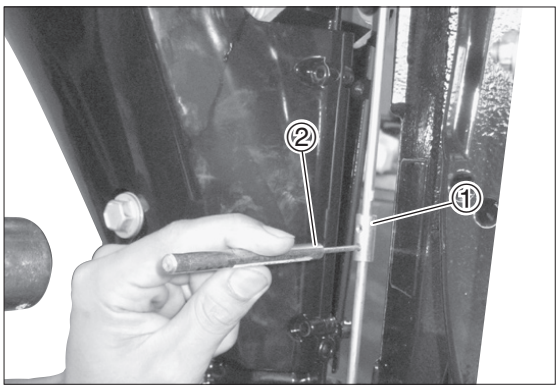
3. Add recommended gear oil to specified level if it is lacking.

> **Gear Oil : 320cm³** (10.8fl.oz)
> Hypoid Gear Oil
> API : GL-4, GL-5
> SAE : #80W-90, #90

> If the oil is lacking much, add through lower oil plug hole.

4. Attach upper oil plug ①.

7) Inspection of Water Pump



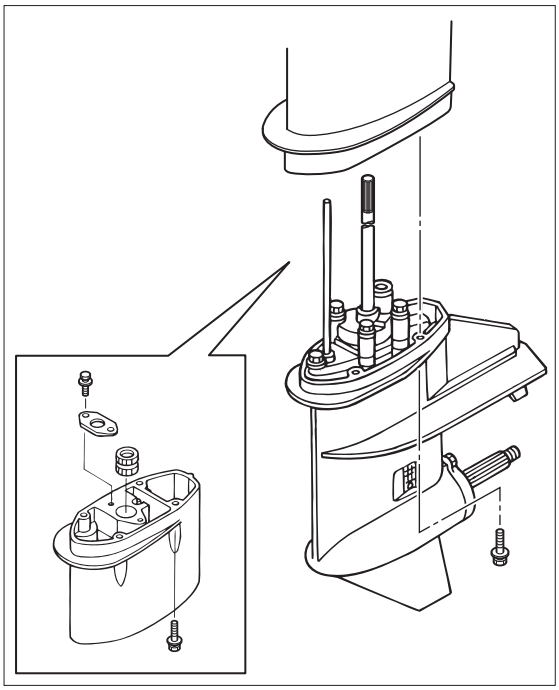
> Inspection of water pump does not require removal of power unit from outboard motor body.

1. Remove spring pin and disconnect shift rod.
(Disconnect shift rod at lower side of shift rod joint ①.)

> · Disconnect shift rod at lower side of shift rod joint ①.
> · Use spring pin tool to remove spring pin.
> · Do not reuse removed spring pin.

> **Spring Pin Tool A** ② (ø3.0) **:**
> P/N. 345-72227-0

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



3. Remove pump case (Upper) ③.

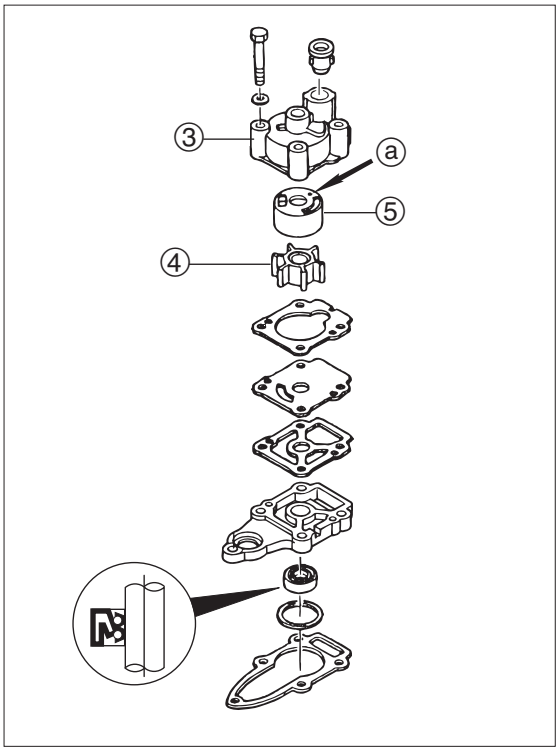
4. Remove impeller ④ and check it.

5. Check upper pump case for deformation. Replace if necessary.

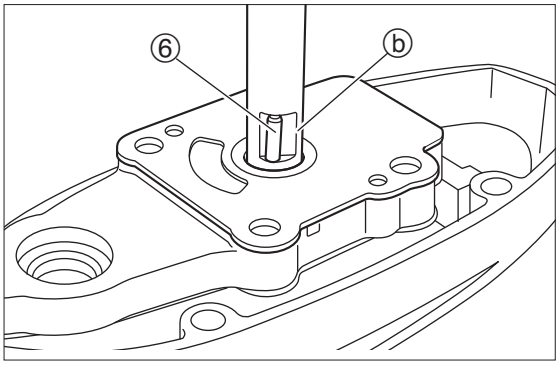
6. Check impeller ④ and pump case liner ⑤ for crack and wear. Replace if necessary.

7. Check pin ⑥ and drive shaft groove ⓑ for wear. Replace if necessary.

8. Reinstall the part. For details, refer to Chapter 6.



ⓐ Projection



8) Replacement of Gear Oil

1. Tilt outboard motor a little as shown.
2. Place waste oil container below lower oil plug ①, and then, loosen upper oil plug to release inner pressure and retighten upper oil plug.
   Then, remove lower oil plug ① and then upper oil plug ② to drain oil. Remove lower oil plug first when draining.

> Remove lower oil plug first when draining.

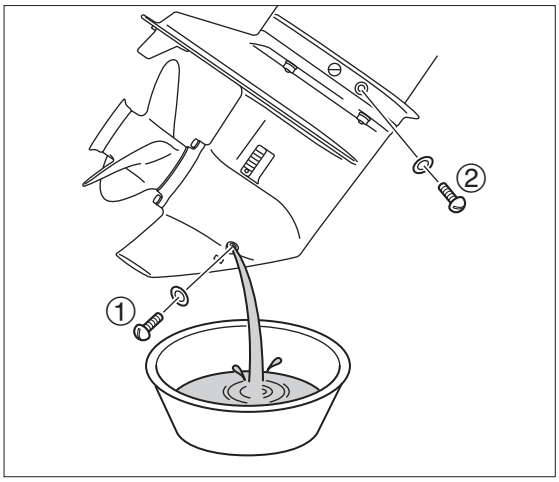
3. Check gear oil for presence of metal particles, change of color (abnormal if clouded), and viscosity. Check lower unit internal components if necessary.
4. Fill with gear oil (from oil tube or pump) through lower plug hole ① until gear oil starts to spill from upper oil plug hole ⓐ without air bubble.

> **Gear Oil :**
> Hypoid Gear Oil
> API : GL-4, GL-5 SAE : #80W-90, #90
> **Quantity of Gear Oil :**
> 320 cm^3 (10.8fl.oz)

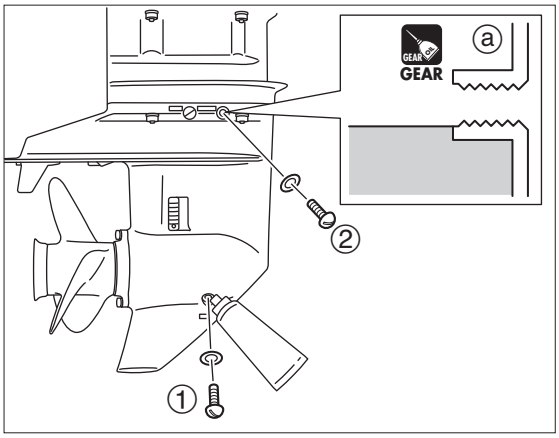
> Use lower plug hole when filling with gear oil. Upper hole cannot be used because doing so will not allow air to evacuate from gear case.

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

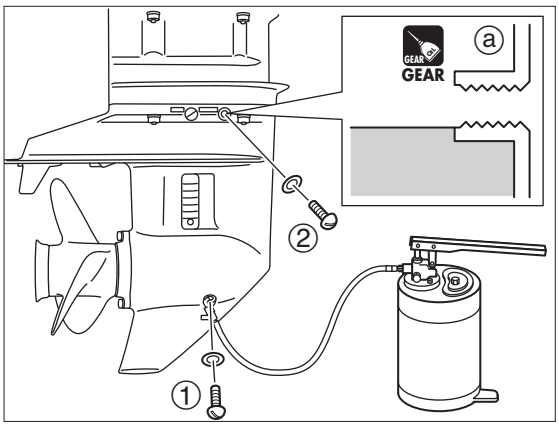
> When fully filled with oil, attach upper oil plug first.



Gasket **Do not reuse.**



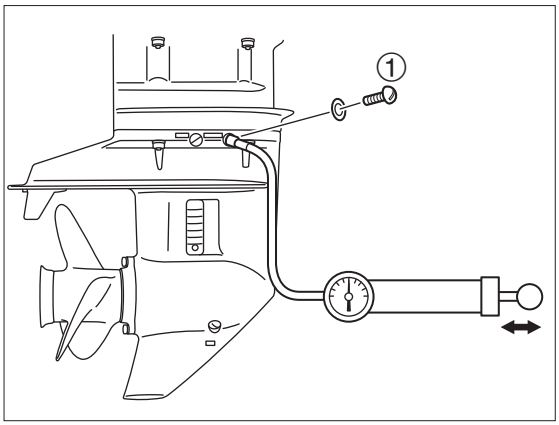
Gasket **Do not reuse.**



Gasket **Do not reuse.**

3

9) 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 base, and check if the pressure is maintained without further compression for 10 seconds.

Specified Gear Case Maintained Pressure :
0.069 MPa (10 psi) [0.7 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

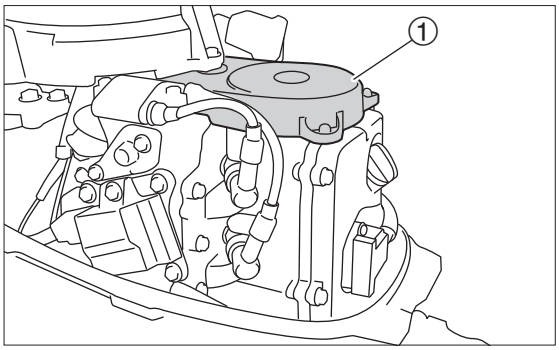
Do not apply pressure to gear case over specified value.
Doing so can cause damage to oil seal.

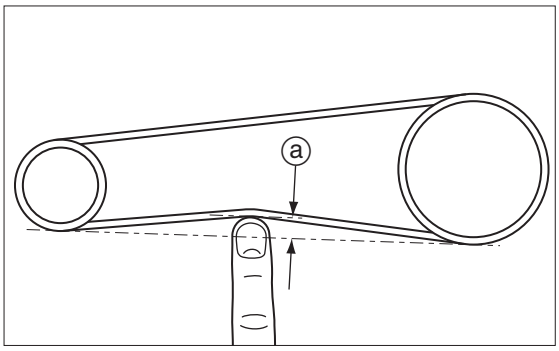
4. If the specified pressure cannot be maintained, check oil seals of drive shaft and propeller shaft and O ring of shift shaft, and propeller shaft housing and water pump case lower for damages.

10) Inspection of Timing Belt

1. Remove belt cover ①, and then check timing belt inner and outer surfaces for cracks, damages and wear while rotating flywheel clockwise with hands. Replace if necessary.

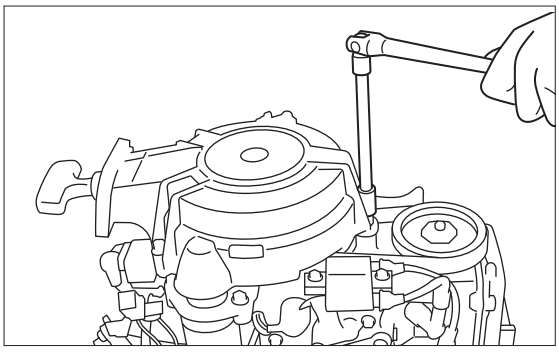
Elongation limit ⓐ :
Press belt at the center, and replace if deflected over 10mm.





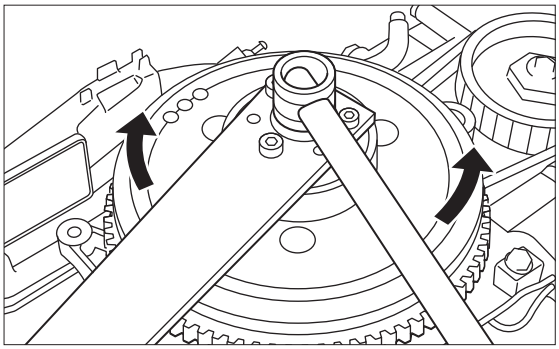
11) Replacement of Timing Belt

1. Remove recoil starter and belt cover.



2. Loosen flywheel nut.

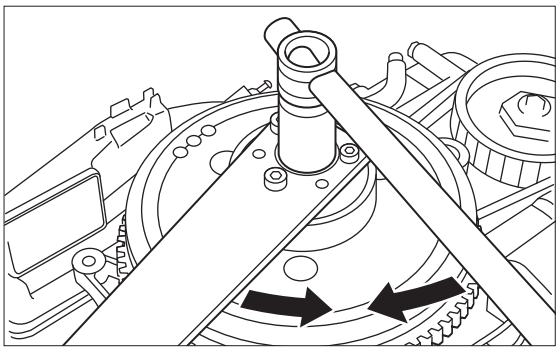
Flywheel Puller Kit :
P/N. 3V1-72210-0



3. Use flywheel puller bolt to remove flywheel and then key.

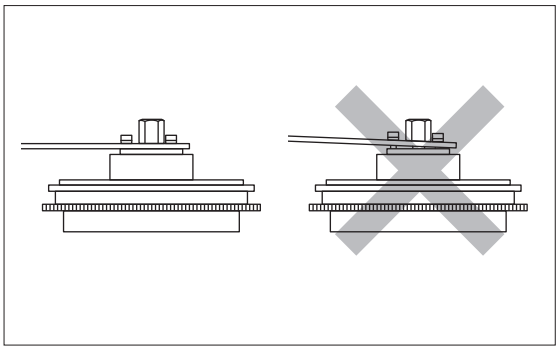
Flywheel Puller Kit :
P/N. 3V1-72210-0

Screw puller onto crankshaft end until flywheel is disengaged from tapered section of crankshaft.

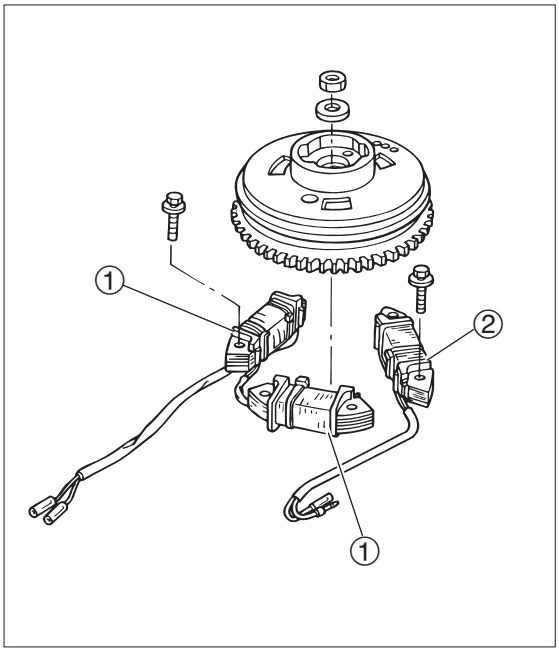


⚠ CAUTION

To prevent damages to engine and special tools, tighten flywheel puller set bolts evenly and keep flywheel puller parallel to flywheel while working.

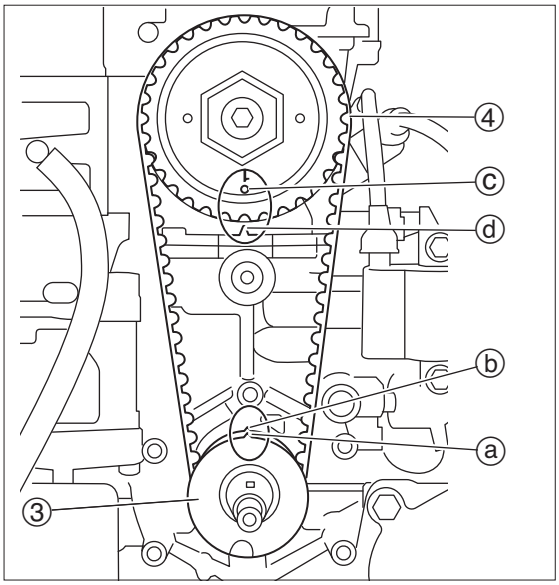


4. Remove bolts of alternator ① and exciter coil ②, and remove alternator and exciter coil.

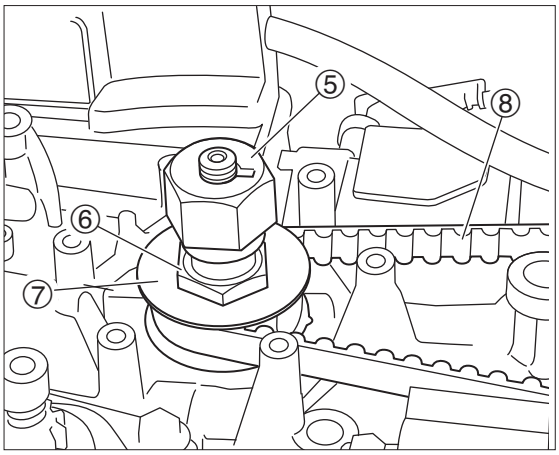


5. Turn timing pulley ③ clockwise to bring "▲" mark ⓐ of timing pulley to "▲" mark ⓑ of cylinder block, and check that "●1" mark ⓒ of cam shaft pulley ④ and "▲" mark ⓓ of cylinder head are aligned with each other.

No.1 piston is to be at top dead center of compression stroke.



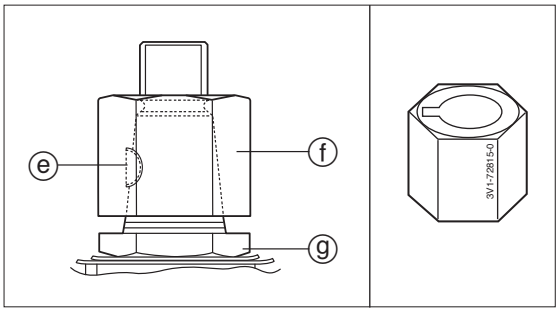
6. Attach crankshaft holder ⑤ to crankshaft and secure it.



7. Loosen timing pulley nut ⑥ and remove it.
Remove belt guide ⑦.

- Use 32mm socket wrench and 30mm spanner wrench for this step.
- When loosening nut ⑥ of timing pulley ③ , hold cam shaft pulley ④ to prevent it from being turned.
- Keep timing belt ⑧ engaged as a means of precaution.

Crank Shaft Holder ⑤ :
P/N. 3V1-72815-0

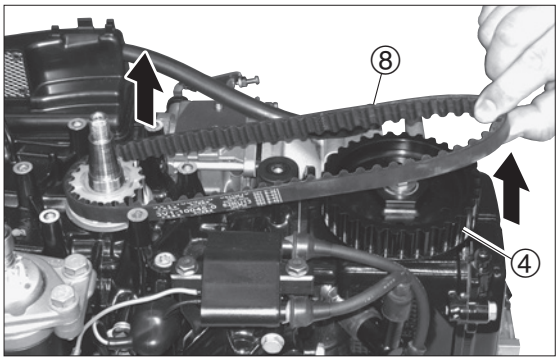


ⓔ Magneto key
ⓕ Crankshaft holder
ⓖ Pulley nut

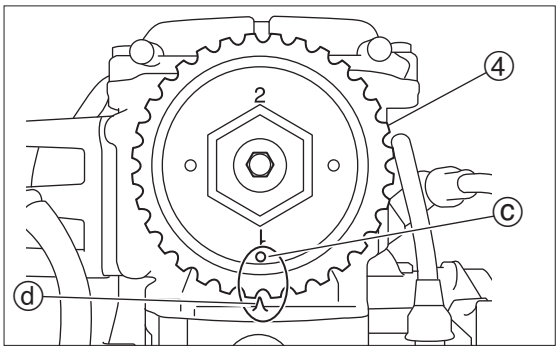
8. Remove timing belt ⑧ from cam shaft pulley ④ side, and then, from timing pulley side.

⚠ CAUTION

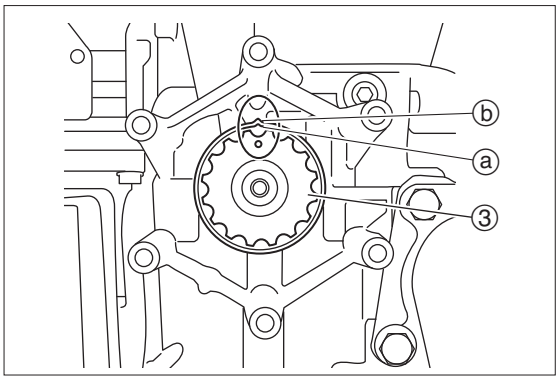
Do not turn timing pulley (crank shaft) or cam shaft pulley with timing belt removed. Doing so can make pistons and valves interfere with each other, possibly resulting in damages to these parts.



9. Check that "●1" mark ⓒ of cam shaft pulley ④ and "▲" mark ⓓ of cylinder head are aligned with each other.

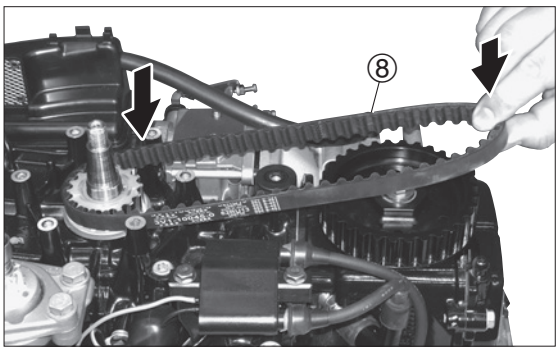


10. Check that "▲" mark ⓐ of timing pulley ③ and "▲" mark ⓑ of cylinder head are alighened with each other.



> #1 piston is to be at top dead center of compression stroke.

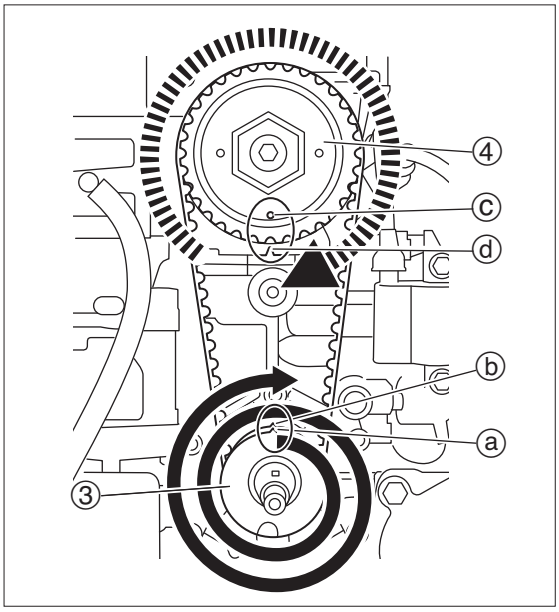
11. Face part number side up of new timing belt ⑧, and engage belt with timing pulley and then with cam shaft pulley.



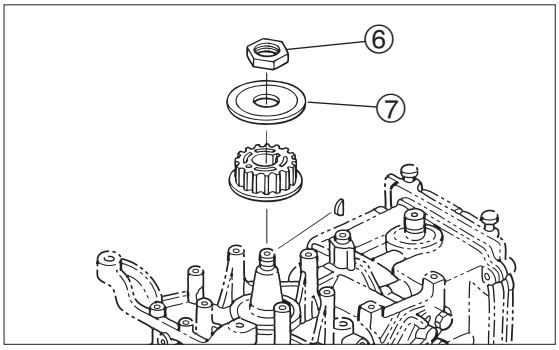
⚠ CAUTION

- **Be careful not to damage timing belt when installing.**
- **Do not twist timing belt, bring inside out, or bend sharp, or it may be damaged.**
- **Be careful not to allow oil or grease to adhere to timing belt.**

12. Turn timing pulley ③ two times clockwise to make timing belt conform to the pulley, and then, check that crankshaft turns smoothly, and the marks ⓐ and ⓑ, and ⓒ and ⓓ, of pulleys ③ and ④ are aligned with each other respectively.



13. Put belt guide ⑦, and secure it with nut ⑥ by tightening the nut temporarily.

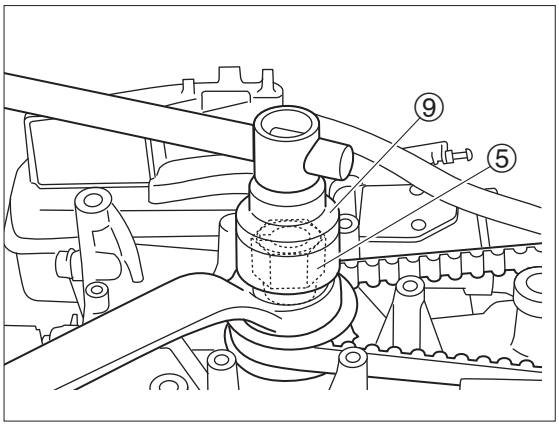


14. Tighten timing pulley nut to specified torque.

- Put pulley nut with chamfered face down.
- Use 32mm socket wrench ⑨ and 30mm spanner wrench for this step.

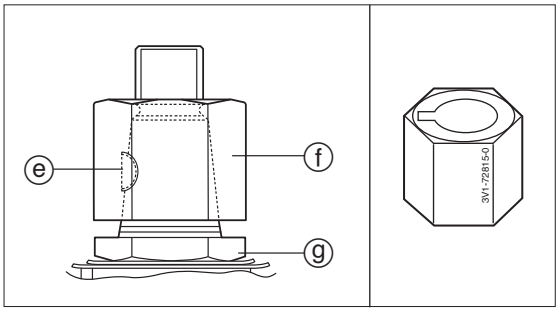
Crankshaft holder ⑤ :
P/N. 3V1-72815-0

Timing Pulley Nut :
50 N · m (36 lb · ft) [5.0 kgf · m]



⑤ Crankshaft holder
⑨ Deep socket 32mm

15. Install alternator and exiter coil.



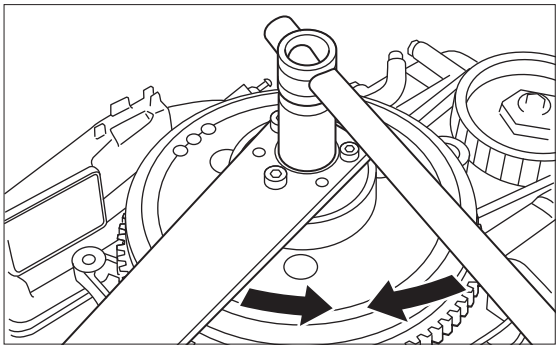
ⓔ Magneto key
ⓕ Crankshaft holder
ⓖ Pulley nut

16. Align key slot of flywheel and crankshaft firmly, then install flywheel.

17. Tighten flywheel nut to specified torque.

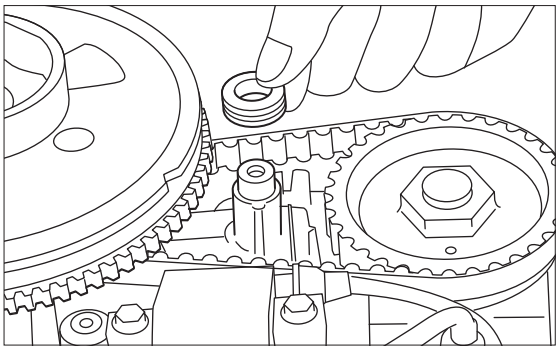
Flywheel puller ass'y :
P/N. 3V1-72211-0

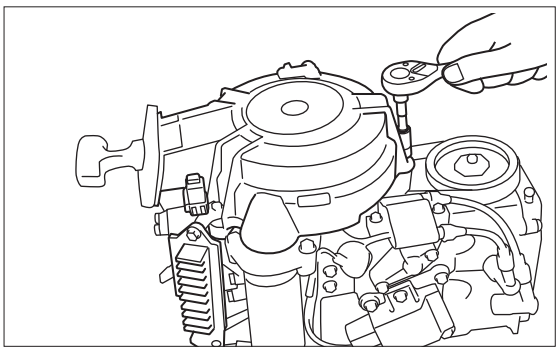
Flywheel Nut :
55 N · m (40 lb · ft) [5.5 kgf · m]

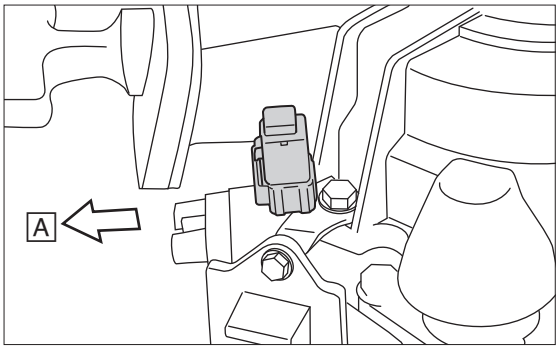


18. Attach grommet to crank case, and then, install recoil starter, fuse holder, cable terminal holder, and belt cover.

- Use port side bolt to secure fuse holder.
- Install fuse holder with hook face directed bow side [A].

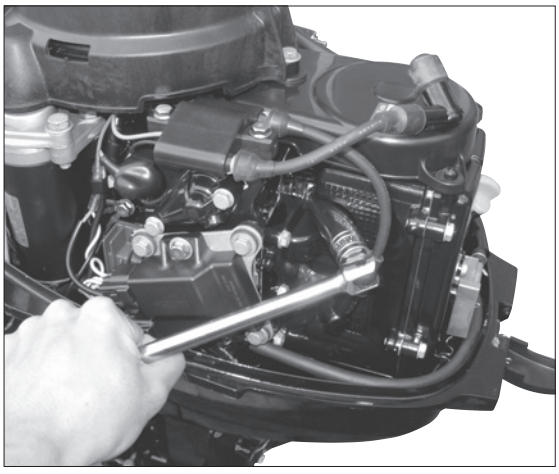






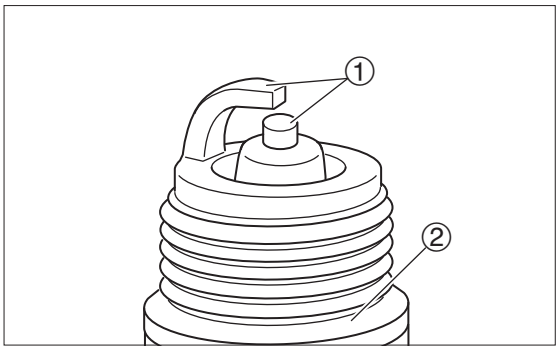
12) Inspection of Spark Plugs

1. Remove plug caps and then spark plugs.



2. Use spark plug cleaner or wire brush to clean spark plug electrodes ①. Replace if necessary.

3. Check electrodes ① for corrosion or excessive build up of carbon, and washer ② for damage. Replace if necessary.

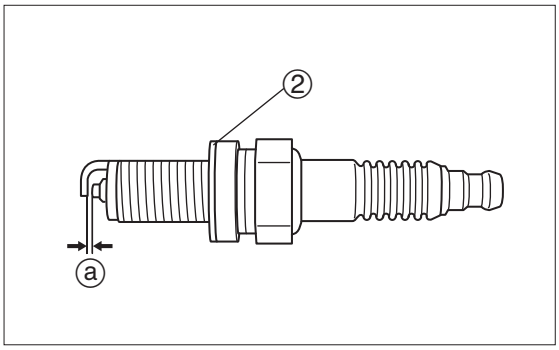


4. Check spark plug gap ⓐ. Replace if it is over specified value. Adjust gap if it is out of specified range.

Spark Plug Gap ⓐ : Standard value
0.8 - 0.9mm (0.031 - 0.035in)

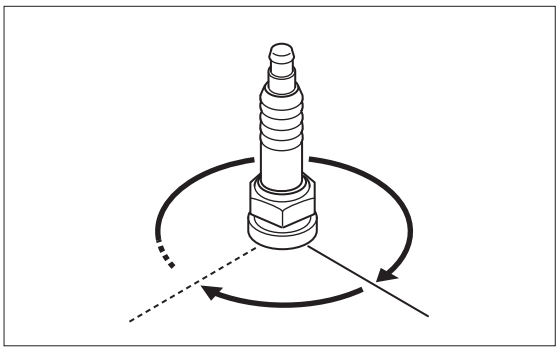
Functional Limit :
1.2mm (0.047in)

Specified Spark Plug :
DCPR6E [NGK]



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

Spark Plugs :
18 N m (13 lb ft) [1.8 kgf m]



13) Inspection of Compression Pressure

1. Start and run 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

Remove lock plate (of stop switch lanyard) from stop switch before measuring compression pressure. This will prevent engine from accidental starting.

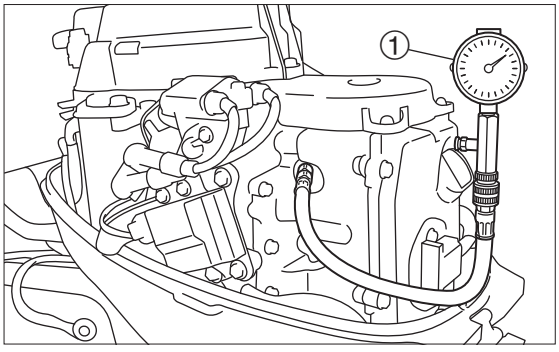
4. Remove all plug caps and then all spark plugs.

⚠ CAUTION

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

5. Install compression gauge ① to plug hole.

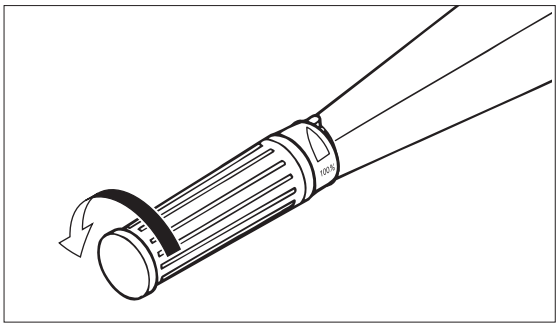
Compression Gauge ① :
P/N. 3AC-99030-0



6. Fully open throttle, crank engine until compression gauge indication stabilizes, and then measure compression pressure.

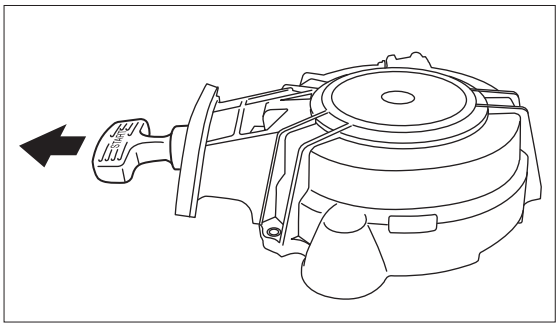
Compression Pressure (Reference) : 500 r/min
: 0.88 MPa (128 psi) [0.9 kgf/cm²]

Compression pressure varies depending on the cranking speed, and normally changes at least as much as approximately 10%.



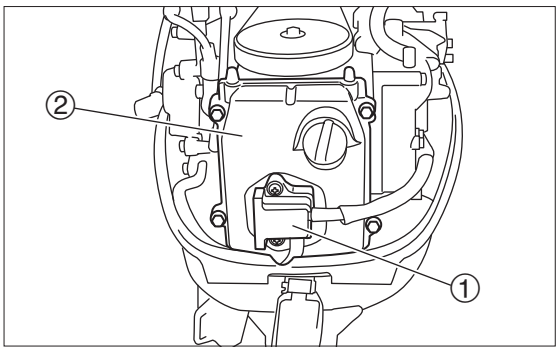
7. If compression pressure is below specified value or varies much among cylinders, put small amount of engine oil into cylinders, and perform the test again.

- If compression pressure increases after the above measure, check pistons and piston rings for wear. Replace if necessary.
- If compression pressure does not increase after the above measure, check valve clearances, valves, valve seats, cylinder sleeves, cylinder head gaskets and cylinder head. Adjust or replace if necessary.



14) Inspection and Adjustment of Valve Clearance

Perform inspection and adjustment of valve clearances when engine is cold.



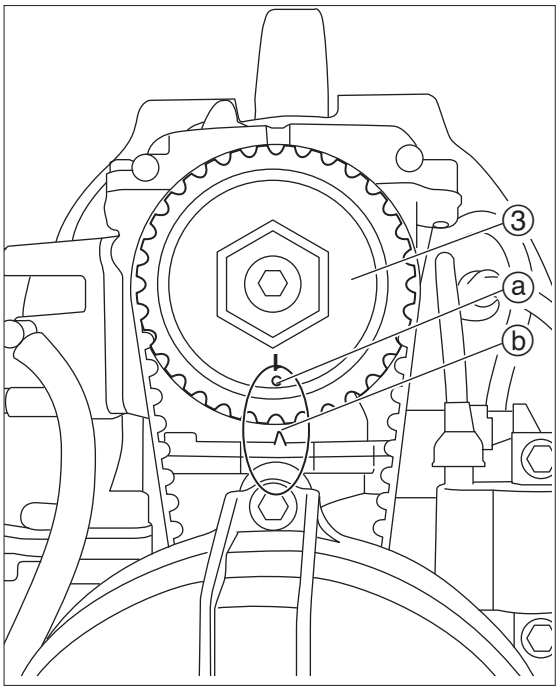
1. Disconnect starter lock cable (upper), and then recoil starter and belt cover.

2. Remove fuel pump ①.

3. Disconnect plug caps, then remove all spark plugs and cylinder head cover ②.

When removing or installing cylinder head cover, use 10mm ring wrench with large offset angle.

4. Pull starter rope slowly to bring "●1" mark ⓐ of cam shaft pulley ③ to "▲" mark ⓑ of cylinder head.

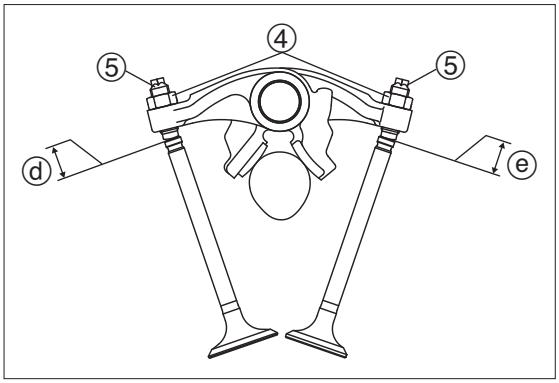


#1 piston is to be at top dead center of compression stroke.

5. Check and adjust #1 cylinder's intake and exhaust valve clearances.

Valve Clearance (when engine is cold) :
(IN) intake side ⓓ : 0.13 - 0.17mm (0.0051 - 0.0067in)
(EX) exhaust side ⓔ : 0.18 - 0.22mm (0.0071 - 0.0087in)

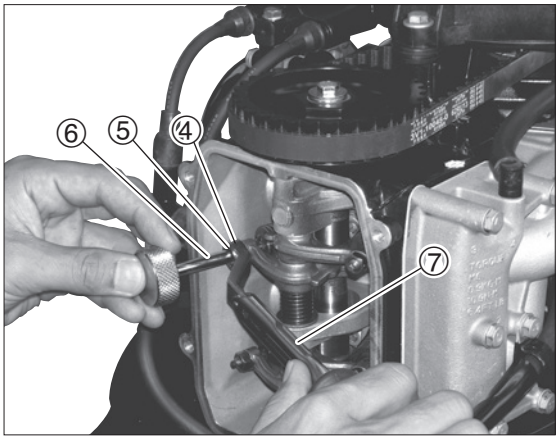
6. Loosen rocker arm lock nut ④, and turn adjusting screw ⑤ so that valve clearances are within the specified range.



- Turning adjust screw ⑤ clockwise makes valve clearance smaller.
- Turning adjust screw ⑤ counterclockwise makes valve clearance larger.

Valve Clearance Driver ⑥ :
P/N. 3AC-99071-0
Torque Wrench ⑦ :
P/N. 3AC-99070-0
Thickness gauge :
Use commercially available item.

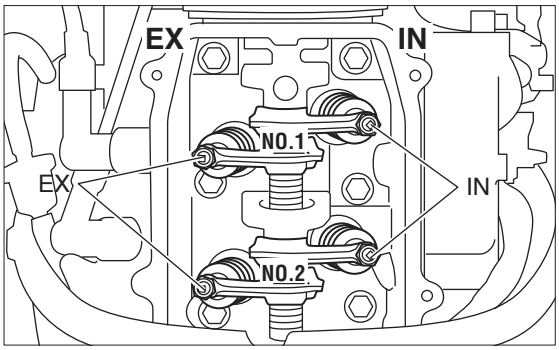
7. Tighten rocker arm lock nut ④ to specified torque, and check valve clearance again. Readjust if necessary.



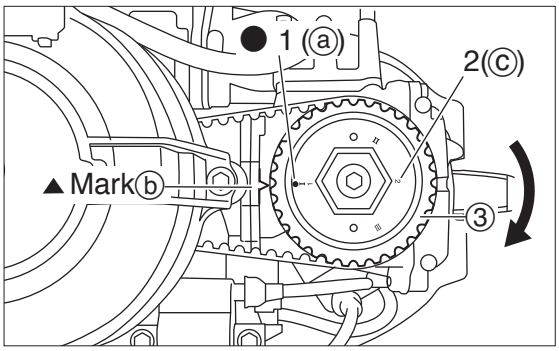
Lock Nut ④ :
7 N m (5 lb ft) [0.7 kgf m]

Valve Clearance (when engine is cold) :
(IN) intake side ⓓ : 0.13 - 0.17mm (0.0051 - 0.0067in)
(EX) exhaust side ⓔ : 0.18 - 0.22mm (0.0071 - 0.0087in)

8. Rotate flywheel clockwise to bring “2” mark of cam shaft pulley ③ to “▲” mark ⓐ of cylinder head.



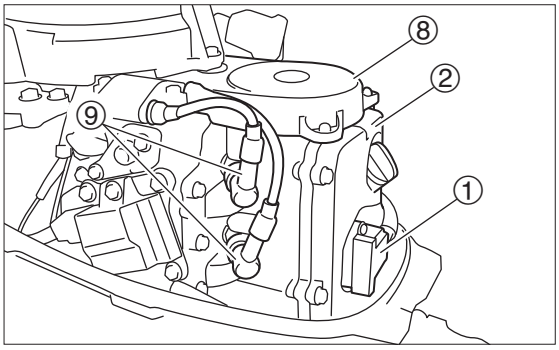
9. Check and adjust #2 cylinder's intake and exhaust valve clearance in the same procedure as #1 cylinder.



10. Reconnect starter lock cable (upper).

11. Attach new O ring, cylinder head cover ②, fuel pump ①, all spark plugs, recoil starter, and belt cover ⑧.

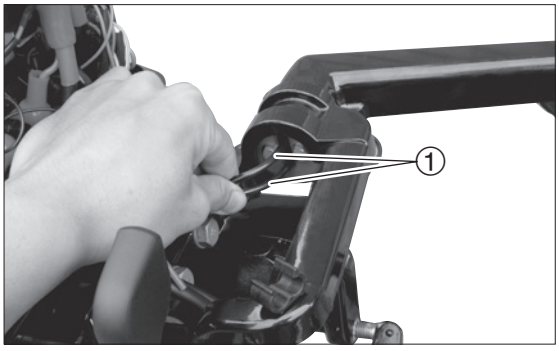
12. Attach spark plug caps ⑨.



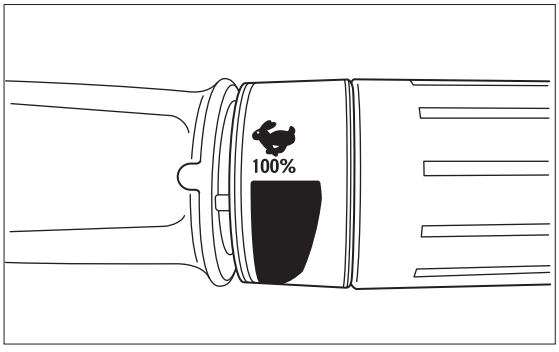
15) Throttle Cable

For F type

1. Push outer ① of throttle cable fully into tiller handle.

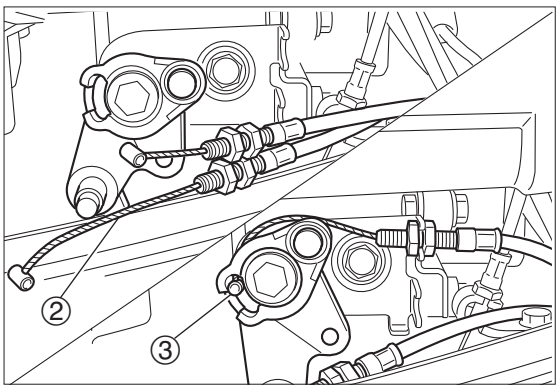


2. Turn throttle grip to wide open throttle position.

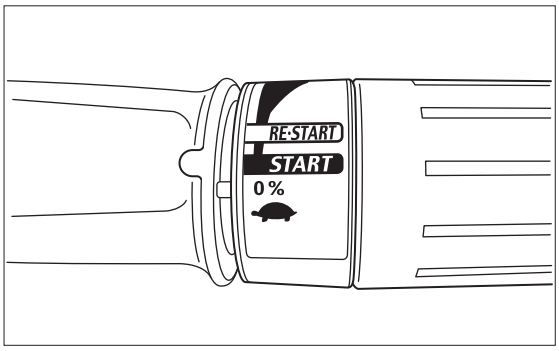


3. Put throttle cable ② with more projection of inner into upper recess ③ of throttle drum, and secure temporarily with nut.

Locate the part at the center of threaded section.

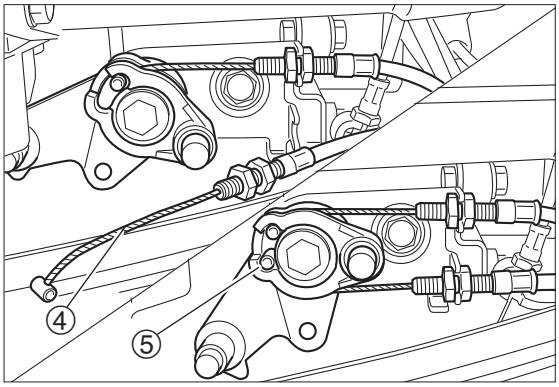


4. Set throttle grip to full close position.

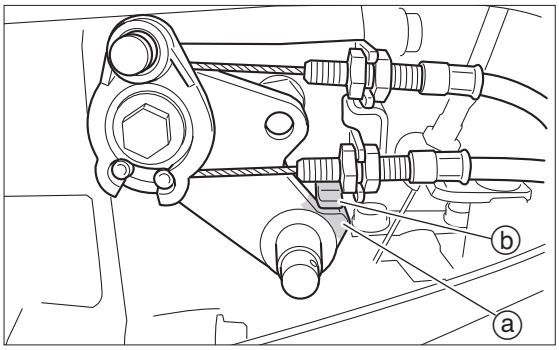


5. Like step 3, put other throttle cable ④ into lower recess ⑤ of throttle drum, and secure temporarily with nut.

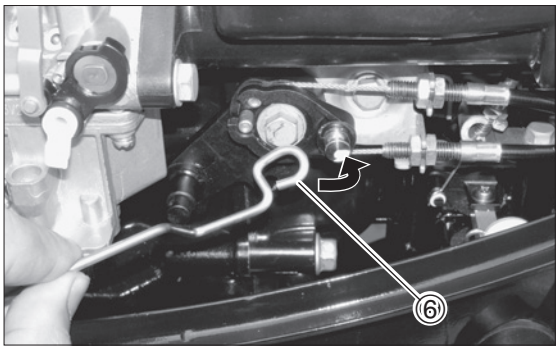
Locate the part at the center of threaded section.



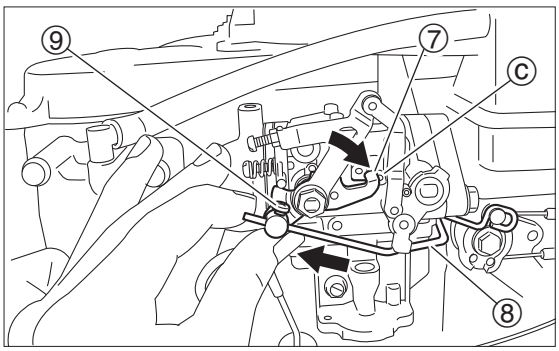
6. Adjust both throttle wires so that throttle drum arm ⓐ touches stopper ⓑ of throttle wire bracket at full open throttle.



7. Attach throttle rod ⑥.

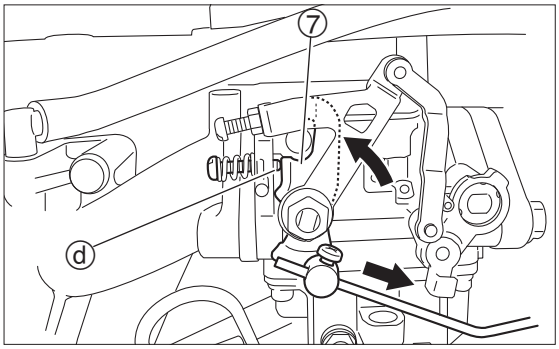


8. Set throttle grip to full open position, and secure throttle rod ⑧ with screw ⑨ with carburetor link ⑦ touching full open stopper ⓒ.



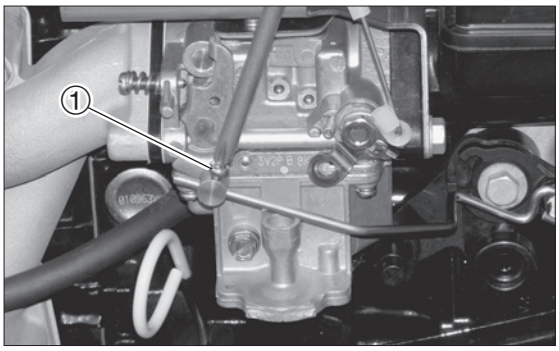
9. Set throttle grip to full close position, and check if carburetor link ⑦ touches full close stopper ⓓ.

10. Repeat above steps 8. and 9. several times to check if carburetor link touches full close stopper.

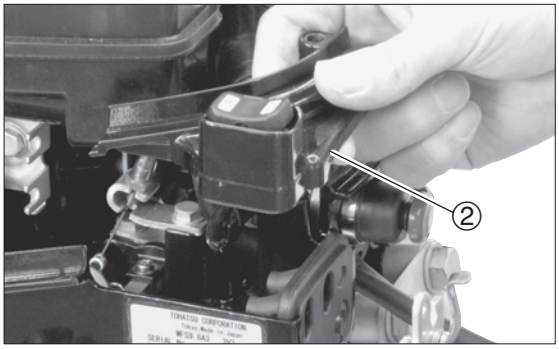


For P type

1. Loosen throttle link rod stop screw ①.

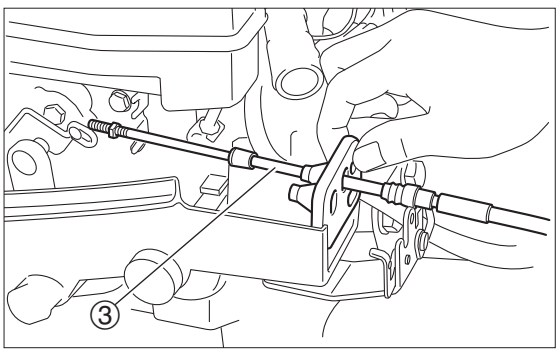


2. Remove bolt of remote control stay cover ② and bolt.

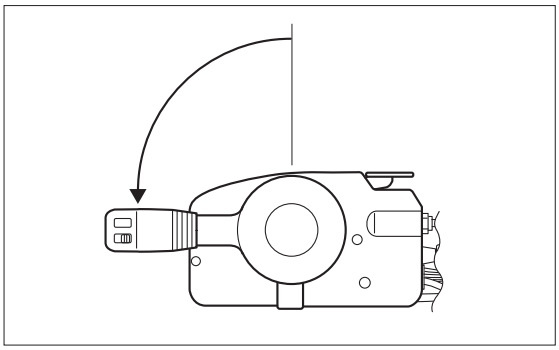


3. Run remote control cable ③ (throttle side) through grommet.

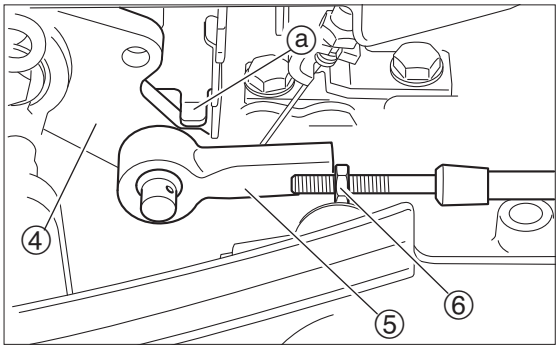
> Applying small amount of grease to grommet makes this work easier.



4. Set remote control lever to full open position.



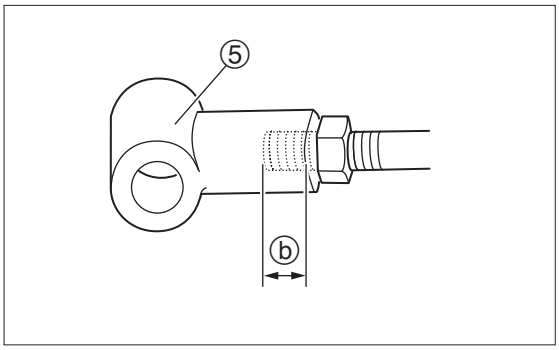
5. Contact throttle drum ④ with full open stopper ⓐ, and then bring remote control cable end nut ⑥ to position of cable joint ⑤.



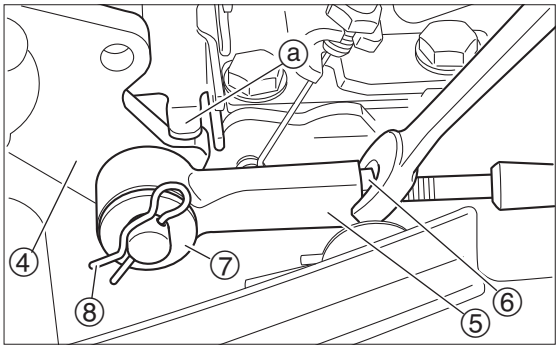
6. Screw on cable joint ⑤ to position of remote control cable nut.

⚠ CAUTION

Screw-in remote control cable joint ⑤ at lease 10mm ⓑ.



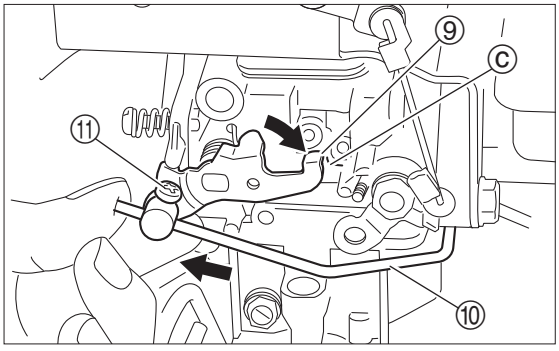
7. Fit cable joint ⑤ into throttle drum ④, and set remote control lever to full open position to check that throttle drum contacts full open stopper ⓐ.
Tighten cable joint nut ⑥ and secure by using washer ⑦ and snap pin ⑧.



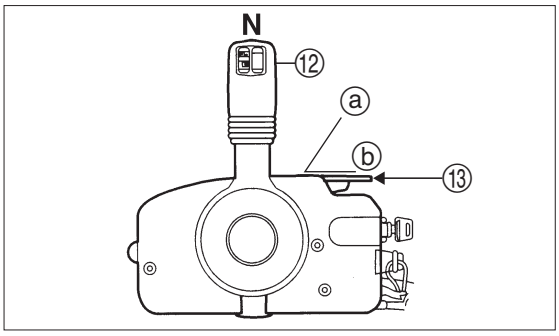
8. With carburetor throttle lever ⑨ pushed against full open stopper ⓒ, push throttle rod ⑩ toward throttle drum, and secure it by using screw ⑪.

⚠ CAUTION

When pushing throttle rod toward throttle drum, be careful not to push too much to prevent throttle drum from going off full open position.

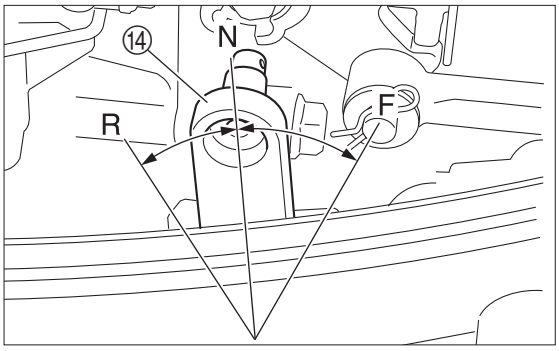


9. Set remote control lever ⑫ to neutral (N), and check that free acceleration lever ⑬ is at full close position ⓑ.



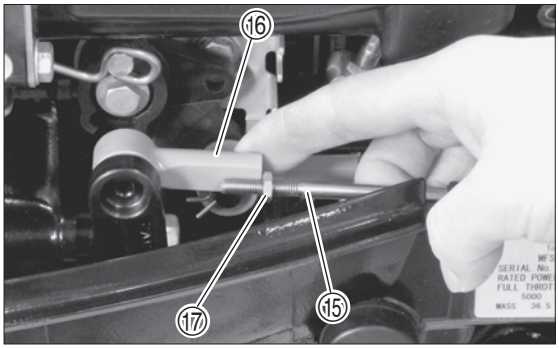
ⓐ Full open
ⓑ Full close

10. Set shift arm ⑭ to forward (F), neutral (N), reverse (R) and then to neutral (N) positions.



11. Run remote control cable ⑮ (shift side) into grommet, and like throttle cable, bring nut ⑰ of cable to position of joint ⑯.

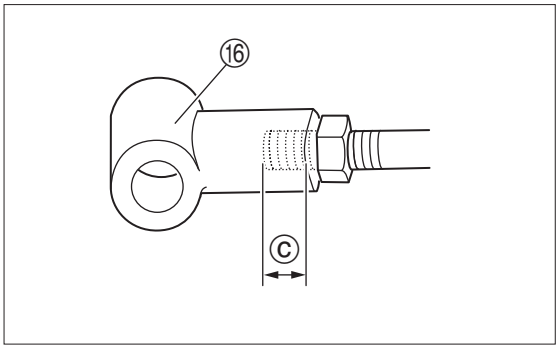
When adjusting position of cable joint, push in remote control cable to remove any play.



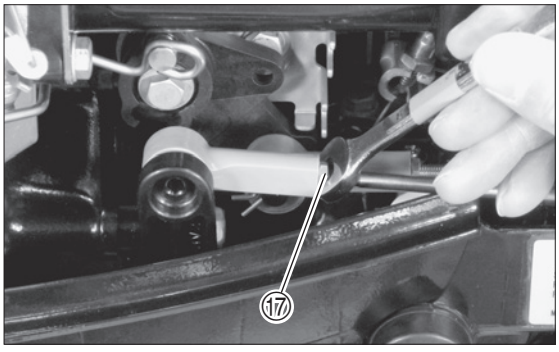
12. Screw on cable joint ⑯ to position of remote control cable nut ⑮.

⚠ CAUTION

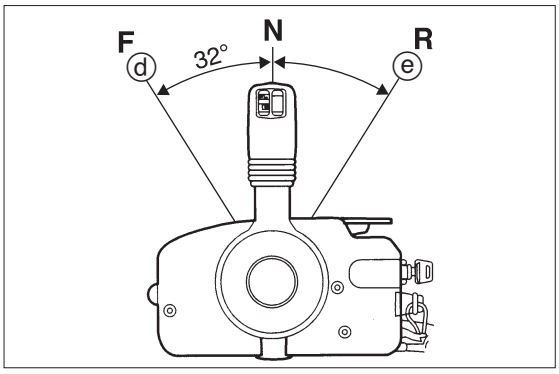
Screw-in remote control cable joint ⑯ at lease 10mm ⓒ.



13. Lock cable joint with nut ⑰, attach it to pin, and then, fix with washer and snap pin.

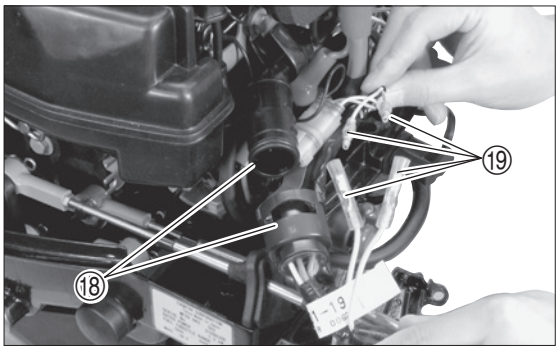


14. Check that shifting control lever forward (F) ⓓ by approximately 32 degrees, where it is stopped once, makes the gear engage, and then, fully shifting the lever makes throttle valve fully open Then, check that shifting the lever reverse (R) ⓓ by approximately 32 degrees, where it is stopped once, makes the gear engage, and fully shifting the lever makes throttle valve fully open.

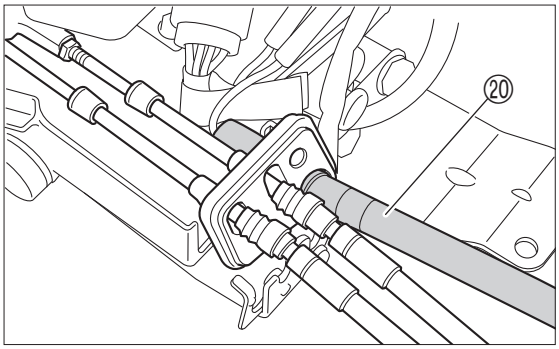


15. Check if throttle valve operates smoothly, and repeat steps 1. to 15. as necessary.

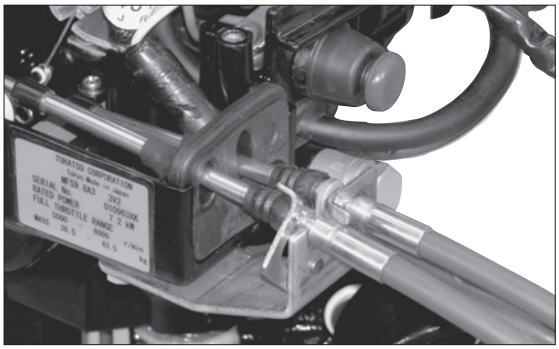
16. Reconnect connector ⑱ (EPT model only) of cord ass'y and single connectors ⑲.



17. Run cord ass'y ⑳ into grommet.



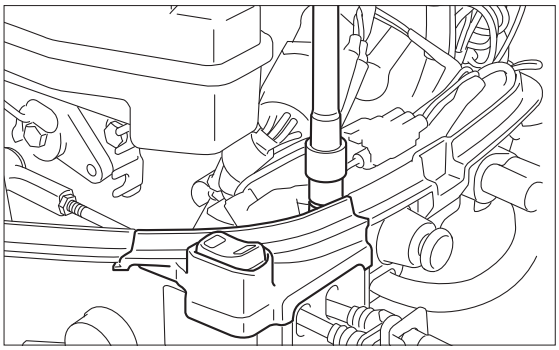
18. Fit grommet into bottom cowl, and fix remote control cables by fitting the grooves on the cable clip.



19. Secure remote control stay cover with screws.

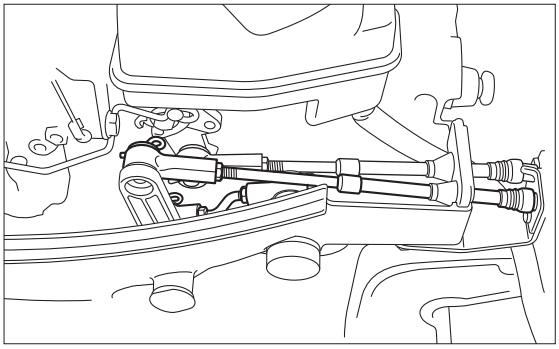
⚠ CAUTION

Be careful not to nip PT switch cord with cover and bottom cowl. (EPT Model)



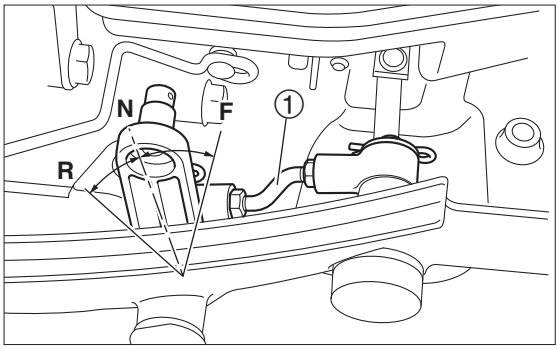
16) Inspection of Gear Shift Operation

Shift gear from neutral (N) to forward (F), neutral (N), and then to reverse (R) to check that shift operation is performed smoothly. Adjust shift link rod length and shift cable position if necessary.



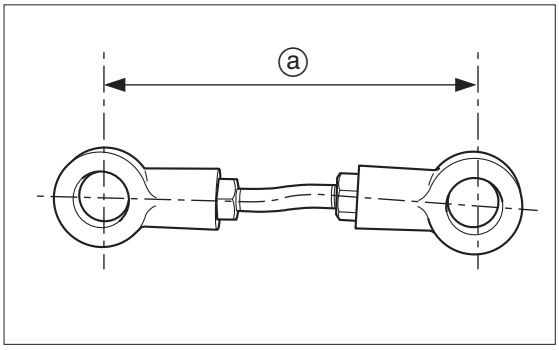
1. Shift gear into neutral (N).

2. Remove shift link rod ①.

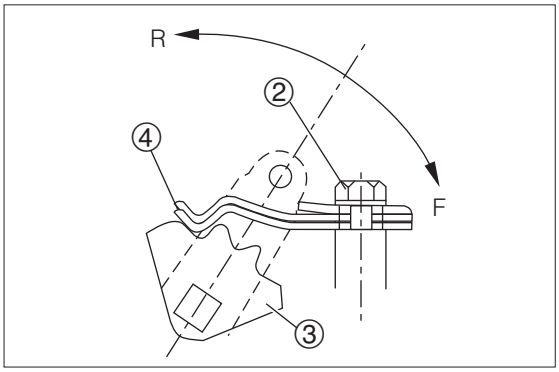


3. Check and adjust standard length ⓐ of shift link rod.

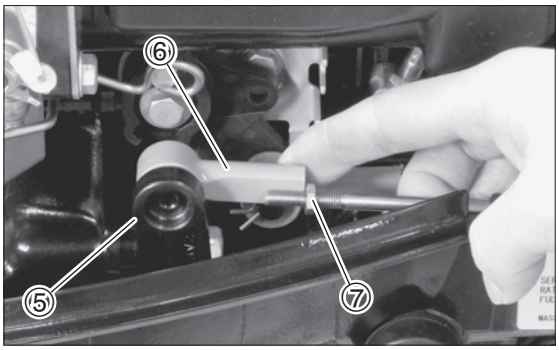
Remote Control Model ⓐ :
74 mm (2.91 in)



4. Perform shift adjustment after assembling lower unit. Loosen shift lever stopper bolt ②. Set shift lever shaft ass'y ③ fully to forward, adjust shift lever stopper ④ position, and then, tighten shift lever stopper bolt ②. Operate shift lever to check that operation from neutral (N) to forward (F) to neutral (N) to reverse (R) is normal, and forward and reverse movements are equal to each other.

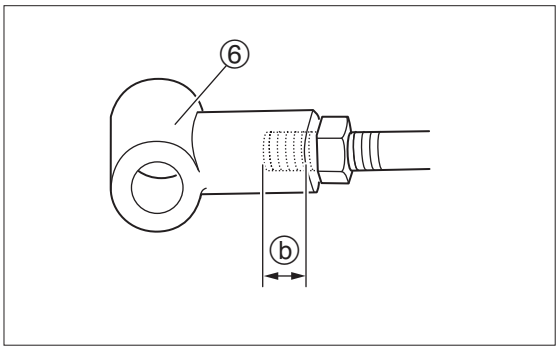


5. Put rod joint ⑥ on shift arm ⑤, and align position of nut ⑦ of remote control cable with rod joint.



When adjusting position of cable joint, push in remote control cable by the amount of the play.

6. Screw on cable joint ⑥ to position of remote control cable nut.



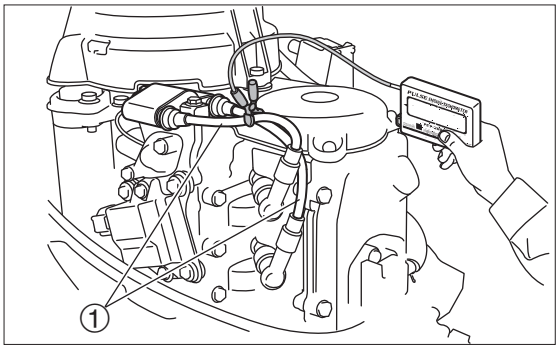
⚠ CAUTION

Screw-in remote control cable joint ⑥ at lease 10mm ⓑ.

7. Reconnect remote control cable joint attach washer, snap pin and tighten lock nut.

8. Check if gear shifts smoothly, and repeat steps 2. to 7. as necessary.

17) Inspection of Idle Engine Speed



1. Start engine and run for 5 minutes to warm up.

2. Attach tachometer to high tension cord ① to check idle speed.

More accurate and stable reading can be obtained when tachometer lead is connected with high tension cords of individual cylinders linked with each other.

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

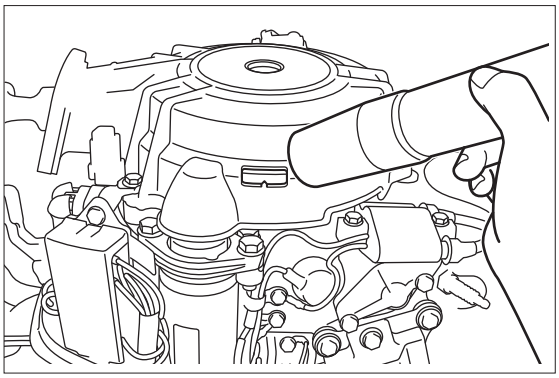
Idle Speed :
950 r/min - In neutral

18) Inspection of Ignition Timing

Adjusting system : Automatic control, no adjustment required

Run engine and use timing light to check ignition timing.

11 timings marks are found on the side of flywheel (TDC0°, ATDC5°, 10°, BTDC5°, 10°, 15°, 20°, 25°, 30°, 35° and 40°), and ignition timing is read with mark on the center of starter case window.



Range of Ignition Angle	Idling [500 r/min]	Accelerating [5500 r/min]
TDC 0°— BTDC 35°	TDC 0°	BTDC 35°

19) Inspection of Anode

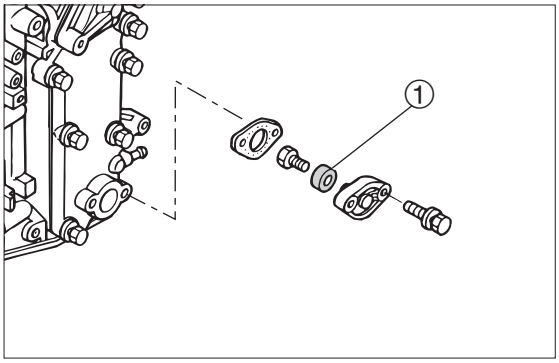
1. Check anode ① and ② (PT models) for build up of scale and adherence of grease and oil. Clean, or replace if necessary.

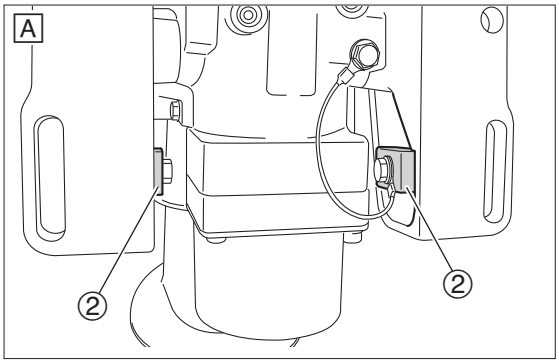
⚠ CAUTION

Do not coat anode and trim tab with oil, grease or paint, or their anti-corrosion function does not work normally.

When it is necessary to disassemble outboard motor for inspection of anode, refer to disassembly procedure described in this manual. Reduction of anode volume can lead to outboard motor body damage.

2. Replace anode ① and ② if they are corroded excessively.





A PT models

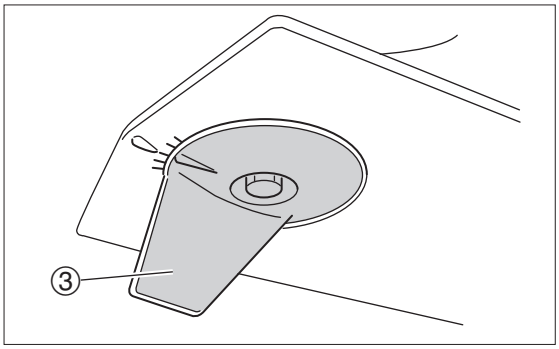
20) Replacement of Anode

Anode protects outboard motor from galvanic corrosion (corrosion of metal due to very weak electric current).

Anodes are used in the gear case, clamp bracket (PT models), and power unit cylinder.

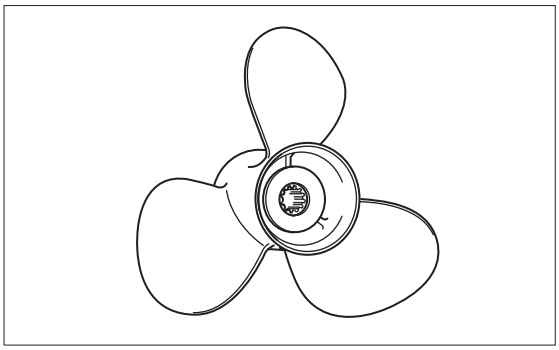
Replace anode if volume is reduced to 2/3 of new part.

- Do not coat anode with oil or paint.
- Since periphery of anode installation bolt is corroded more than other areas, be sure to retighten bolt at every inspection.



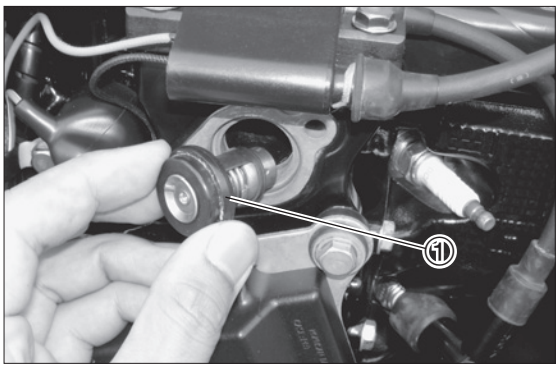
21) Inspection of Propeller

1. Check propeller blades and spline for cracks, damages, wear and corrosion. Replace if necessary.



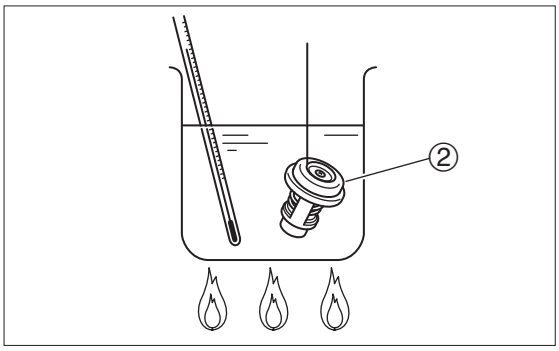
22) Inspection of Thermostat

1. Loose thermostat cover nut and remove thermostat ①.



2. Hang thermostat ② in the water contained in vessel.

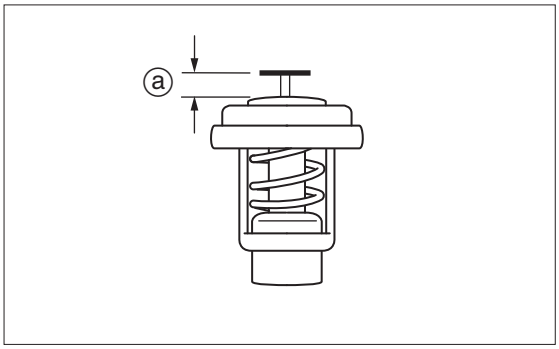
3. Put thermometer in the water, warm up water and measure water temperature when valve opens.



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

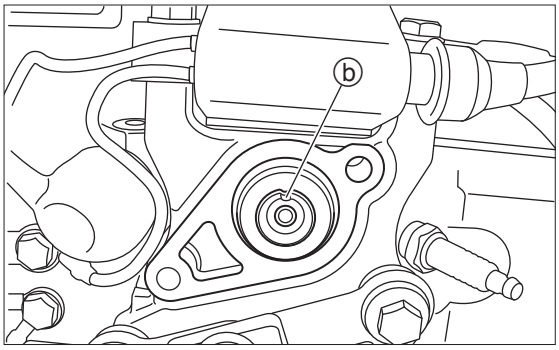
Valve Opening Temperature :
60±1.5°C (140 ± 3°F)
(Valve starts to open at this temperature.)

4. 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±1.5°C (167 ± 3.0°F)	3.0mm (0.12in) or over

5. Install thermostat, new gasket and cover.

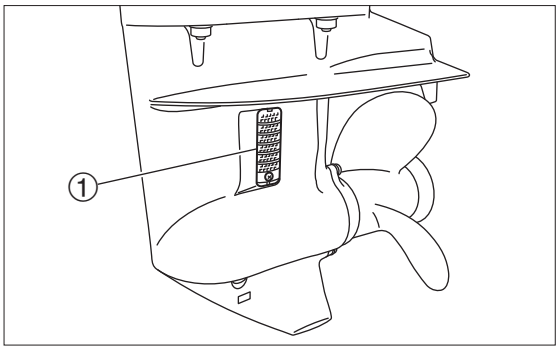


Install thermostat with recess ⓑ of air bleeding valve directing upward.

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

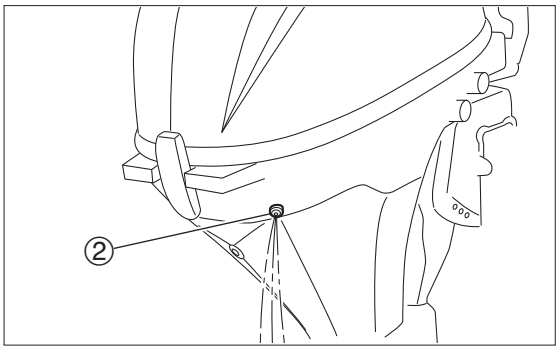
23) Inspection of Cooling Water Passage

1. Check water strainer ① for clogging. Clean if necessary.



2. Set outboard motor in the water and start engine.

3. Check that cooling water is discharged from cooling water check port ②. If not, check water pump and cooling water passage in the engine.



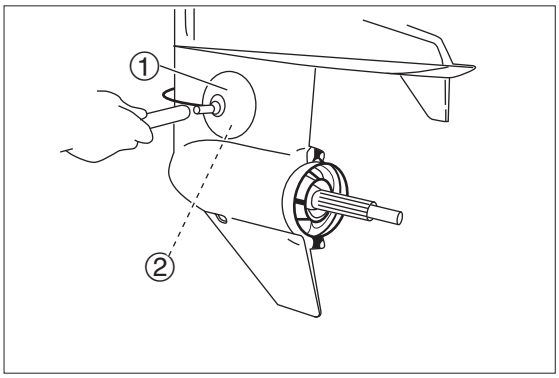
24) Flushing with Water

⚠ CAUTION

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

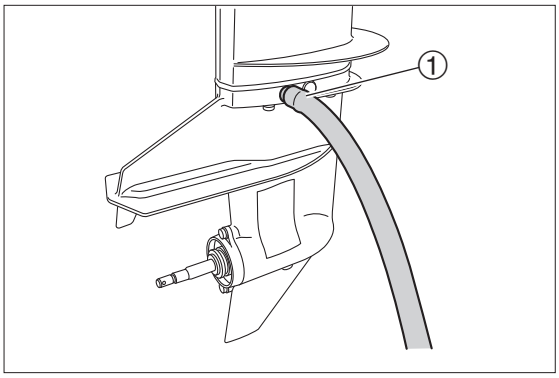
⚠ WARNING

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



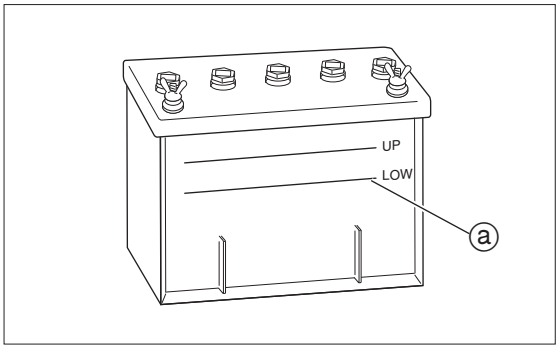
Flushing with water using flusher ①

1. Remove propeller and thrust holder.
2. Attach flushing kit or flusher ① to water strainer ②, connect water hose to the attachment, and run water.
3. Set gear shift to neutral (N) and start engine.
4. Check that cooling water check port discharges water, and run engine for 3 to 5 minutes at low speed.
5. Stop engine and stop water supply, remove flusher ①, and remove tape, and then, install propeller.



25) Inspection of Battery

1. Inspect battery liquid level. If lower than “LOW” mark ⓐ, add distilled water until the level goes in between “UP” and “LOW” 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, and so it 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 adhere 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.**

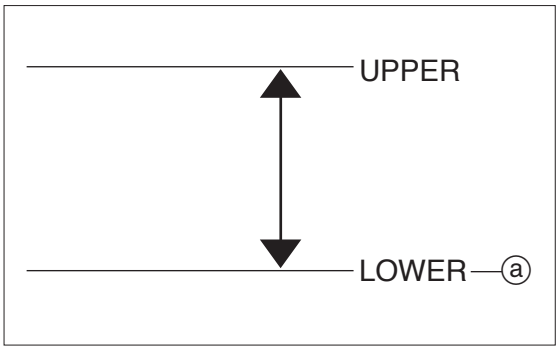
First Aid in Emergency (if swallowed)

- **Drink much water, magnesium hydrate solution (magnesium milk), fresh egg, or salad oil, and have doctor's evaluation immediately.**

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 smoke or 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.

· When removing battery, disconnect negative lead first and then positive lead.

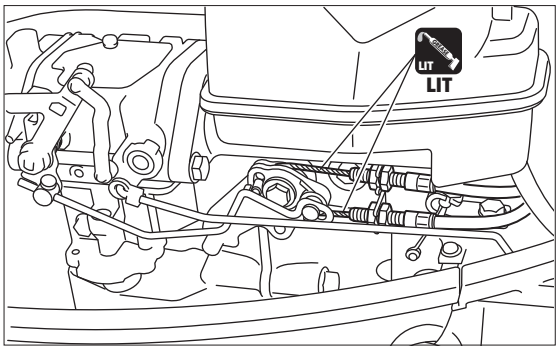
Battery :
12V40AH or more

Specific Gravity of Electrolyte :
1.280 (at 20°C)

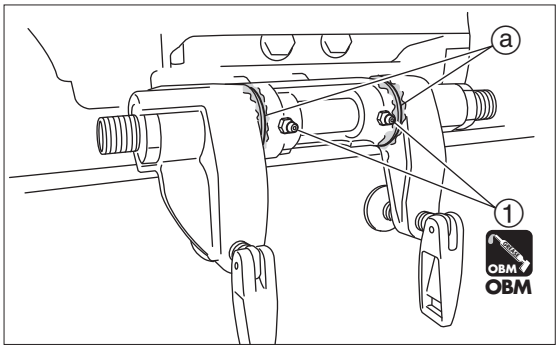
Charging Requirements : for 12V70AH battery
Charging Current : 70AH - $\frac{1}{10}$ = 7A
Charging Hours : 70AH ÷ 7A = 10H

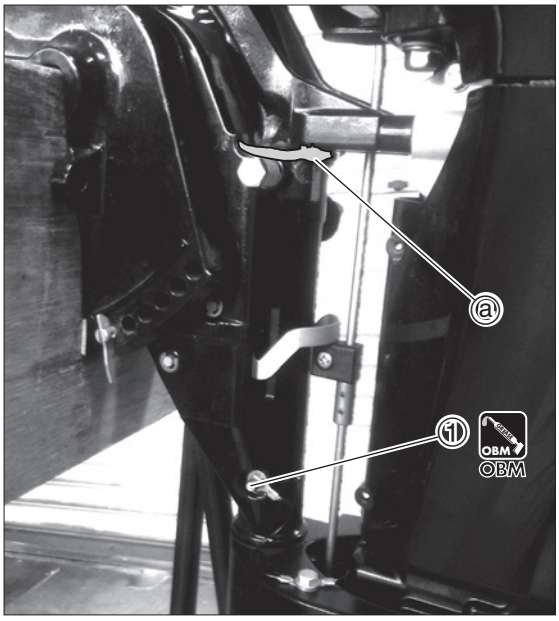
26) Greasing Points

1. Apply grease to throttle cable and sliding areas.

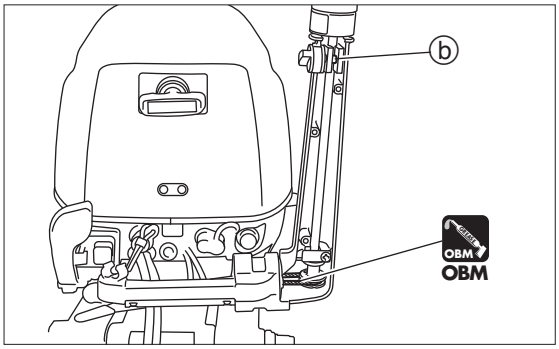


2. Put grease through grease nipples ① until excessive grease appears from bushing ⓐ.





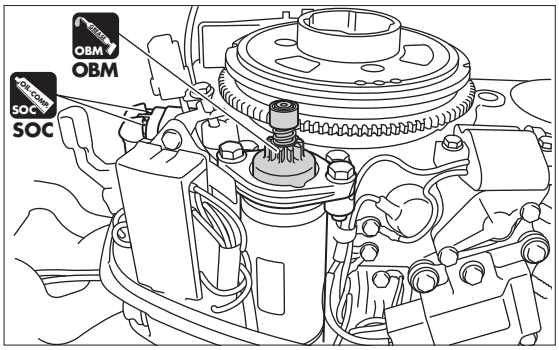
3. Apply grease to throttle cable and sliding areas.



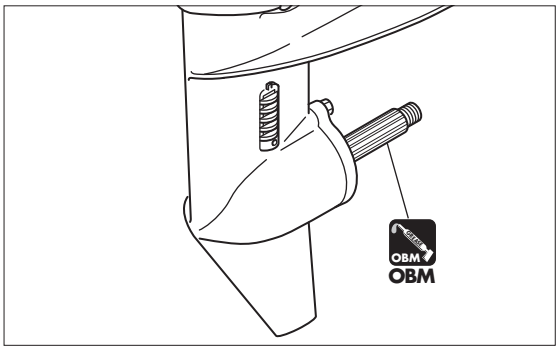
ⓑ Do not lubricate here.

4. Raise pinion and lube worm gear. (Grease on teeth will collect dirt cause early failure)

5. Apply grease to terminals of starter motor, starter solenoid and PT solenoid.



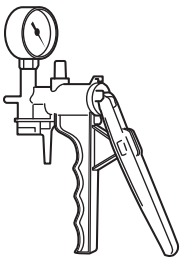
6. Apply grease to propeller shaft spline.



4

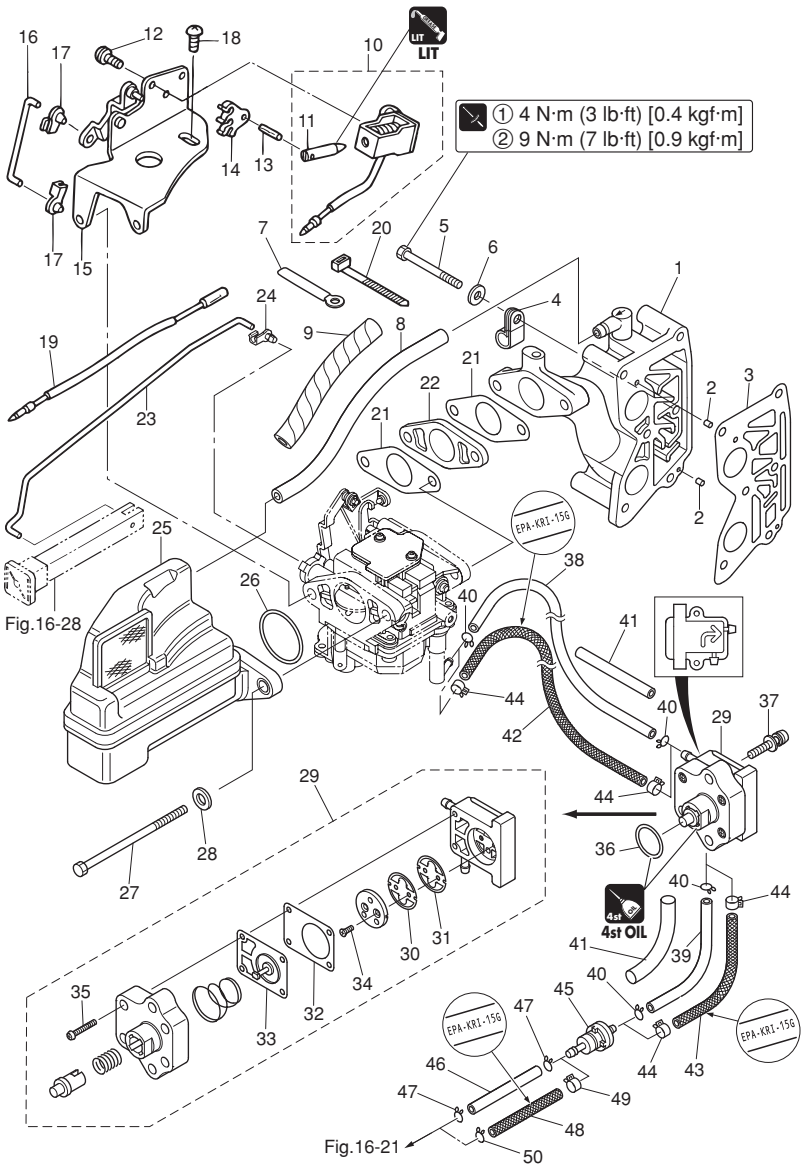
Fuel System

1. Special Tools

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

2. Parts Layout

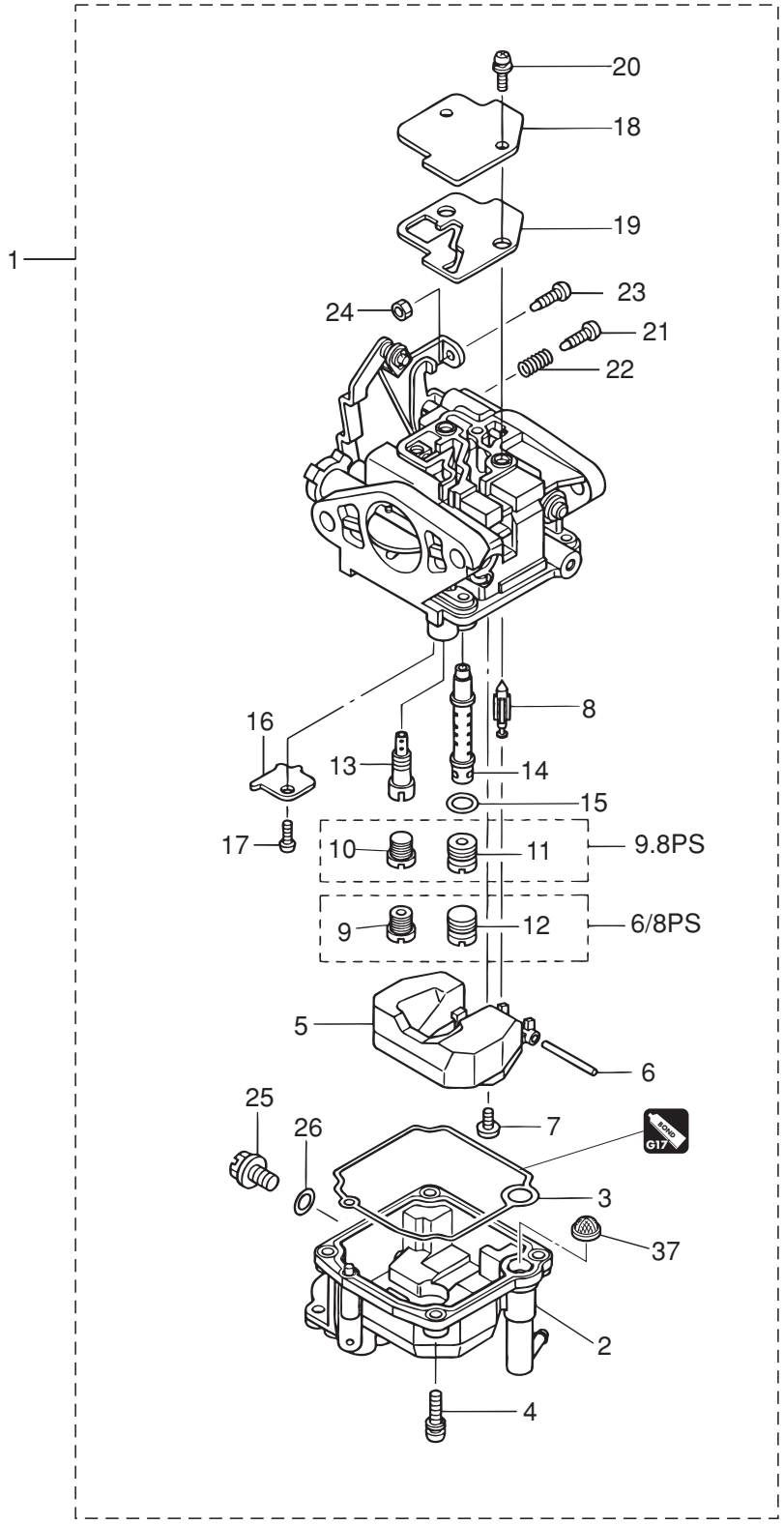
Intake Manifold & Fuel Pump



Ref. No.	Description	Q'ty	Remarks
1	Intake Manifold Ass'y	1	
2	Spring Pin 3-10	2	
3	Intake Manifold Gasket	1	Do not reuse.
4	Clamp 6.5-14L	1	
5	Bolt	6	
6	Washer	6	
7	Clamp 6.5-87P	1	Starter Case
8	Hose	1	Intake Manifold-Intake Silencer 98AB-701000
9	Spiral Tube Protector ø10-100	1	for EP/EPT
10	Choke Solenoid	1	for EP/EPT
11	Plunger	1	
12	Screw	3	Choke Solenoid for EP/EPT
13	Spring Pin 3-12	1	for EP/EPT
14	Choke Solenoid Hook	1	for EP/EPT
15	Choke Solenoid Bracket Ass'y	1	for EP/EPT
16	Link Rod	1	for EP/EPT
17	Rod Snap 1.5-2	2	for EP/EPT
18	Screw	1	for EP/EPT
19	Assist Cord (Blu)	1	Blue for EP
20	Band 104	1	for EP/EPT
21	Carburetor Gasket	2	Do not reuse.
22	Insulator	1	
23	Choke Rod	1	for MF & EF/EFT
24	Rod Snap 3-B	1	for MF & EF/EFT
25	Intake Silencer Ass'y	1	

Ref. No.	Description	Q'ty	Remarks
26	O-ring 2.4-35.2	1	Do not reuse.
27	Bolt	2	Carburetor
28	Washer	2	
29	Fuel Pump Ass'y	1	
30	Check Valve	1	White
31	Check Valve	1	Black R
32	Pump Body Gasket	1	
33	Pump Diaphragm	1	
34	Screw	2	
35	Screw	4	
36	O-ring 2.6-18.7	1	Do not reuse.
37	Screw	2	
38	Hose	1	Fuel Pump-Carburetor STD 98AB-501000
39	Hose	1	Fuel Filter-Fuel Pump STD 98AB-501000
40	Clip ø10	4	STD
41	Protector ø12-120	2	STD Fuel Filter-Fuel Pump Fuel Pump-Carburetor
42	Fuel Hose W/Protector L=260	1	Low Permeation Parts USA EPA-KRI-15G
43	Fuel Hose W/Protector L=150	1	Low Permeation Parts USA EPA-KRI-15G
44	Clip ø9.4	4	for USA Model
45	Fuel Filter Ass'y	1	
46	Hose	1	Connector-Fuel Filter STD 98AB-501000
47	Clip ø10	2	STD
48	Fuel Hose W/Protector L=350	1	Low Permeation Parts USA EPA-KRI-15G
49	Clip ø9.4	1	Fuel Filter Side for USA Model
50	Clip ø10	1	Connector Side for USA Model

Carburetor

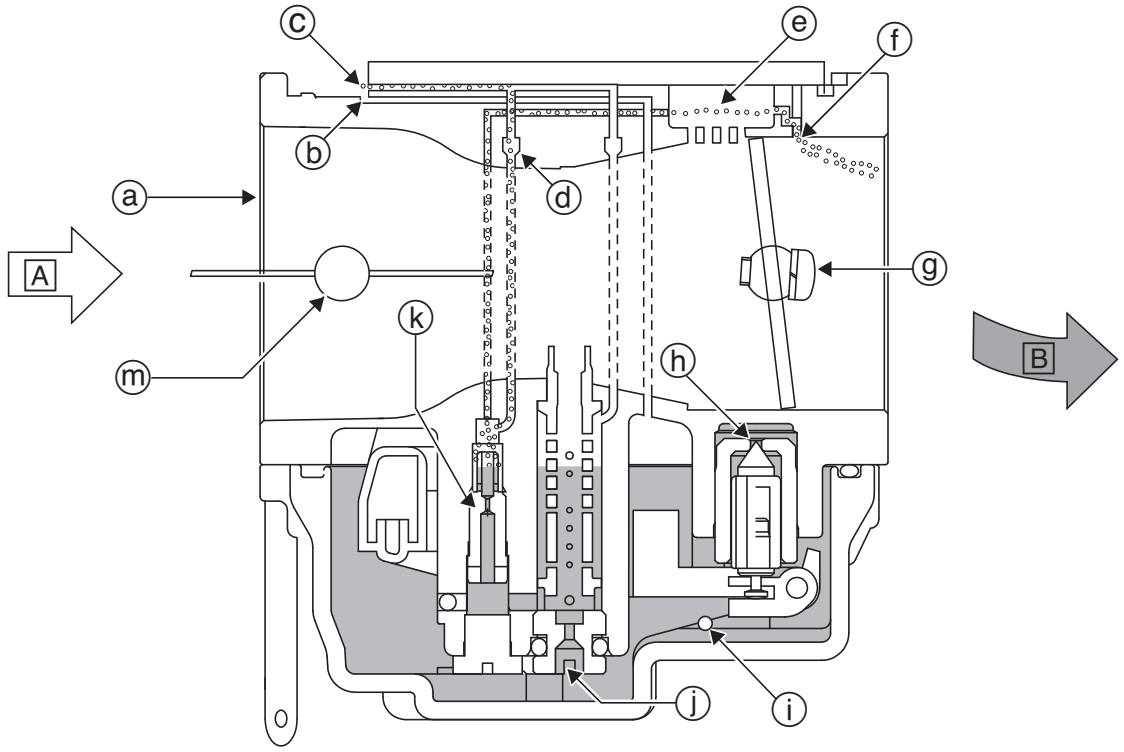


G17

Ref. No.	Description	Q'ty	Remarks
1	Carburetor Ass'y	1	for MF & EF/EFT (mark : 3V2FB) } MFS9.8
	Carburetor Ass'y (EP)	1	for EP/EPT (mark : 3V2PB)
	Carburetor Ass'y	1	for MF & EF/EFT (mark : 3V1FB) } MFS8
	Carburetor Ass'y (EP)	1	for EP (mark : 3V1PB)
2	Float Chamber	1	
3	Float Chamber Gasket	1	Do not reuse.
4	Screw	4	
5	Float	1	
6	Float Arm Pin	1	
7	Screw	1	
8	Float Valve	1	
9	Main Jet (#76)	1	MFS6/8
10	Plug	1	MFS9.8
11	Main Jet (#92)	1	MFS9.8
12	Plug	1	MFS6/8
13	Slow Jet (#39)	1	
14	Main Nozzle ø2.3	1	MFS6/8
	Main Nozzle ø2.6	1	MFS9.8
15	O-ring	1	Do not reuse.
16	Plate	1	
17	Screw	1	
18	Carburetor Cover	1	
19	Carburetor Cover Gasket	1	Do not reuse.
20	Screw	2	
21	Stop Screw L=18	1	
22	Spring L=14	1	
23	Stop Screw L=15	1	for F-Type
24	Nut	1	for F-Type
25	Drain Screw	1	
26	Gasket	1	
37	Filter	1	

3. Carburetor Inner Passages

1) Idling Passage



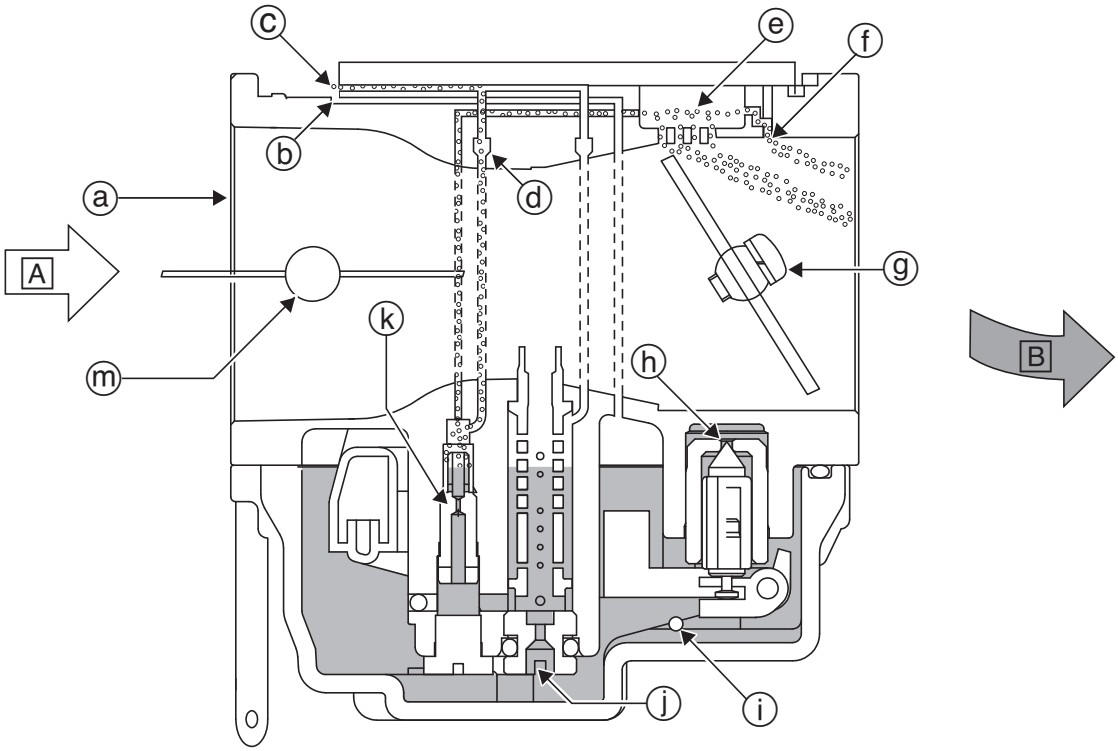
a - Air intake
b - Air vent inlet
c - Air-bleed inlet
d - Slow air jet
e - Bypass port
f - Idle Port
g - Throttle valve
h - Fuel inlet
i - Chamber drain
j - Main jet
k - Slow jet
m - Choke valve
A Air
B Air-fuel mixture

As engine rotates, intake valve opens and piston moves from top dead center toward bottom dead center, the piston movement causes vacuous area to occur in the back of throttle valve.

Then, the air enters carburetor through air intake port, runs through throat venturi and throttle valve, and then is sucked into the vacuous area in the cylinder that is in air intake stroke.

The float chamber receives atmospheric pressure through air vent. This pressure causes fuel to be sucked into vacuous area in the back of throttle valve. The fuel is sent to main fuel well through main jet, runs through idle passage, slow jet, bypass (off idle) port, and then is ejected from idle port. When this fuel goes through bypass port, it is mixed with air in the carburetor bore to be air-fuel mixture which is sucked into the cylinder.

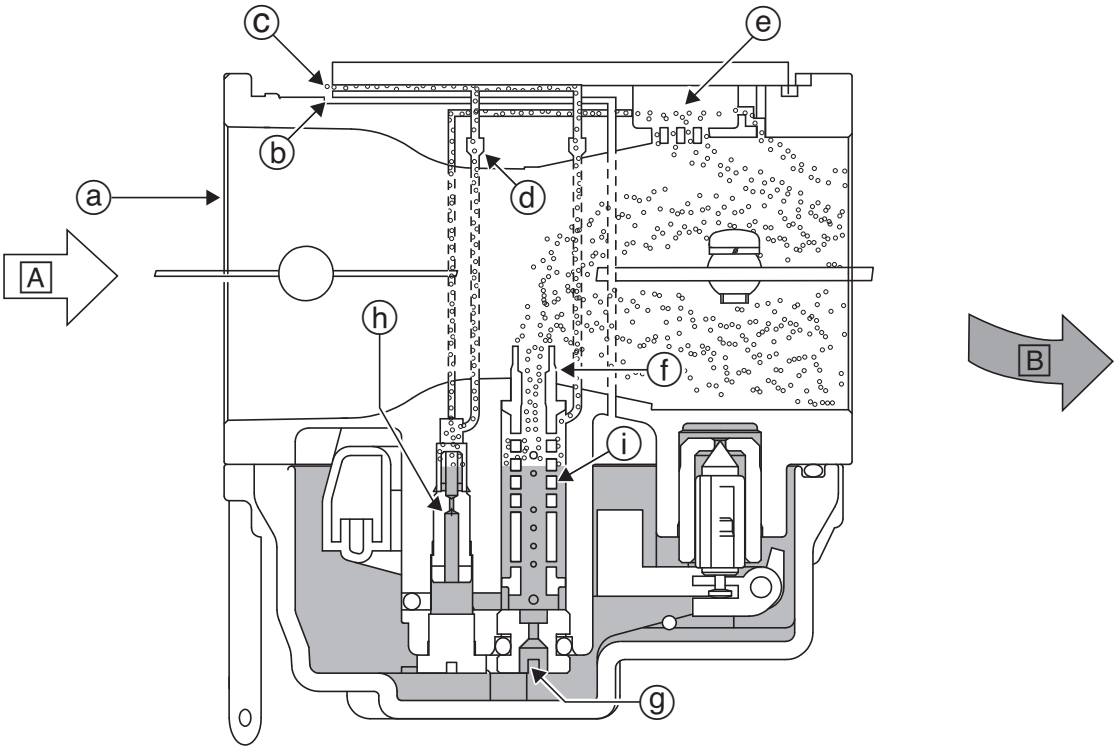
2) Off-Idle Passage



a - Air intake
b - Air vent inlet
c - Air-bleed inlet
d - Slow air jet
e - Bypass port
f - Idle Port
g - Throttle valve
h - Fuel inlet
i - Chamber drain
j - Main jet
k - Slow jet
m - Choke valve
A Air
B Air-fuel mixture

When throttle valve is turned to a position over bypass port, the bypass port is exposed to vacuous pressure existing in the back of throttle valve. The vacuous pressure causes the fuel to be ejected from bypass port and idle port.

3) High Speed Passage



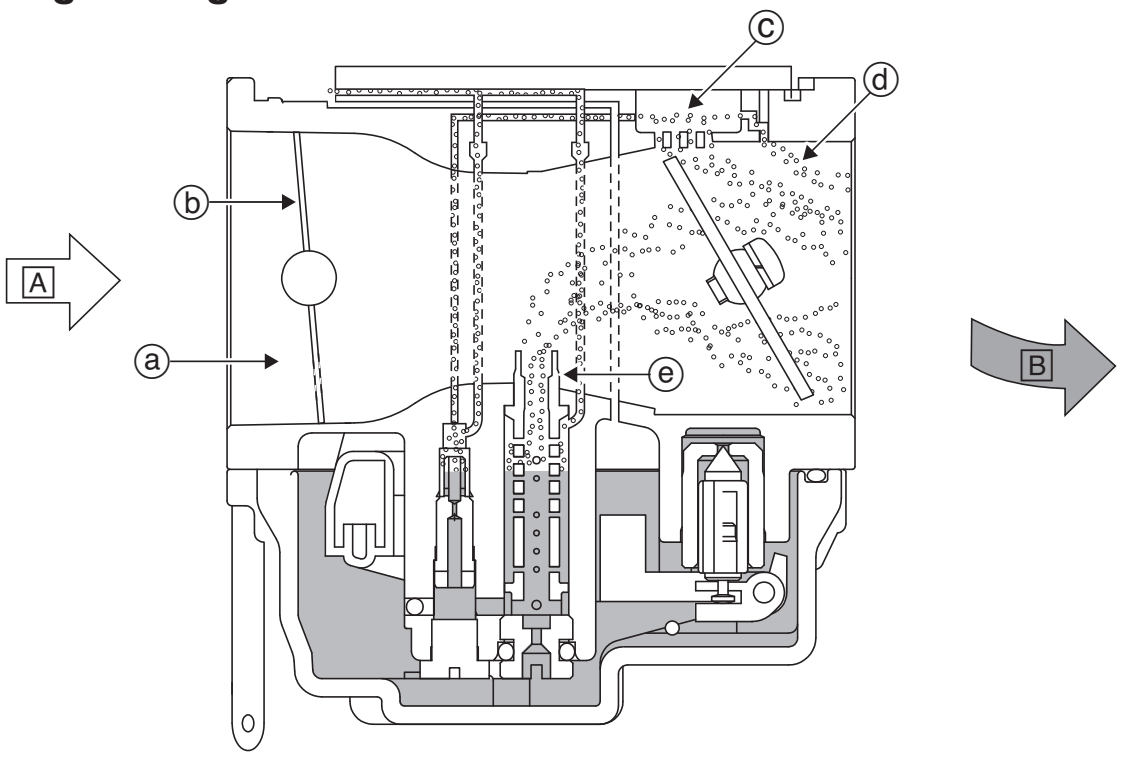
a - Air intake
b - Float chamber inlet
c - Air-bleed inlet
d - Slow air jet
e - Bypass port
f - Main nozzle
g - Main jet
h - Slow jet
i - Air bleed hole
A Air
B Air-fuel mixture

As throttle valve is turned to a position over bypass port, the vacuum produced in the back of throttle valve extends to an area near main nozzle. At the same time, as flow of air that runs through carburetor bore increase, the whole space in the venturi becomes vacuous. The vacuous pressure in this venturi causes large suction force in the main nozzle. The fuel goes through main jet, flows into main fuel well, goes through main nozzle, and ejects from venturi.

The fuel that runs through main nozzle is mixed with air that comes from air bleed hole made on the side of main nozzle to make the fuel lighter. When throttle valve is fully open, the amount of fuel is determined by the size of main jet.

The idle and off-idle passages keep feeding fuel as well as air to the engine.

4) Choking Passage



a - Air intake
b - Choke valve
c - Bypass port
d - Idle Port
e - Main nozzle
A Air
B Air-fuel mixture

Choke system consists of choke valve, detent and push-pull cable or electric solenoid. When starting cold engine, the operator should judge whether it is necessary to operate the choke to make engine starting easier, and if necessary, to operate the handle of choke cable manually to set it to a proper position or to activate the solenoid for electric starting model. When attempting to start cold engine, pull choke lever or activate the solenoid to close choke valve. When engine starts, low pressure (vacuous) area is formed in the venturi on the back of choke valve. Then, the fuel goes through main nozzle, bypass port and idle port, and sucked into carburetor bore, where it is mixed with air that runs in from opening of the choke valve to form thick air-fuel mixture.

As engine warms up, operate choke cable manually or turn off the solenoid to open choke valve. When engine has warmed up to a temperature suitable to the operation. For manual choke system, set choke lever to its original position.

4. Inspection Items

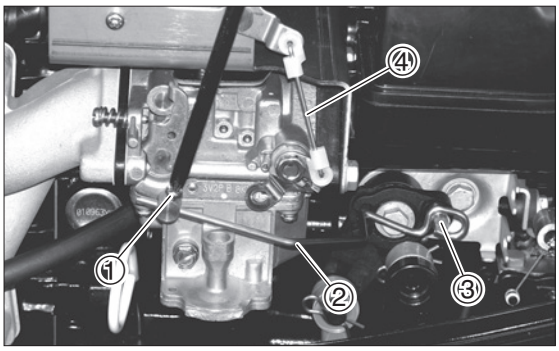
1) Inspection of Choke Solenoid (some models only)

<Refer to inspection items of Chapter 8.>

2) Removing Carburetor

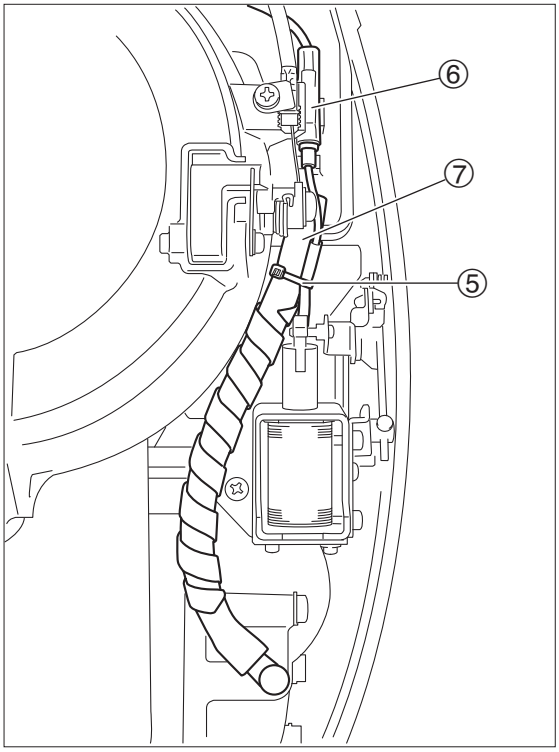
⚠ WARNING

Before working on fuel system, make sure to disconnect battery cables from the battery, or electric sparks can occur, possibly igniting fuel or making fuel to explode.



Remote Control Model

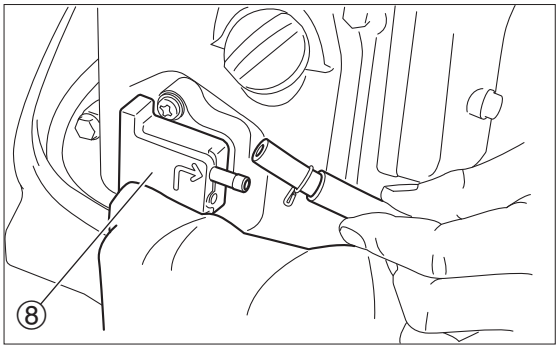
1. Loosen throttle link rod set screw ①. Remove throttle link rod ② from link drum ③.
2. Separate choke link rod ④ from carburetor.
3. Cut band ⑤ that secures solenoid wire of intake silencer head hose.
4. Disconnect choke solenoid wire ⑥ from engine wireharness.
5. Remove intake silencer head hose ⑦ from air silencer.



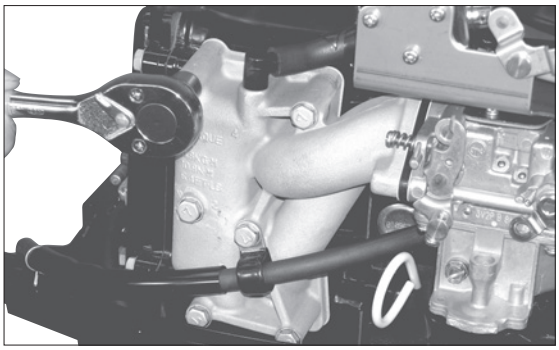
6. Disconnect fuel hose from outlet of fuel pump ⑧.

⚠ CAUTION

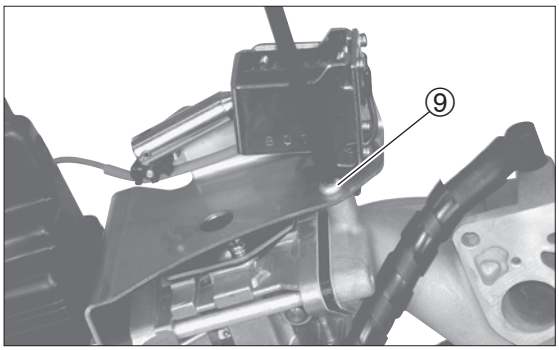
Use rag to absorb fuel flowing out from hose.



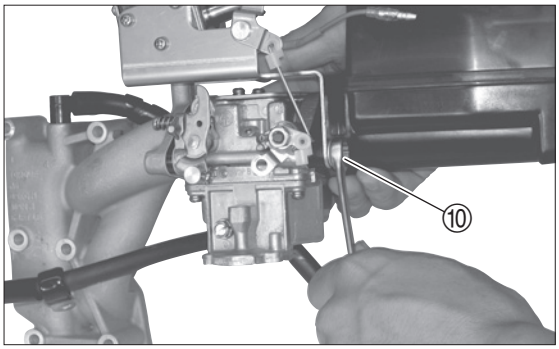
7. Loosen intake manifold installation bolts, and remove carburetor ass'y and silencer cover at the same time.



8. Loosen solenoid mount plate screws ⑨.



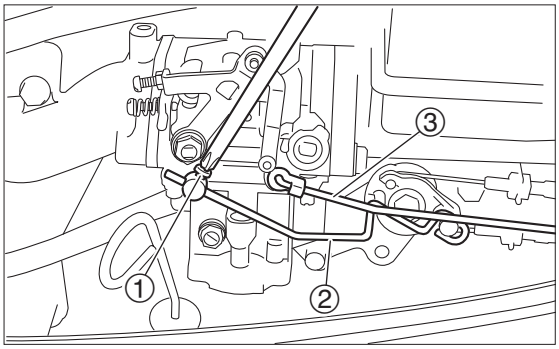
9. Loosen solenoid mount plate bolts ⑩ and then remove carburetor.



Tiller Handle Model

1. Loosen throttle link rod set screw ①. Remove throttle link rod ② from link drum.

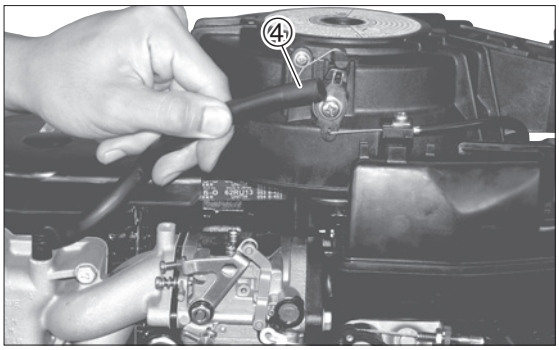
2. Separate choke rod ③ from carburetor.



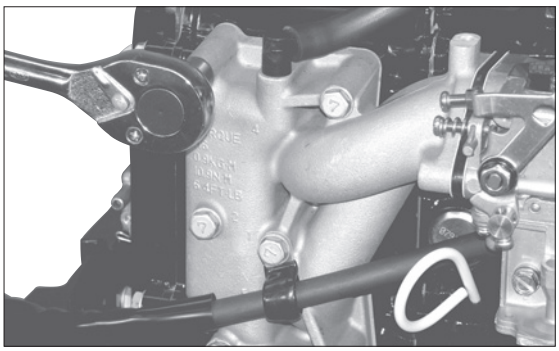
3. Remove air silencer head hose ④ from intake manifold.

⚠ CAUTION

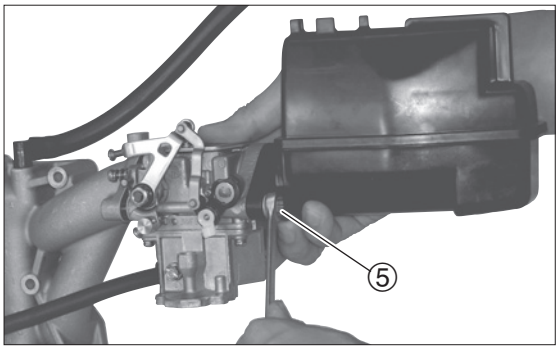
Use rag to absorb fuel flowing out from hose.



4. Loosen intake manifold installation bolts, and remove carburetor ass'y and silencer cover at the same time.



5. Loosen air silencer mount bolts ⑤ and then remove carburetor.



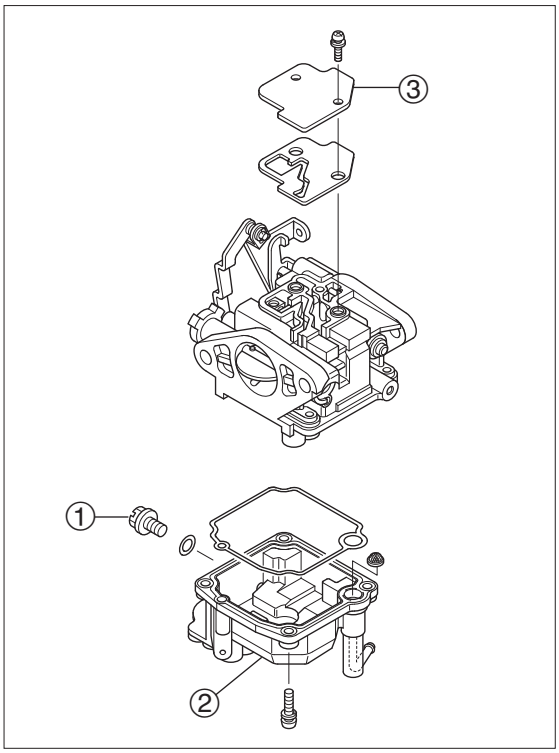
3) Disassembling Carburetor

1. Remove drain screw ① to drain fuel.

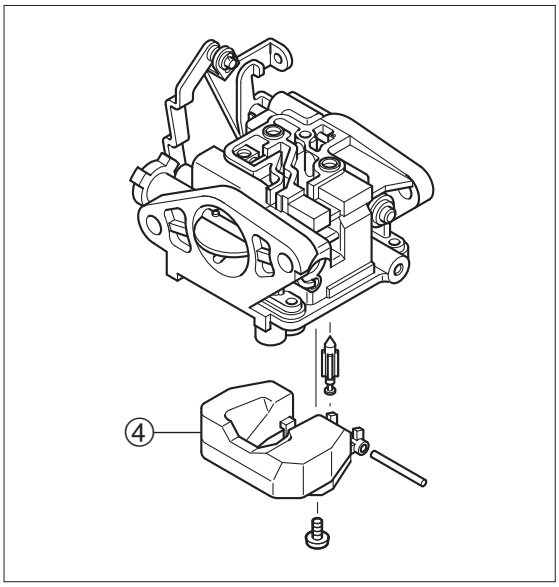
> **⚠ CAUTION**
>
> **To prevent fuel from dripping on the floor, use a vessel to catch the fuel.**

2. Remove float chamber ②.

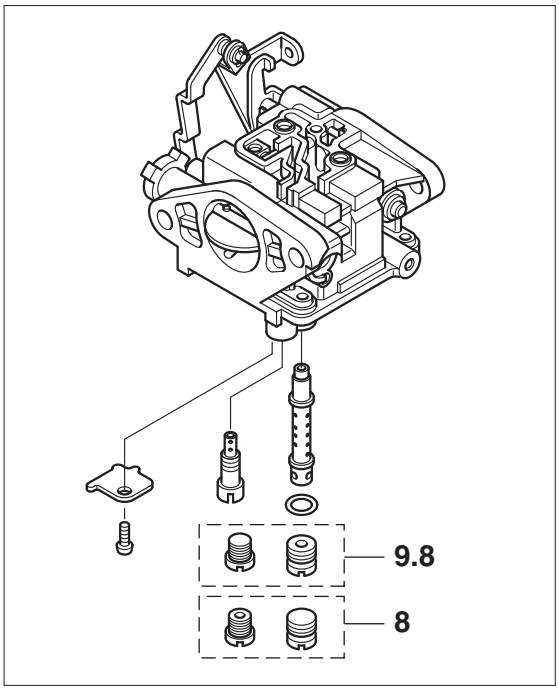
3. Remove carburetor cover ③.



4. Remove float ass'y ④.



5. Remove jets and nozzle.

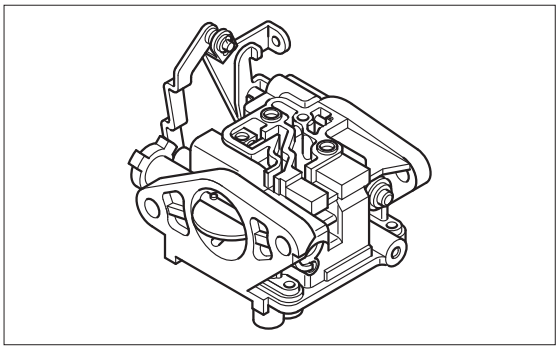


4) Cleaning and Inspection

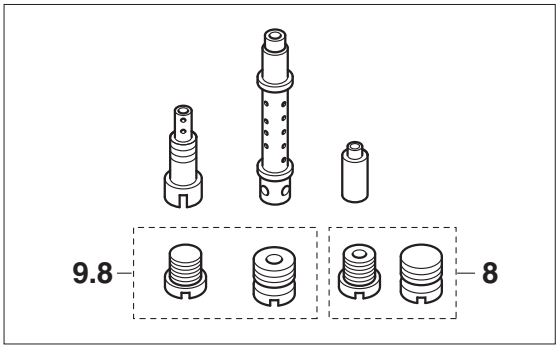
1. Check carburetor body for crack, damage and dirt. Replace or clean as necessary.

⚠ CAUTION

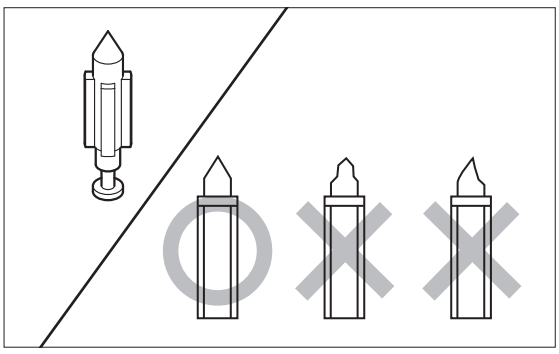
Use cleaning solution to remove dirt. Blow passages with compressed air to remove dirt. Do not use wire to remove dirt.



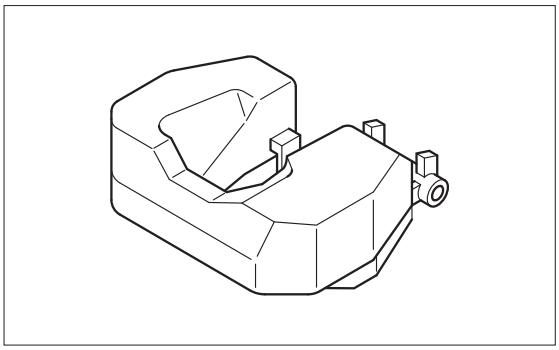
2. Check jets and nozzle for dirt, and replace if necessary.



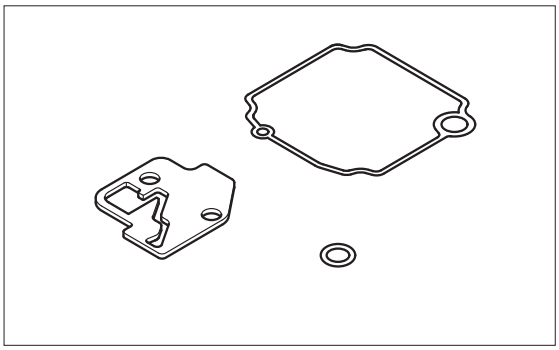
3. Check tip of needle valve, and replace if necessary.



4. Check float for crack and damage, and replace if necessary.



5. Check accelerator plunger (some models only), O rings and gaskets for damage, and replace if necessary.

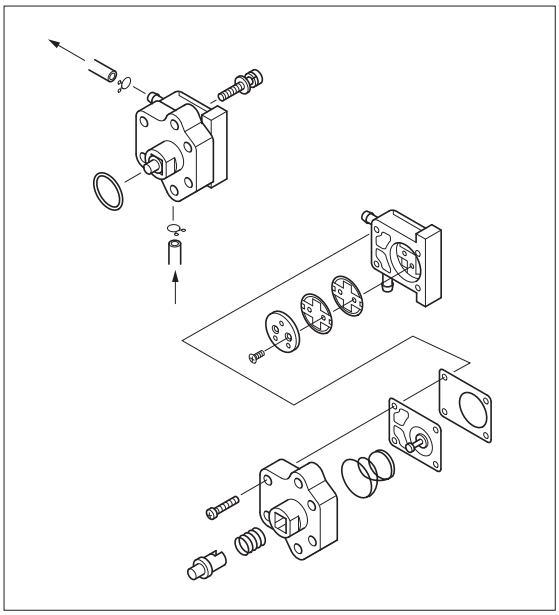


5) Disassembly and Inspection of Fuel Pump

⚠ CAUTION

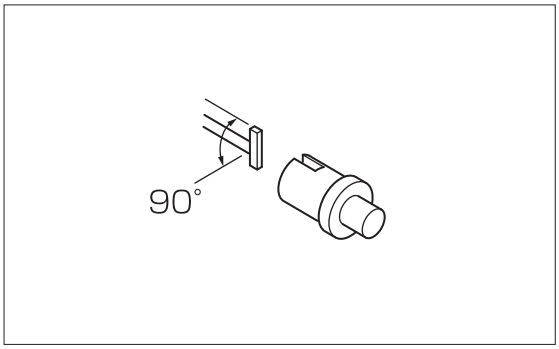
To prevent fuel from dripping on the floor, use a vessel to catch the fuel.

1. Remove screws (4) to disassemble fuel pump body.



2. Remove diaphragm from fuel pump body.

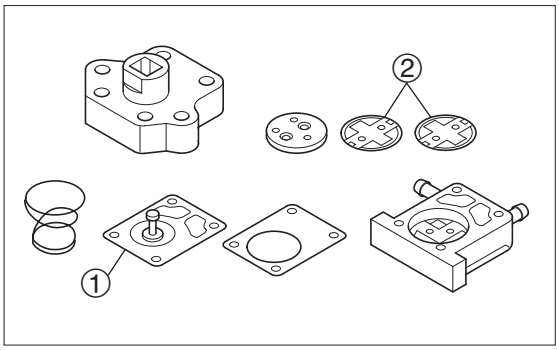
While holding push rod, turn diaphragm approximately 90 degrees to left or right while pushing it using a finger to remove it from push rod.



3. Check diaphragm ① for break, crack and damage, and replace if necessary.

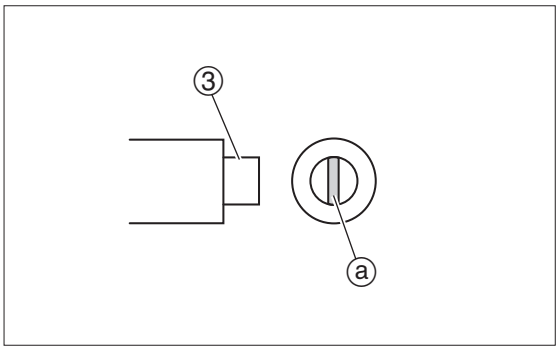
4. Check check valve ② for damage and deterioration, and replace if necessary.

5. fuel pump body for crack and damage, and replace if necessary.



6. Check push rod ③ for wear on the slipper surface ⓐ, and replace if severely worn.

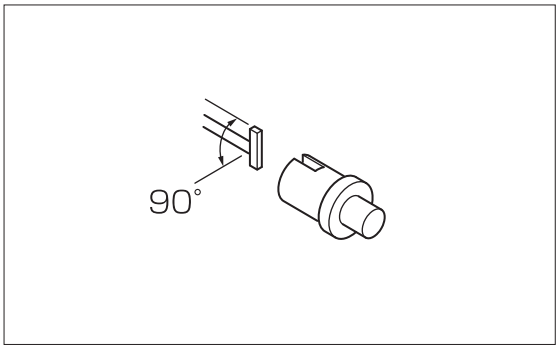
7. Clean fuel pump body.



6) Assembly of Fuel Pump

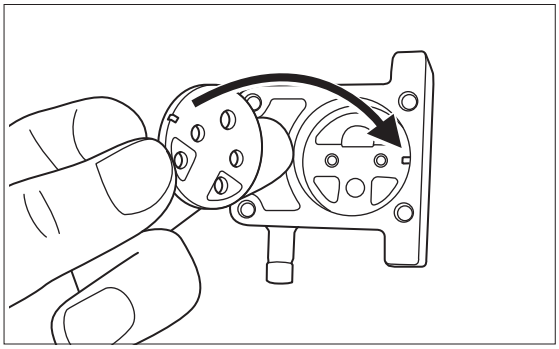
To achieve higher tightness of gasket, wet interior of fuel pump with small amount of gasoline.

1. Attach diaphragm spring, and then diaphragm to fuel pump body.



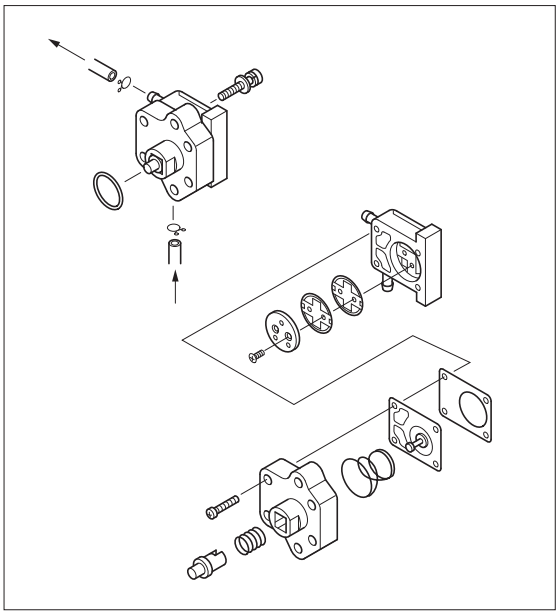
- While holding push rod, turn diaphragm approximately 90 degrees to left or right while pushing it using a finger to attach it to push rod.
- After attaching the part, check if it can be moved smoothly by pushing push rod using a finger.

2. Assemble check valve using rubber (black), plastic (semi-transparent) and then plate (white) in this order.



Set plate with its notch brought to projection of fuel pump body.

3. Attach new gasket and assemble fuel pump body using screws (4).



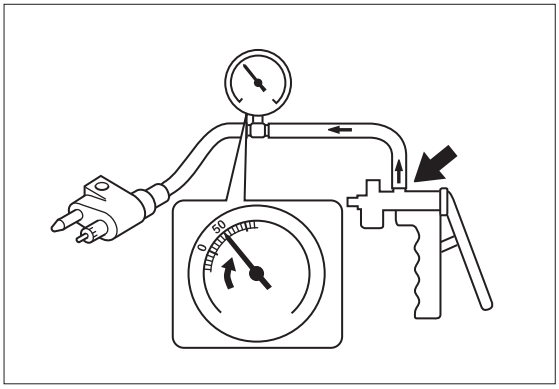
After assembling, check for air leak again.

7) Inspection of Fuel Connector

1. Check fuel connector for crack and damage.

2. Connect vacuum/pressure gauge to outlet of fuel connector.

3. Apply specified pressure, and check if the pressure is maintained for 10 seconds. Replace if necessary.



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

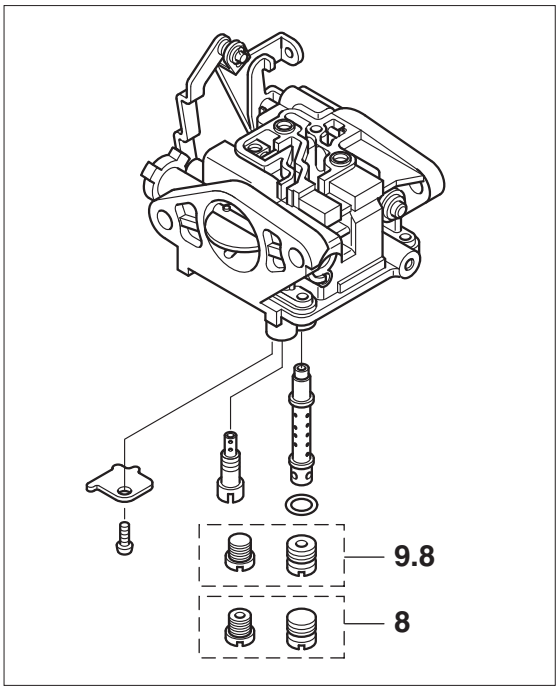
Specified Pressure :
0.029 MPa (4 psi) [0.3 kgf/cm^2]

8) Inspection of Fuel Filter

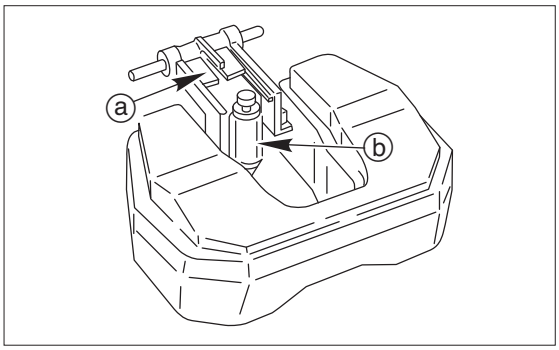
<Refer to inspection items of Chapter 3.>

9) Assembling Carburetor

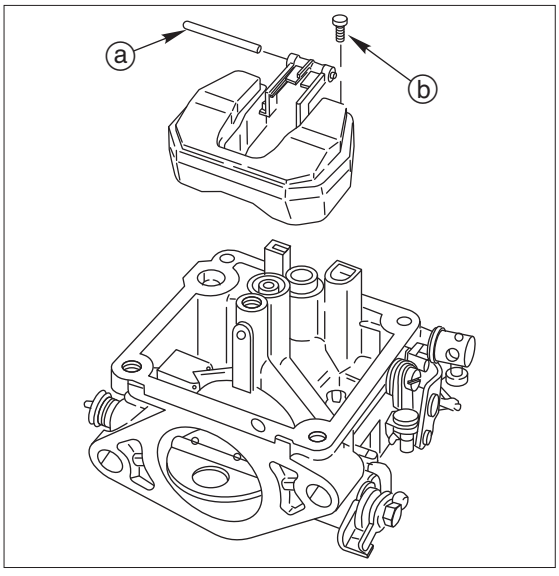
1. Install jets and nozzle



2. Attach needle valve ⓑ to float hinge ⓐ.



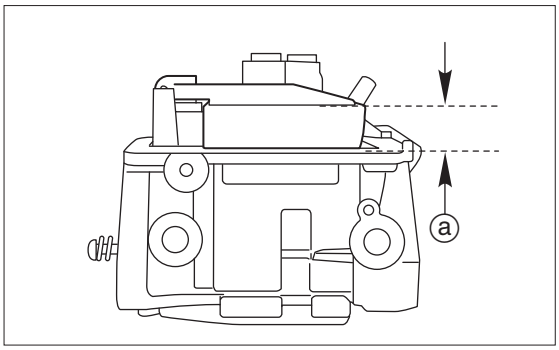
3. Attach float ass'y with float arm pin ⓐ and secure with screw ⓑ.



10) Adjusting Float Height

1. Measure float height as shown, and replace float if out of specification.

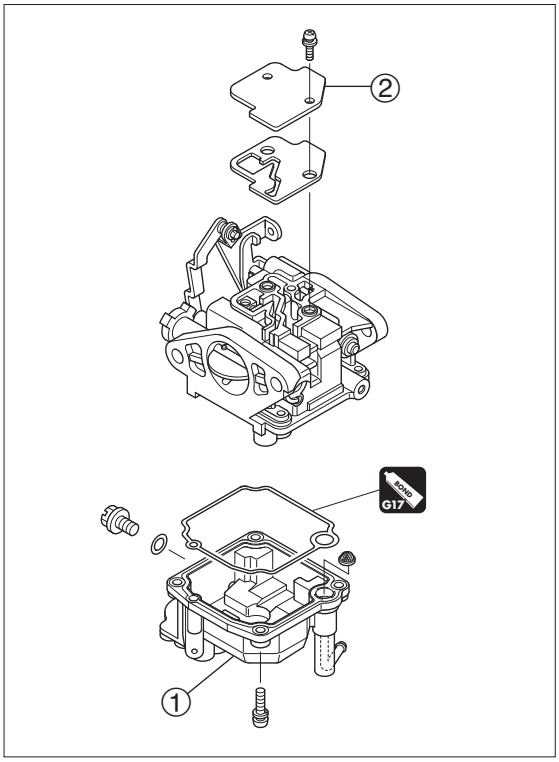
Float Height ⓐ :
10.0±0.5mm (0.3937±0.0197in)



2. Install drain screw, float chamber ① and cover ②.

Thinly apply G17 to gasket before attaching it to float chamber side to prevent it from moving.

G17

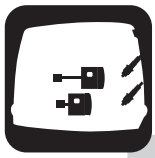


11) Installing Carburetor

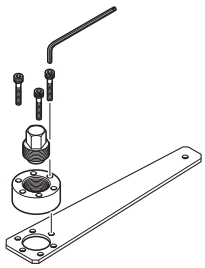
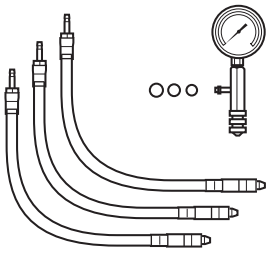
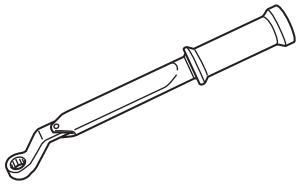
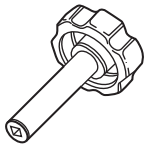
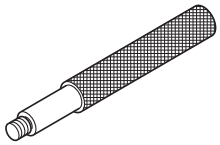
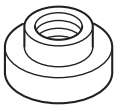
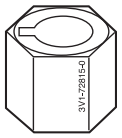
1. Reverse carburetor removing steps to install.

5

Power Unit

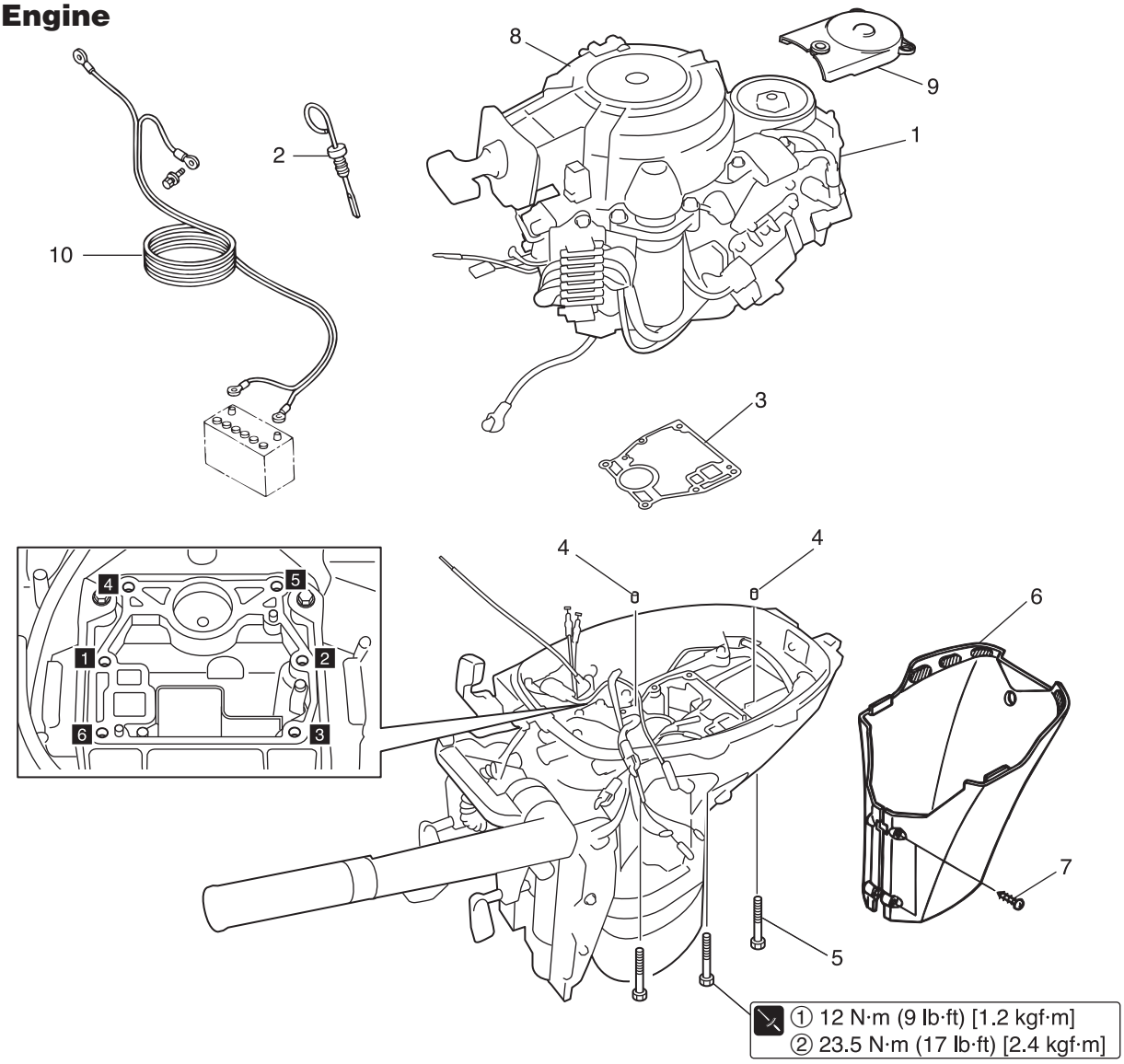


1.Special tools

			
Flywheel Puller Kit P/N. 3V1-72211-0	Piston Slider P/N. 3V1-72871-0	Compression Gauge P/N. 3AC-99030-0	Torque Wrench P/N. 3AC-99070-0
Removing/installing flywheel	Installing piston	Measuring compression pressure	Adjusting valve clearance
		ø34.5 x ø17.5 	
Valve Clearance Driver P/N. 3AC-99071-0	Driver Rod P/N. 3AC-99702-0	Oil Seal Attachment P/N. 3AC-99820-0	Crank Shaft Holder P/N. 3V1-72815-0
Adjusting valve clearance	Installing oil seal	Installing cam shaft oil seal	Holding crank shaft

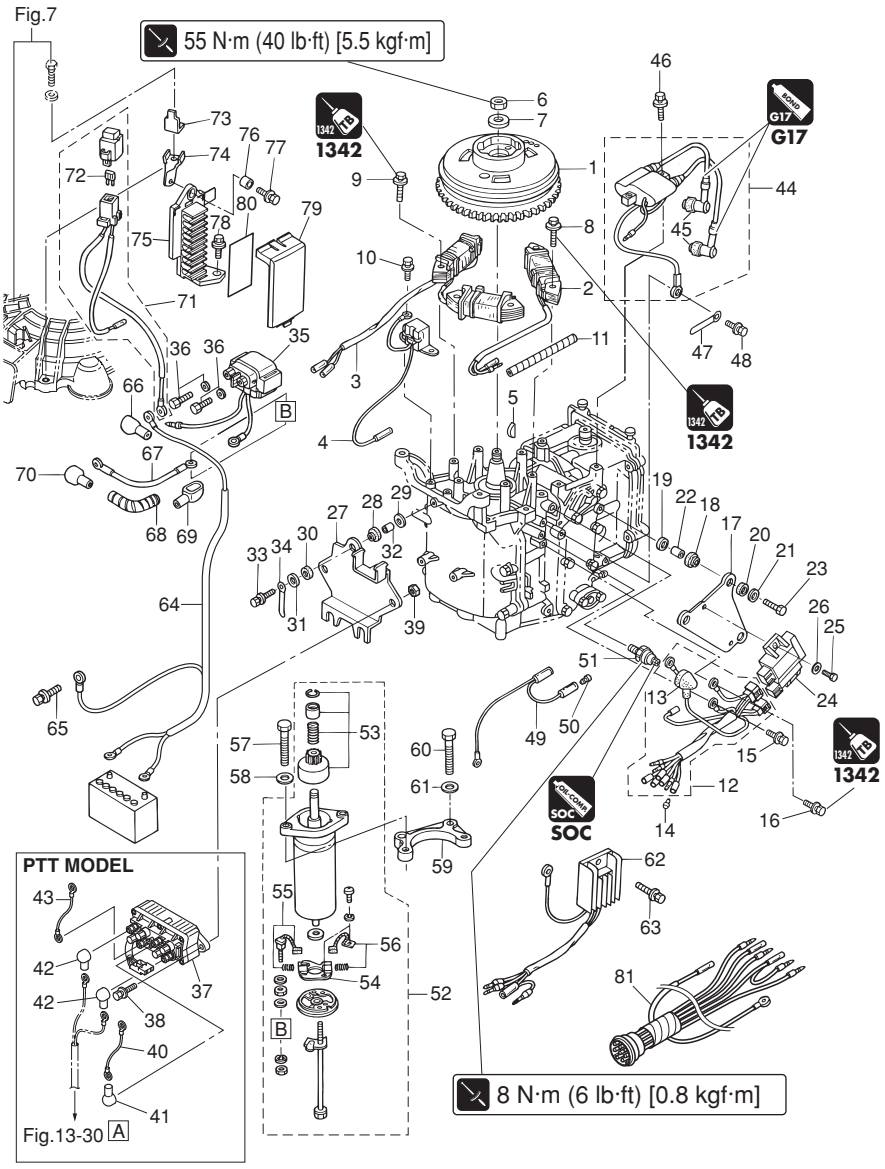
2. Parts Layout

Engine



Ref. No.	Description	Q'ty	Remarks
1	Power Unit	1	
2	Oil Level Gauge	1	
3	Gasket	1	Do not reuse.
4	Dowel Pin	2	
5	Bolt	6	M8 L=35 mm
6	Apron Ass'y	1	
7	Screw	2	M5 L=30 mm
8	Recoil Starter	1	
9	Belt Cover	1	
10	Battery Cable	1	

Magneto • Electric Parts



Ref. No.	Description	Q'ty	Remarks
1	Flywheel W/Gear	1	FF-51
2	Exciter Coil	1	
3	Alternator Ass'y	1	for EF/EFT & EP/EPT
4	Pulsar Coil	1	
5	Key	1	Magneto
6	Nut 12-P1.25	1	
7	Washer	1	
8	Bolt	2	
9	Bolt	4	Alternator for EF/EFT & EP/EPT
10	Bolt	2	Pulsar Coil
11	Spiral Tube Protector ø10-100	1	Alternator & Exciter Cord for EF/EFT & EP/EPT
12	Cd Unit Cord Ass'y	1	
13	Grommet	1	
14-1	Cable Terminal Plug	2	Remote Control Light Green & White
14-2	Cable Terminal Plug	2	Stop Switch Brown & Black for EP/EPT
15	Bolt	1	Ground Cable
16	Bolt	1	for MF
17	Cd Unit Bracket	1	
18	Rubber Mount 8.5-18-7	3	
19	Washer 6-16-1.5	3	Cylinder Block Side
20	Rubber Mount 9-16-4.3	3	

Ref. No.	Description	Q'ty	Remarks
21	Washer 6-16-1.5	3	for EF/EFT & EP/EPT
22	Collar 6.2-9-7.4	3	
23	Bolt	3	
24	CD Unit	1	
25	Pre-coated Bolt 6-16	2	
26	Washer 6-16-1.5	2	
27	Electric Bracket Ass'y	1	for EF/EFT & EP/EPT
28	Rubber Mount 8.5-18-7	3	for EF/EFT & EP/EPT
29	Washer 6-16-1.5	3	Cylinder Block Side
30	Rubber Mount 9-16-4.3	3	for EF/EFT & EP/EPT
31	Washer 6-16-1.5	3	for EF/EFT & EP/EPT Solenoid Switch Side
32	Collar 6.2-9-7.4	3	for EF/EFT & EP/EPT
33	Bolt	3	for EF/EFT & EP/EPT
34	Clamp 6.5-87P	1	for EP/EPT
35	Starter Solenoid	1	for EF/EFT & EP/EPT
36	Bolt	2	for EF/EFT & EP/EPT
37	PTT Solenoid Switch (A)	1	for EFT & EPT
38	Bolt	2	for EPT
39	Nut	2	for EPT
40	Solenoid Switch Cord (A) L=80	1	Red for EFT & EPT
41	Terminal Cap 8-13-28	1	Red Cord for EFT & EPT

Fig.7

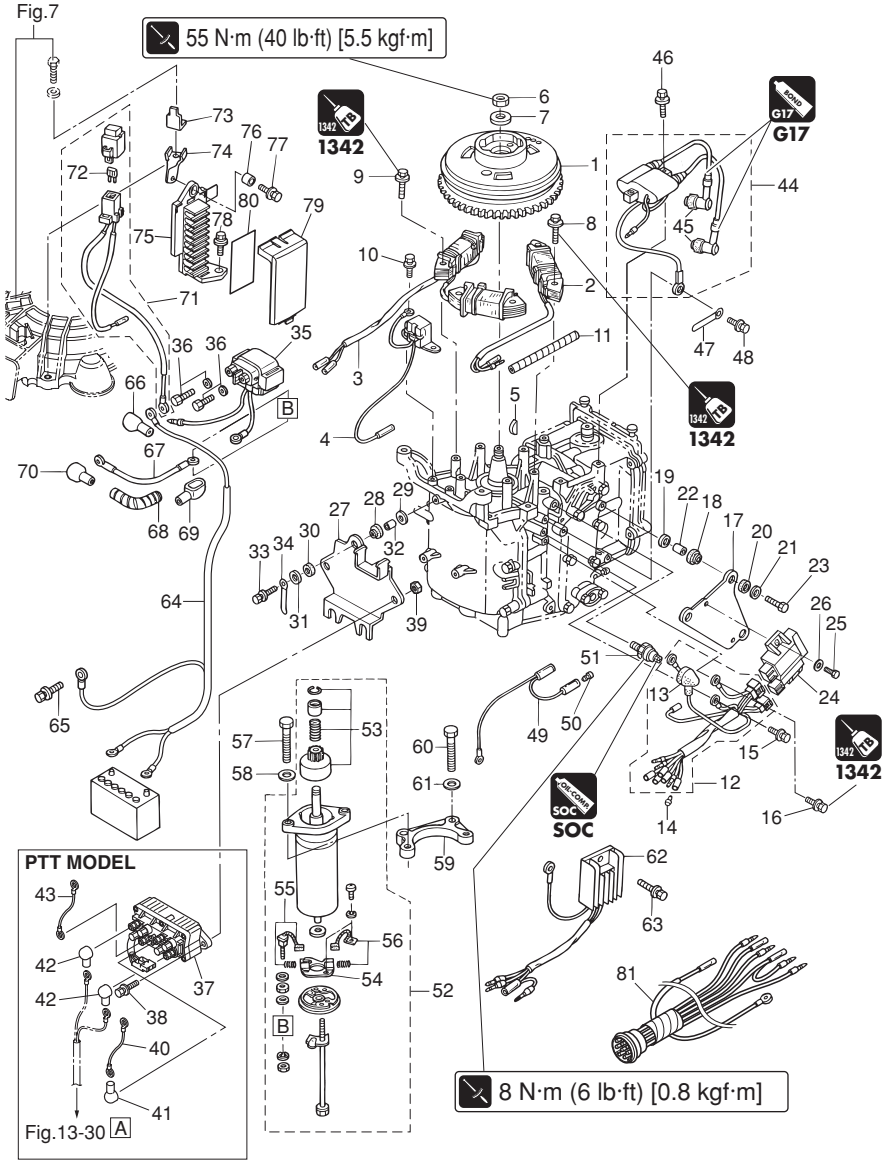
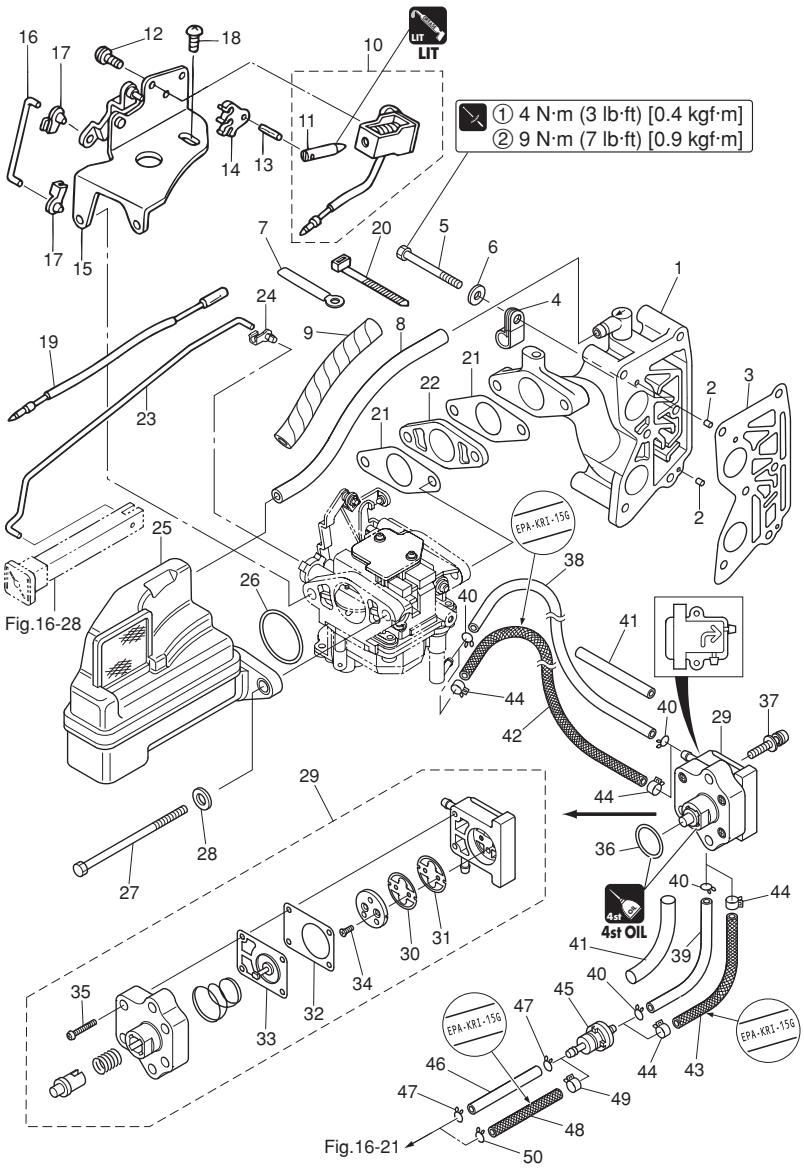


Fig.13-30 A

Ref. No.	Description	Q'ty	Remarks
42	Terminal Cap 8-13-28	2	PTT Cord for EFT & EPT
43	Solenoid Switch Cord (B) L=150	1	Black for EFT & EPT
44	Ignition Coil W/R-cap	1	
45	Plug Cap W/Resistance	2	
46	Bolt	2	
47	Clamp 6.5-47.5P	1	Alternator & Exciter Cord
48	Bolt	1	
49	Separate Cord (Blk)	1	Yellow & Black
50	Cable Terminal Plug	1	Yellow Separate Cord
51	Oil Pressure Switch	1	
52	Starter Motor Ass'y	1	for EF/EFT & EP/EPT
53	Pinion Ass'y	1	
54	Brush Holder	1	
55	Positive Brush	1	Spring
56	Negative Brush	1	Spring
57	Bolt	2	Starter Motor
58	Washer	2	Starter Motor
59	Starter Motor Bracket	1	for EF/EFT & EP/EPT
60	Bolt	2	Bracket
61	Washer	2	Bracket
62	Rectifier Complete	1	for EF/EFT & EP/EPT

Ref. No.	Description	Q'ty	Remarks
63	Bolt	1	
64	Battery Cable L=2500	1	for EF/EFT & EP/EPT
65	Bolt	1	
66	Terminal Cap 13-13-28	1	
67	Starter Cable L=200	1	for EF/EFT & EP/EPT
68	Spiral Tube Protector ø10-100	1	Starter Cable
69	Terminal Cap 8-18-28	1	
70	Terminal Cap 8-13-28	1	
71	Fuse Wire Ass'y L=185	1	for EF/EFT & EP/EPT
72	Fuse 20A	2	for EF/EFT & EP/EPT
73	Fuse Holder Bracket	1	for EF/EFT & EP/EPT
74	Cable Terminal Holder Stay	1	for EF/EFT & EP/EPT
75	Cable Terminal Holder	1	for EF/EFT & EP/EPT
76	Collar 6-8-6	1	
77	Bolt	1	
78	Bolt	1	
79	Cover	1	for EF/EFT & EP/EPT
80	Wiring Diagram Decal	1	
81	Cord Ass'y	1	for EPT

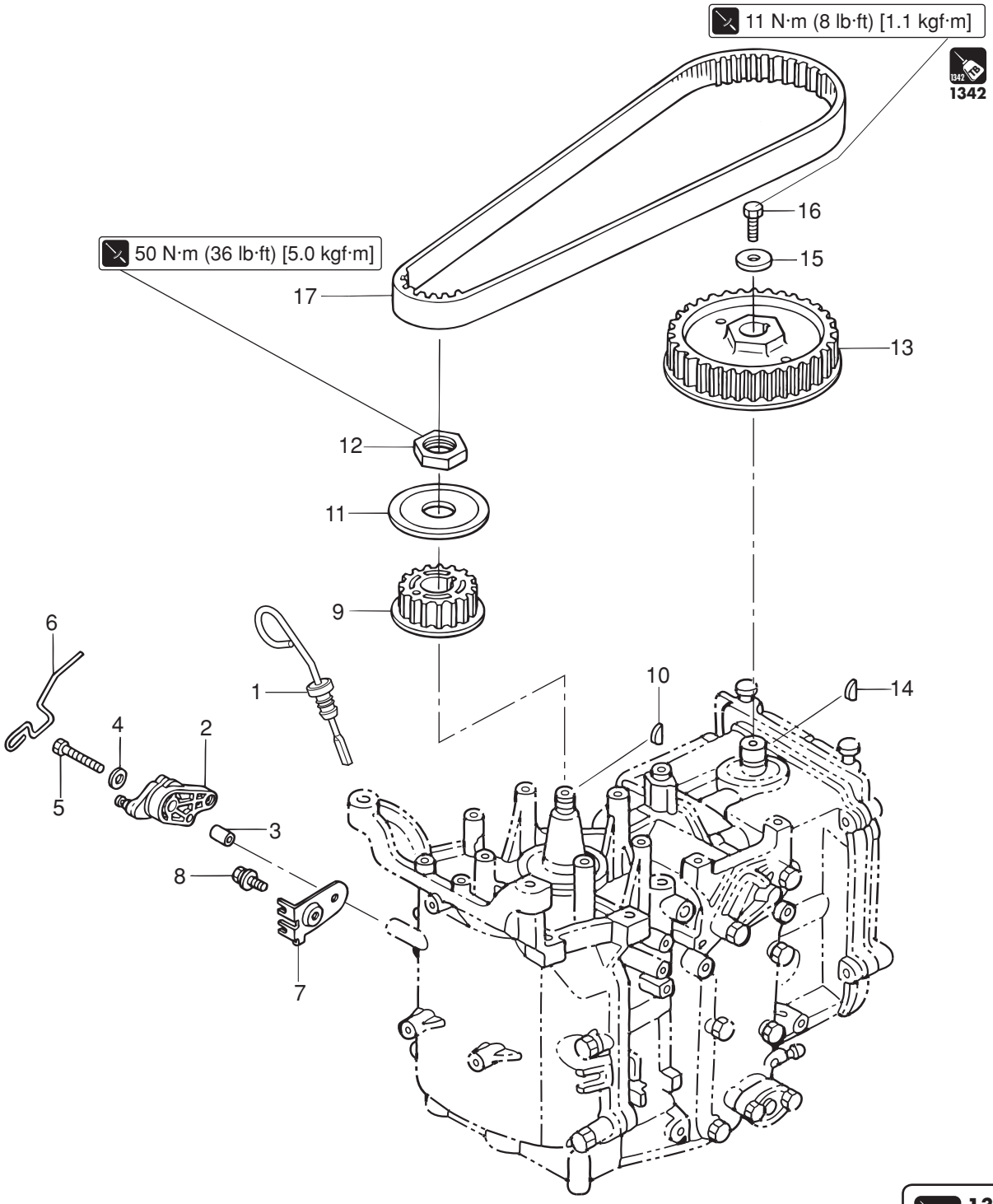
Intake Manifold & Fuel Pump



Ref. No.	Description	Q'ty	Remarks
1	Intake Manifold Ass'y	1	
2	Spring Pin 3-10	2	
3	Intake Manifold Gasket	1	Do not reuse.
4	Clamp 6.5-14L	1	
5	Bolt	6	
6	Washer	6	
7	Clamp 6.5-87P	1	Starter Case
8	Hose	1	Intake Manifold-Intake Silencer 98AB-701000
9	Spiral Tube Protector ø10-100	1	for EP/EPT
10	Choke Solenoid	1	for EP/EPT
11	Plunger	1	
12	Screw	3	Choke Solenoid for EP/EPT
13	Spring Pin 3-12	1	for EP/EPT
14	Choke Solenoid Hook	1	for EP/EPT
15	Choke Solenoid Bracket Ass'y	1	for EP/EPT
16	Link Rod	1	for EP/EPT
17	Rod Snap 1.5-2	2	for EP/EPT
18	Screw	1	for EP/EPT
19	Assist Cord (Blu)	1	Blue for EP
20	Band 104	1	for EP/EPT
21	Carburetor Gasket	2	Do not reuse.
22	Insulator	1	
23	Choke Rod	1	for MF & EF/EFT
24	Rod Snap 3-B	1	for MF & EF/EFT
25	Intake Silencer Ass'y	1	

Ref. No.	Description	Q'ty	Remarks
26	O-ring 2.4-35.2	1	Do not reuse.
27	Bolt	2	Carburetor
28	Washer	2	
29	Fuel Pump Ass'y	1	
30	Check Valve	1	White
31	Check Valve	1	Black R
32	Pump Body Gasket	1	
33	Pump Diaphragm	1	
34	Screw	2	
35	Screw	4	
36	O-ring 2.6-18.7	1	Do not reuse.
37	Screw	2	
38	Hose	1	Fuel Pump-Carburetor STD 98AB-501000
39	Hose	1	Fuel Filter-Fuel Pump STD 98AB-501000
40	Clip ø10	4	STD
41	Protector ø12-120	2	STD Fuel Filter-Fuel Pump Fuel Pump-Carburetor
42	Fuel Hose W/Protector L=260	1	Low Permeation Parts USA EPA-KRI-15G
43	Fuel Hose W/Protector L=150	1	Low Permeation Parts USA EPA-KRI-15G
44	Clip ø9.4	4	for USA Model
45	Fuel Filter Ass'y	1	
46	Hose	1	Connector-Fuel Filter STD 98AB-501000
47	Clip ø10	2	STD
48	Fuel Hose W/Protector L=350	1	Low Permeation Parts USA EPA-KRI-15G
49	Clip ø9.4	1	Fuel Filter Side for USA Model
50	Clip ø10	1	Connector Side for USA Model

Pulley & Timing Belt



Ref. No.	Description	Q'ty	Remarks
1	Oil Level Gauge	1	
2	Throttle Drum Ass'y	1	
3	Spacer 6.2-9-15.7	1	
4	Washer 6-16-1.5	1	
5	Bolt	1	
6	Throttle Rod	1	
7	Throttle Wire Bracket	1	
8	Bolt	1	
9	Drive Pulley	1	Timing Pulley

Ref. No.	Description	Q'ty	Remarks
10	Key	1	Crankshaft
11	Belt Guide	1	
12	Nut	1	
13	Driven Pulley	1	Camshaft Pulley
14	Key 10-3.7-3	1	Camshaft
15	Washer 6.5-19-3.2	1	
16	Pre-coated Bolt 6-20	1	
17	Timing Belt	1	

Cylinder Head & Oil Pump

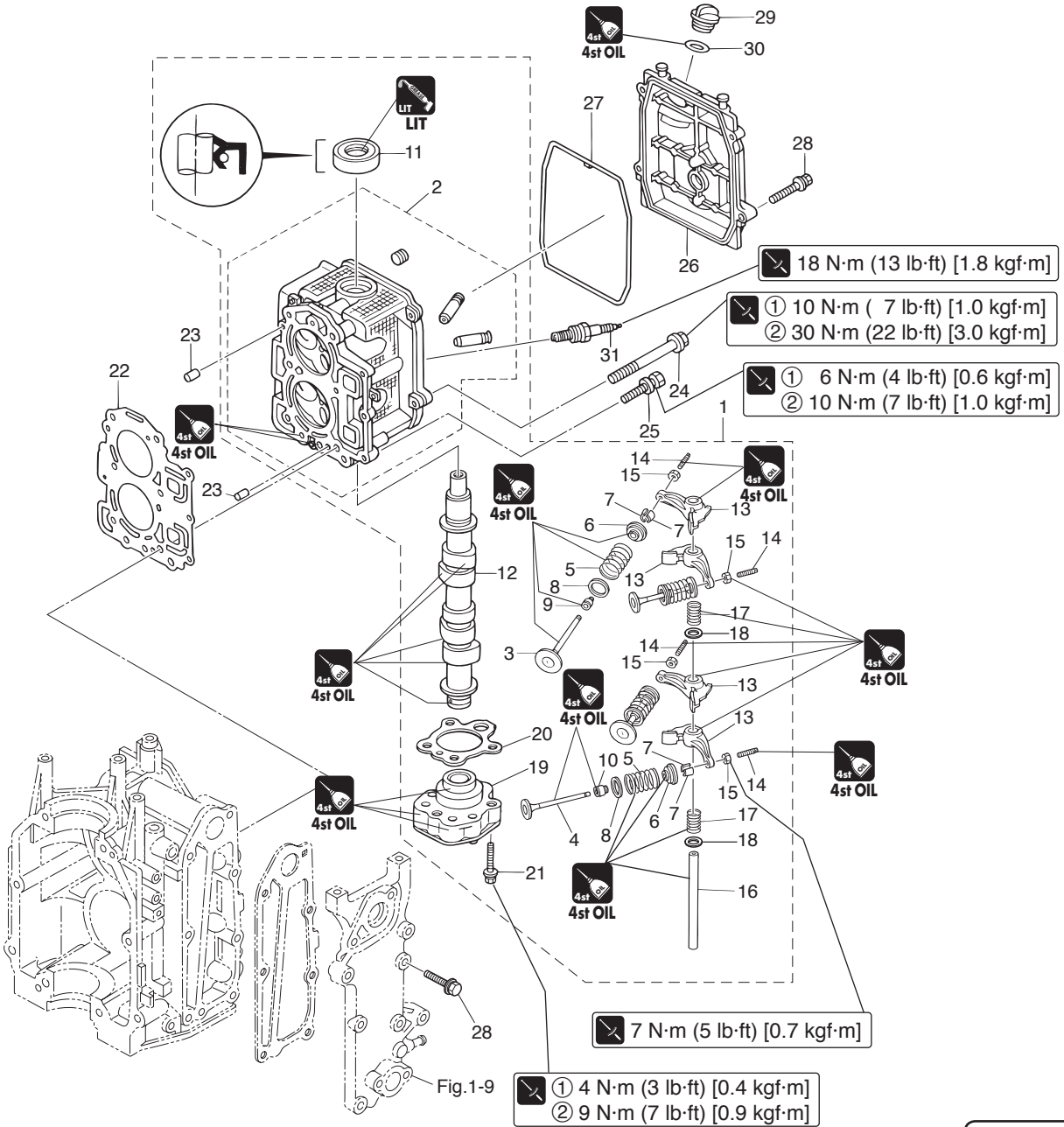


Fig.1-9

Ref. No.	Description	Q'ty	Remarks
1	Cylinder Head Complete	1	
2	Cylinder Head Ass'y	1	
3	Intake Valve	2	
4	Exhaust Valve	2	
5	Valve Spring L=38.3	4	
6	Retainer	4	
7	Cotter	8	
8	Valve Spring Seat	4	

Ref. No.	Description	Q'ty	Remarks
9	Intake Valve Stem Seal	2	Black Do not reuse.
10	Exhaust Valve Stem Seal	2	Green Do not reuse.
11	Oil Seal 18-35-8	1	Do not reuse.
12	Camshaft Ass'y	1	
13	Rocker Arm	4	
14	Adjusting Screw	4	
15	Adjusting Nut	4	
16	Rocker Arm Shaft	1	

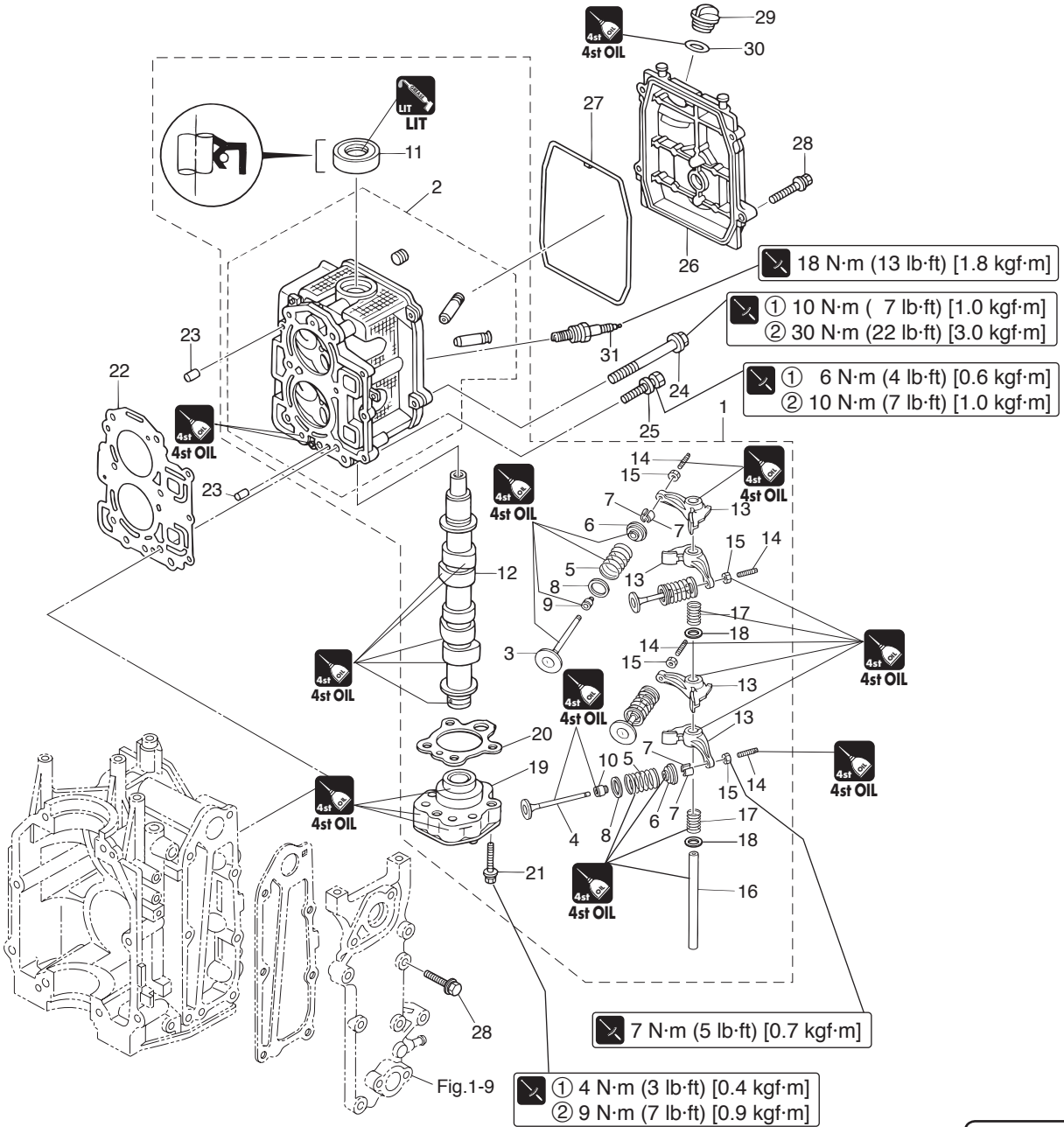
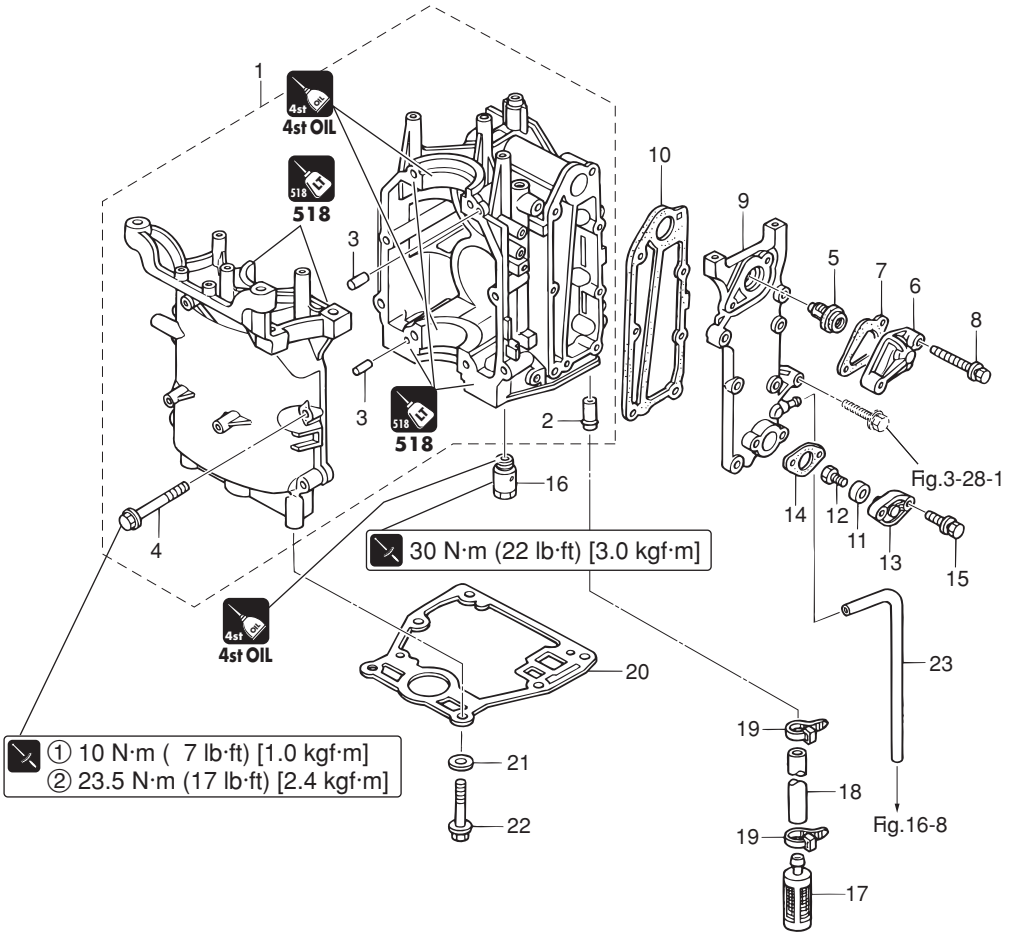


Fig.1-9

Ref. No.	Description	Q'ty	Remarks
17	Rocker Shaft Spring L=25	2	
18	Washer 13.2-21.8-2	2	
19	Oil Pump Ass'y	1	
20	Oil Pump Gasket	1	
21	Bolt	3	
22	Cylinder Head Gasket	1	Do not reuse.
23	Dowel Pin 6-12	2	
24	Cylinder Head Bolt 8-50	6	

Ref. No.	Description	Q'ty	Remarks
25	Bolt	3	
26	Cylinder Head Cover	1	
27	Cylinder Head Cover Gasket	1	Do not reuse.
28	Bolt	5	Exhaust Cover
28	Bolt	4	Cylinder Head Cover
29	Oil Filler Cap	1	
30	O-ring 3.1-24.4	1	Do not reuse.
31	Spark Plug (DCPR6E)	2	NGK

Cylinder & Crank Case



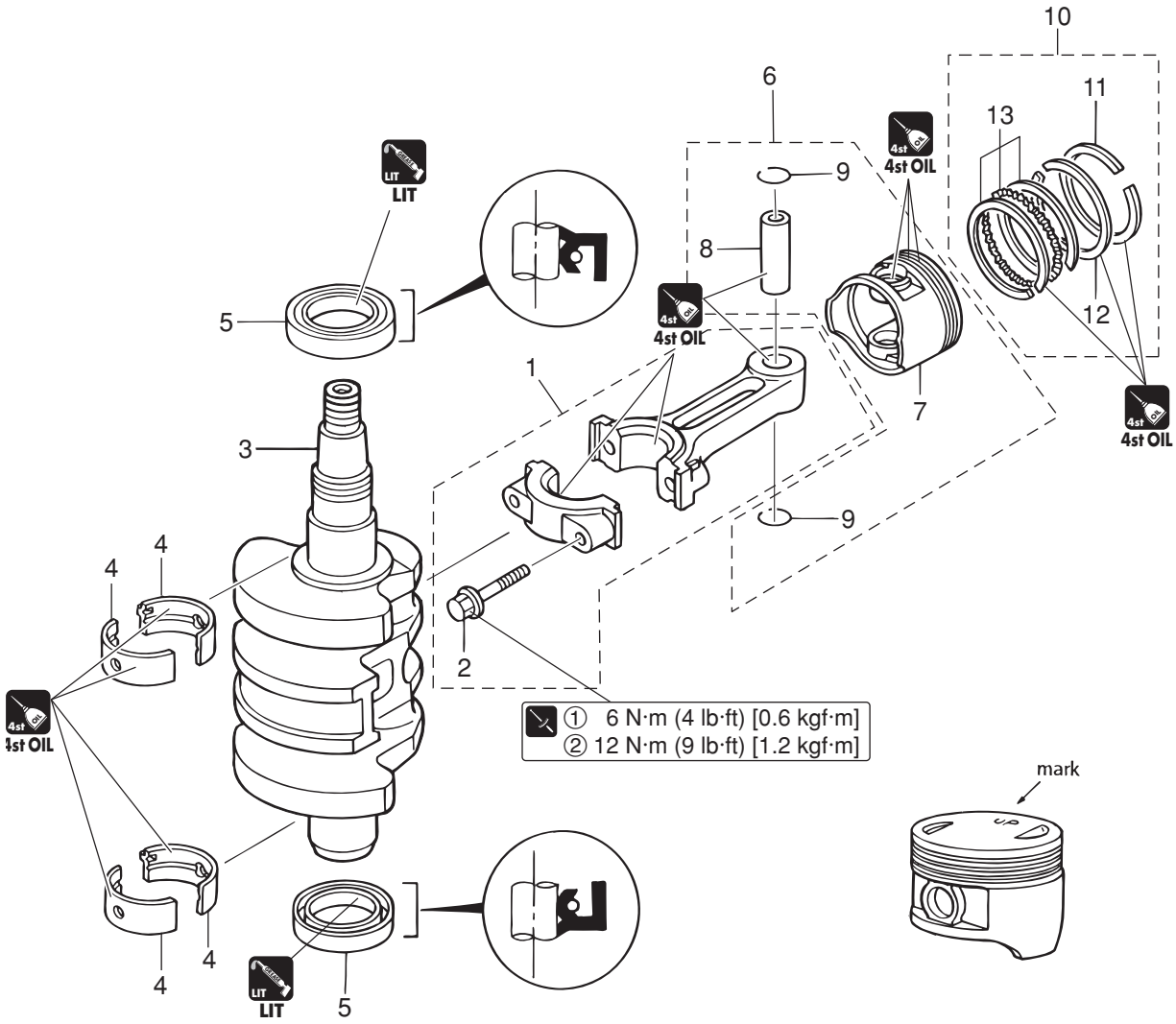
4st OIL

518

Ref. No.	Description	Q'ty	Remarks
1	Cyl Block & Crankcase Ass'y	1	
2	Nipple 10-32	1	
3	Dowel Pin 6-12	2	
4	Cylinder Head Bolt 8-50	8	
5	Thermostat	1	Mark 60
6	Thermostat Cap	1	
7	Thermostat Cap Gasket	1	Do not reuse.
8	Bolt	2	
9	Exhaust Cover (Outer)	1	
10	Exhaust Cover Gasket	1	Do not reuse.
11	Anode	1	
12	Bolt	1	

Ref. No.	Description	Q'ty	Remarks
13	Anode Plug	1	
14	Gasket	1	Do not reuse.
15	Bolt	2	
16	Plunger Ass'y	1	
17	Oil Strainer Ass'y	1	
18	Hose	1	98AH-951000
19	Band 158	2	Do not reuse.
20	Engine Basement Gasket	1	Do not reuse.
21	Washer	6	
22	Bolt 8-35	6	
23	Hose	1	Exhaust Cover-Water Nipple 98AB-501000

Piston & Crankshaft

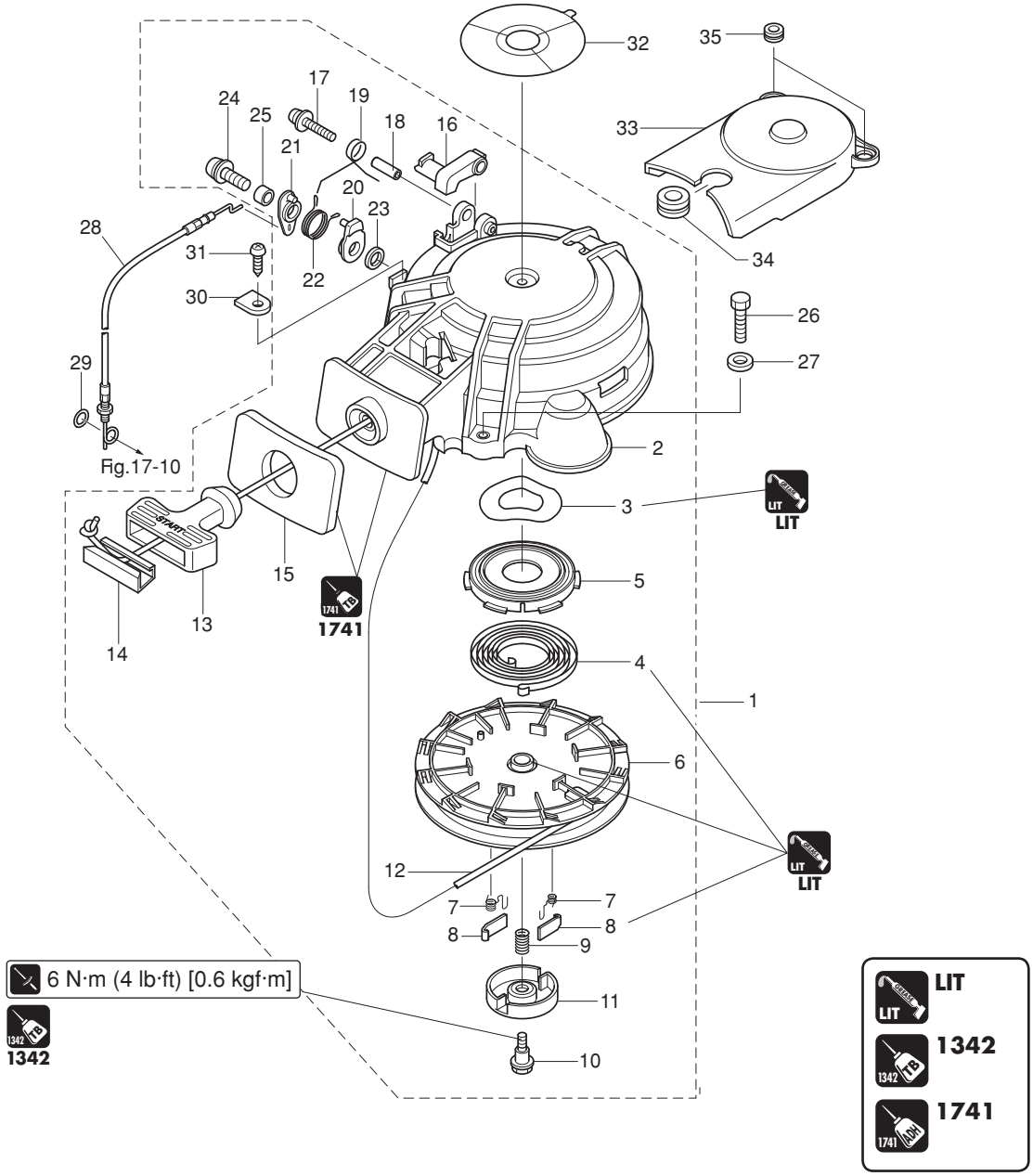


4st OIL
LIT

Ref. No.	Description	Q'ty	Remarks
1	Connecting Rod Ass'y	2	
2	Connecting Rod Bolt	2	
3	Crankshaft Ass'y	1	
4	Plain Shaft Bearing 30-33-15	4	t=1.5 0.006-0.012
	Plain Shaft Bearing 30-33-15	4	t=1.5 0-0.006
5	Oil Seal 30-45-8	2	Do not reuse.
6	Piston Repair Kit	2	STD
	Piston Repair Kit (0.5 O/S)	2	OPT
7	Piston	2	STD
	Piston (0.5 O/S)	2	OPT

Ref. No.	Description	Q'ty	Remarks
8	Piston Pin	2	
9	Piston Pin Clip	4	Do not reuse.
10	Piston Ring Set	2	STD
	Piston Ring Set (0.5 O/S)	2	OPT
11	Piston Ring	2	STD 1st
	Piston Ring (0.5 O/S)	2	OPT 1st
12	Piston Ring	2	STD 2nd
	Piston Ring (0.5 O/S)	2	OPT 2nd
13	Piston Ring-oil	2	STD Oil
	Piston Ring-oil (0.5 O/S)	2	OPT Oil

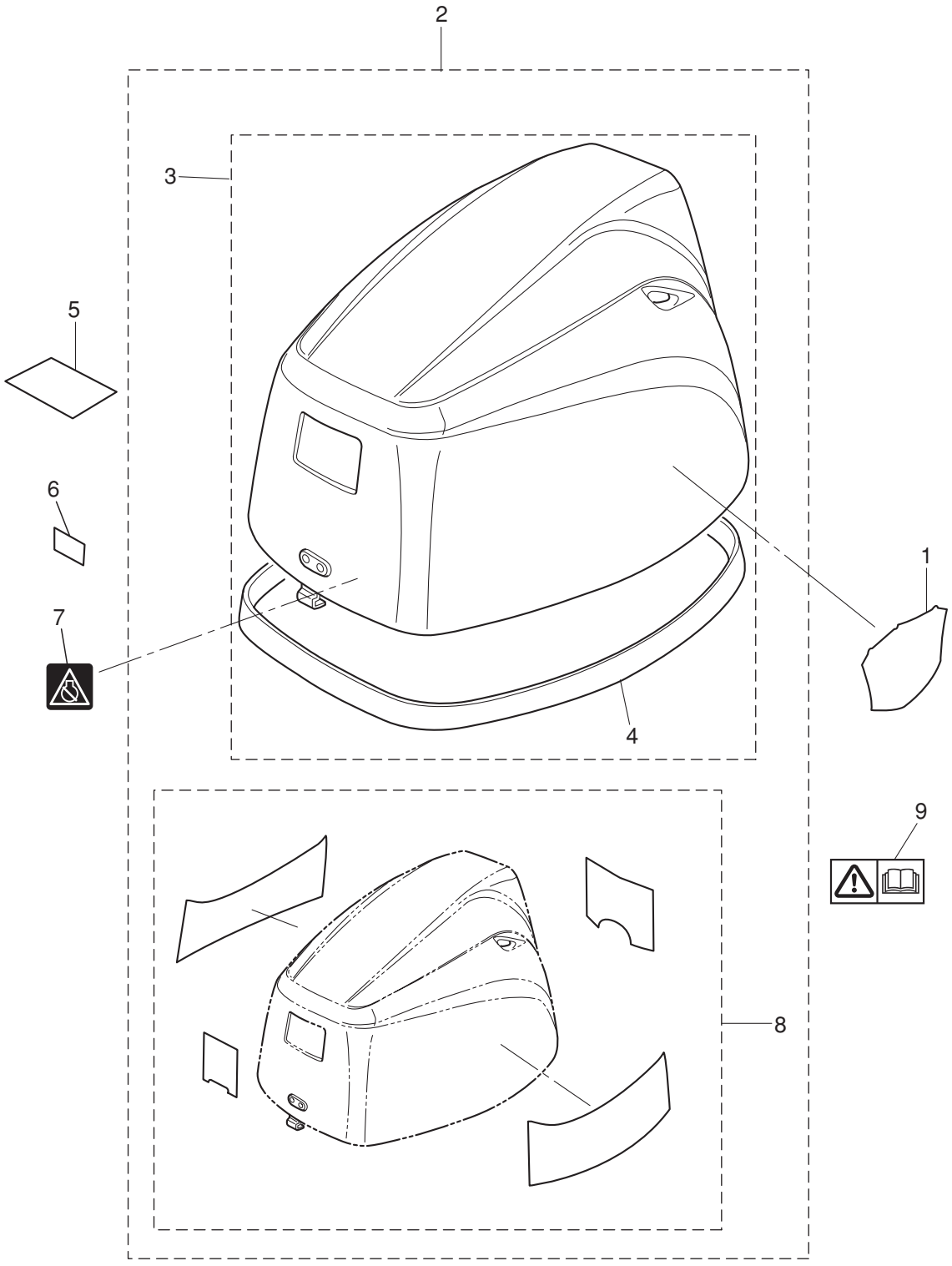
Recoil Starter



Ref. No.	Description	Q'ty	Remarks
1	Recoil Starter Ass'y	1	
2	Starter Case Ass'y	1	
3	Wave Washer	1	
4	Starter Spring	1	
5	Starter Spring Case	1	
6	Reel ø140	1	
7	Return Spring	2	
8	Ratchet	2	
9	Friction Spring	1	
10	Bolt 5-10-6.8-7.8	1	
11	Friction Plate	1	
12	Starter Rope ø4.5-1600	1	
13	Starter Handle	1	
14	Rope Anchor	1	
15	Starter Seal	1	
16	Starter Lock	1	
17	Screw	1	
18	Collar 4-6-21	1	
19	Starter Lock Spring	1	

Ref. No.	Description	Q'ty	Remarks
20	Starter Lock Cam	1	
21	Starter Lock Lever	1	
22	Starter Lock Cam Spring	1	
23	Washer	1	
24	Screw	1	
25	Collar 6.2-9-12.3	1	
26	Pre-coated Bolt 6-25	3	
27	Washer 6-16-1.5	3	for MF
	Washer 6-16-1.5	2	for EF/EFT & EP/EPT
28	Starter Lock Wire	1	
29	O-ring 1.5-2.5	1	**Do not reuse.**
30	Stopper	1	
31	Tapping Screw 5-12	1	
32	Caution Decal (B)	1	
33	Belt Cover	1	
34	Rubber Mount 2.5-20	1	
35	Grommet 13-2	2	

Top Cowl



Ref. No.	Description	Q'ty	Remarks
1	Ptt Decal	2	for EFT/EPT
2	Top Cowl Ass'y	1	
3	Top Cowl Sub-Ass'y	1	
4	Top Cowl Seal L=1295	1	
5	Caution Decal (A)	1	
6	Oil Pressure Decal	1	

Ref. No.	Description	Q'ty	Remarks
7	Stop Switch Decal	1	for EF/EFT
8	Decal Set (MFS8B)	1	
	Decal Set (MFS9.8B)	1	
	Decal Set (MFS6BZ)	1	
9	Caution Decal	1	for EU Model

3. Inspection Items

1) Inspection of Compression Pressure

1. Run engine 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.

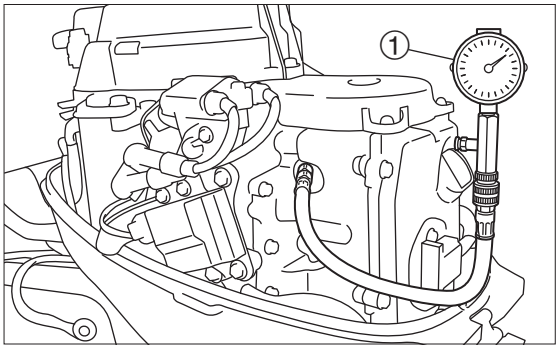
> **⚠ CAUTION**
>
> **Remove lock plate (of stop switch lanyard) from stop switch before measuring compression pressure. This will prevent engine from accidental starting.**

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.**

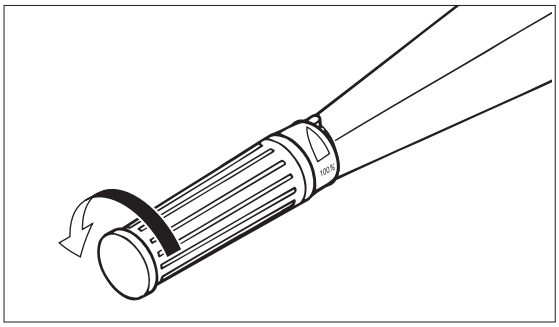
5. Install compression gauge to plug hole.

> **Compression gauge ① :**
> P/N. 3AC-99030-0



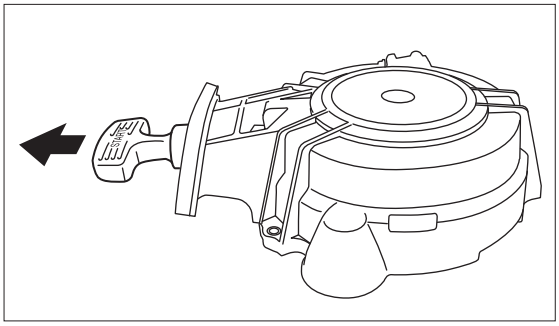
6. Fully open throttle, crank engine until compression gauge indication stabilizes, and then measure compression pressure.

> **Compression Pressure (Reference) :500 r/min**
> : 0.88 MPa (128 psi) [9.0 kgf/cm²]



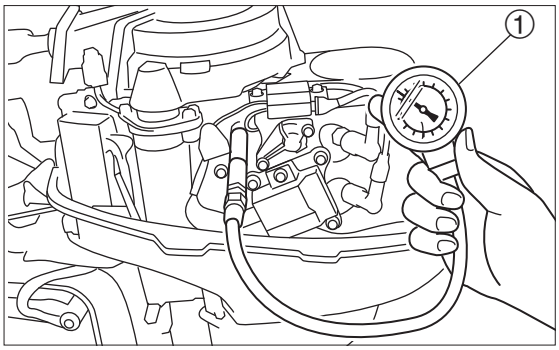
Compression pressure varies depending on the cranking speed, and normally changes at least as much as approximately 10%.

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



- If compression pressure of a cylinder increases after the above measure, check pistons and piston rings of the cylinder for wear. Replace if necessary.
- If compression pressure does not increase after the above measure, check valve clearances, valves, valve seats, cylinder sleeves, cylinder head gaskets and cylinder head. Adjust or replace if necessary.

2) Inspection of Oil Pressure



1. Spread rag below oil pressure switch.

2. Remove oil pressure switch and connect oil pressure gauge ① to switch hole.

⚠ CAUTION

Do not overtighten, or Block damage can occur.

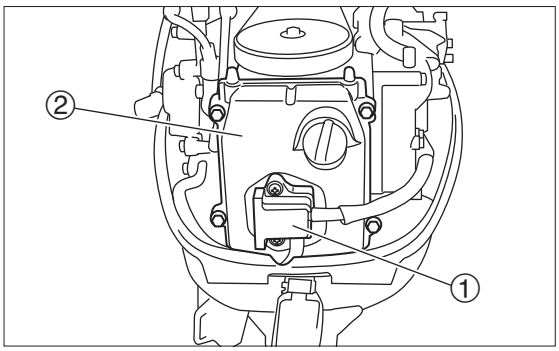
Use commercially available oil pressure gauge (1/8" npt test port).
Use the instrument applicable to 1 MPa (142 psi) [10 kgf/cm²].

3. Start engine and run 5 minutes to warm up at idling revolution speed.

4. Measure oil pressure. If the pressure is below specified value, check oil pump for oil leak, and oil strainer and plunger.

Hydraulic Pressure (Reference)
:Oil Temperature 70°C (167°F)
0.10MPa (14 psi) [1.0 kgf/cm²] or higher at 950 r/min
0.33 MPa (47 psi) [3.3 kgf/cm²] or higher at 5,000 r/min

3) Inspection of Valve Clearance



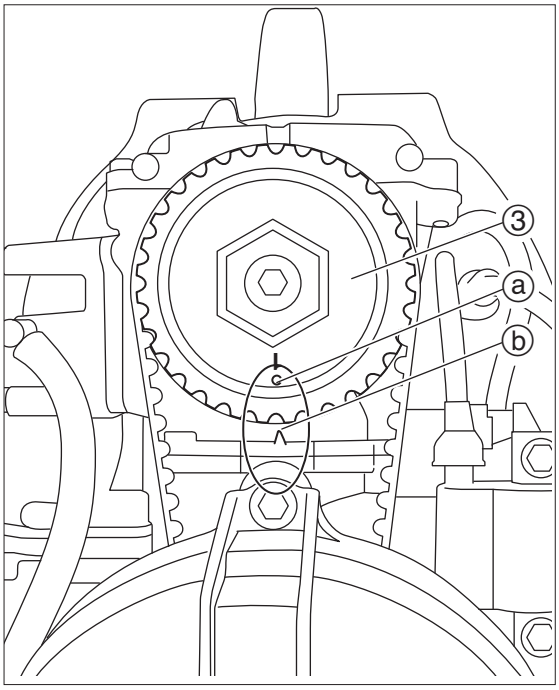
Perform adjustment of valve clearances when engine is cold.

1. Remove starter lock cable (Upper), and then recoil starter and belt cover.

2. Remove fuel pump ①.

3. Disconnect plug cap connection, and then, remove spark plug and cylinder head cover ②.

When removing or installing cylinder head cover, use 10mm ring wrench with large offset angle.



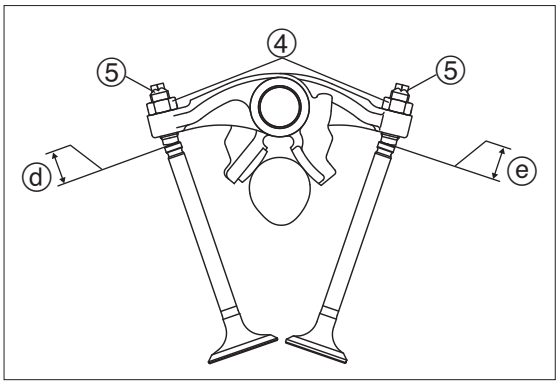
4. Operate recoil starter slowly to bring "●1" mark ⓐ of cam shaft pulley ③ to "▲" mark ⓑ of cylinder head.

No.1 piston is to be at top dead center of compression stroke.

5. Check and adjust No. 1 cylinder's intake and exhaust valve clearances. Adjust gap if it is out of specified range.

Valve Clearance (when engine is cold):
(IN) Intake valve ⓐ : 0.13 - 0.17 mm (0.0051 - 0.0067 in)
(EX) Exhaust valve ⓑ : 0.18 - 0.22 mm (0.0071 - 0.0087 in)

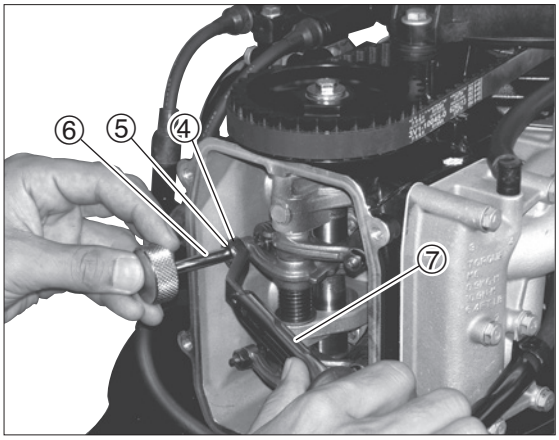
6. Loosen rocker arm lock nut ④, and turn adjusting screw ⑤ so that valve clearances are within the specified range.



- Turning adjust screw ⑤ clockwise makes valve clearance smaller.
- Turning adjust screw ⑤ counterclockwise makes valve clearance larger.

Valve clearance driver ⑥ :
P/N. 3AC-99071-0
Torque wrench ⑦ :
P/N. 3AC-99070-0
Thickness gauge :
Use commercially available item.

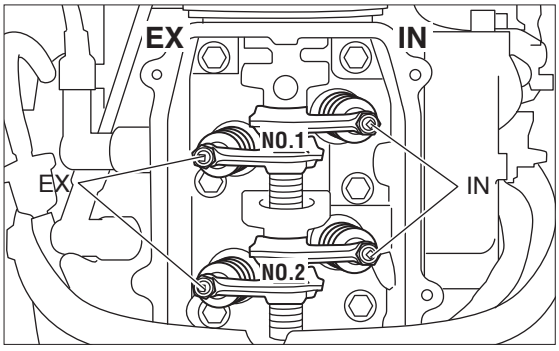
7. Tighten rocker arm lock nut ④ to specified torque, and check valve clearance again. Readjust if necessary.



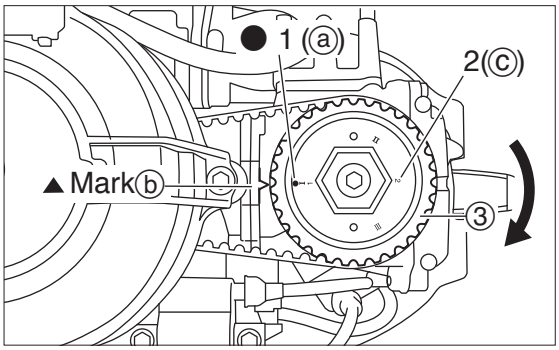
Rocker arm lock nut ④ :
7 N · m (5 lb · ft) [0.7 kgf · m]

Valve Clearance (when engine is cold):
(IN) Intake valve ⓐ : 0.13 - 0.17 mm (0.0051 - 0.0067 in)
(EX) Exhaust valve ⓑ : 0.18 - 0.22 mm (0.0071 - 0.0087 in)

8. Rotate flywheel clockwise to bring "2" mark ⓒ of cam shaft pulley ③ to "▲" mark ⓑ of cylinder head.



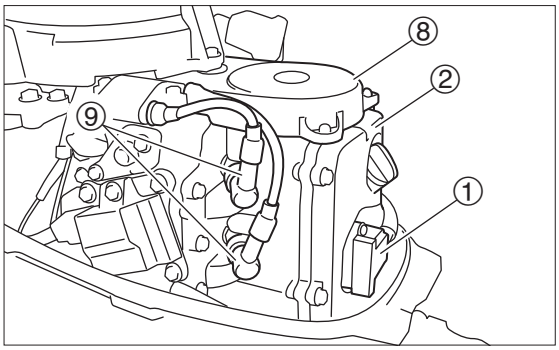
9. Check and adjust No. 2 cylinder's intake and exhaust valve clearances. Adjust gap if it is out of specified range.



10. Attach new O ring, cylinder head cover ②, fuel pump ①, all spark plugs, recoil starter, and belt cover ⑧.

11. Reconnect starter lock cable (Upper).

12. Reconnect plug cap ⑨.

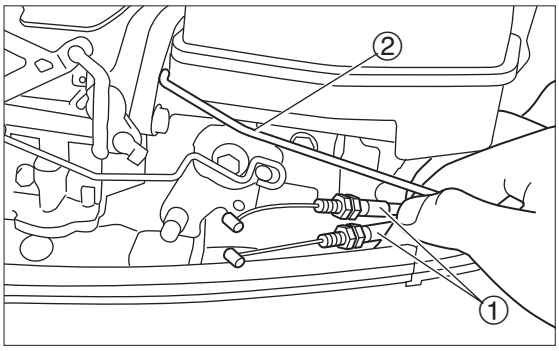


4) Removing Power Unit

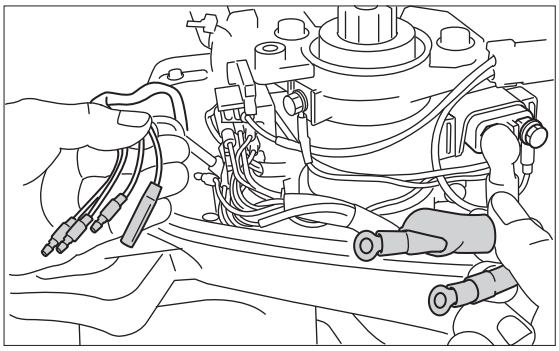
1. Disconnect starter lock cable (upper).

2. Disconnect throttle wire ① and choke link rod ②. (Tiller handle model)

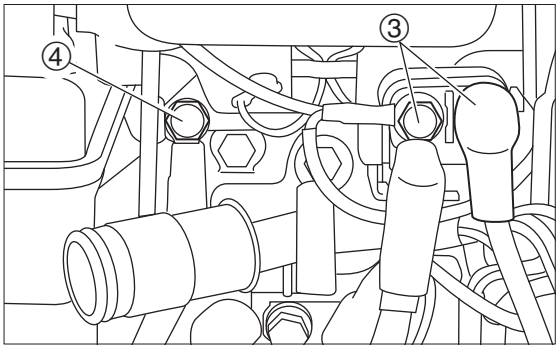
3. Remove throttle cable and shift cable. (Remote Control Model)



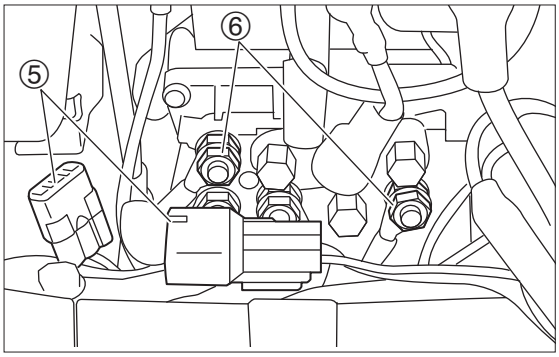
4. Disconnect remote controller harness coupler, and then, remove remote controller harness. (Remote Control Model)



5. Disconnect battery cords ③ and ④. (Electric starter model)
Disconnect ground wire of PT solenoid ④. (PT Model)

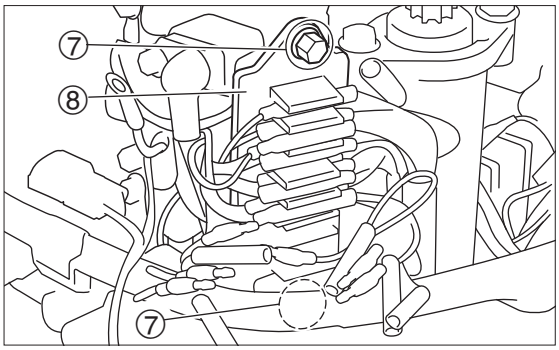


6. Disconnect PT solenoid coupler ⑤ and PT leads ⑥. (PT Model)



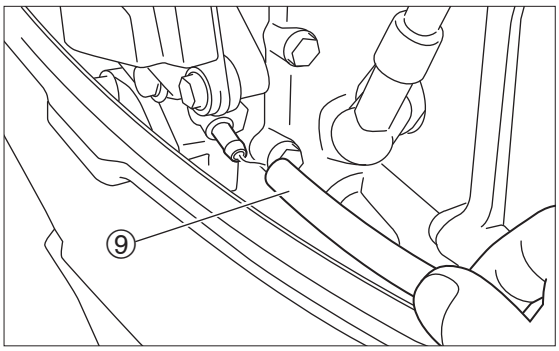
5

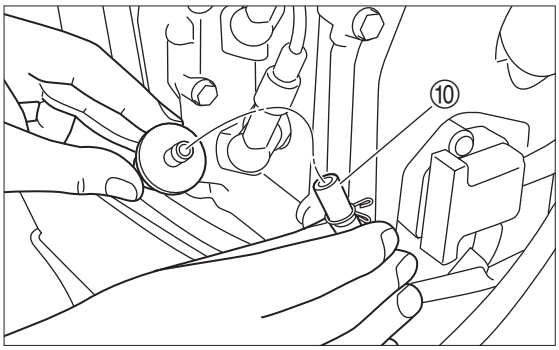
7. Disconnect all electrical leads.
   Remove cord holder bolts (2) ⑦, and then, remove all leads from cord holder ⑧. (PT Model)



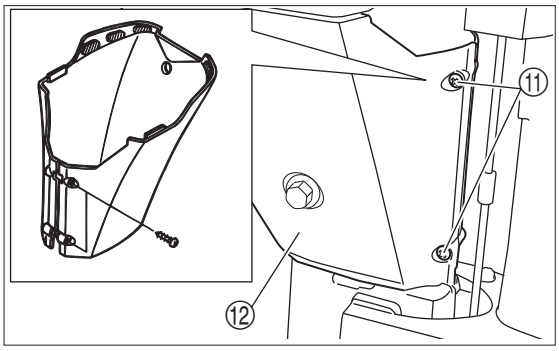
8. Remove oil level gauge.

9. Disconnect cooling water (pilot water) hose ⑨ and fuel hose ⑩.



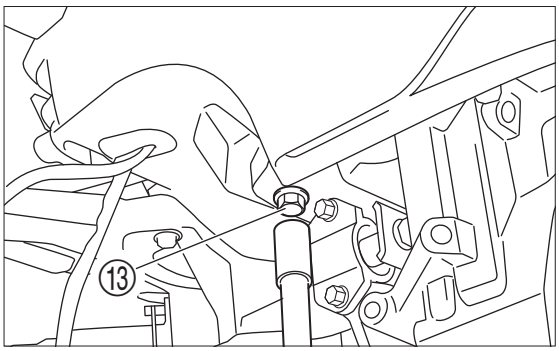


10. Remove screw ⑪ (2), and then, remove Apron Ass'y ⑫.

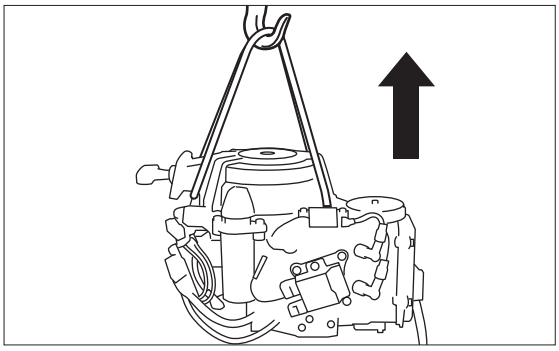


11. Remove power unit by removing bolts ⑬ (6) and then hoisting it.

- When hoisting power unit, perform the work carefully while checking if wires and hoses are caught by other parts.
- Before removing power head ass'y, note arrangement of oil strainer hose.
- Loosen power unit mounting bolts in the order reverse of tightening.

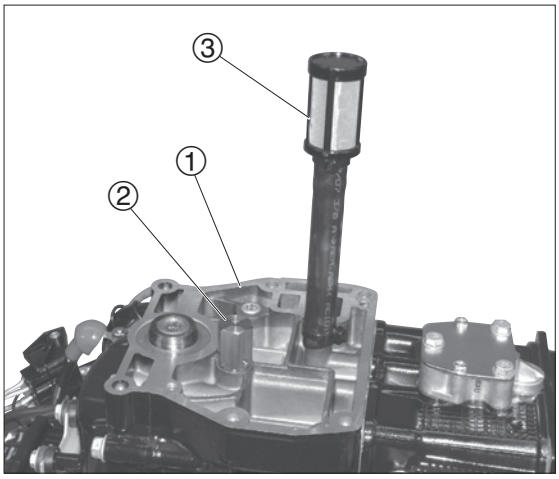


12. Remove gasket and dowel pins (2).



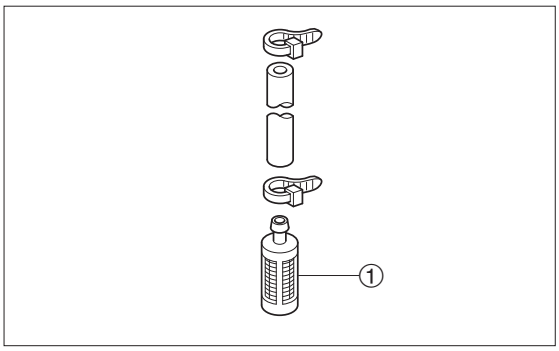
5) Removing Plunger and Oil Strainer

1. Put removed power head ass'y ① upside down on the work bench.
2. Remove plunger ② from power head ass'y ①.
3. Remove oil strainer ③ from power head ass'y ①.



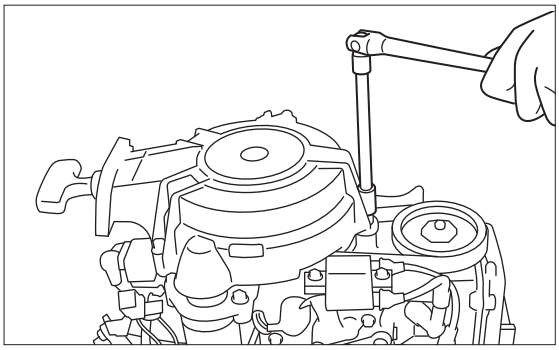
6) Inspection of Plunger and Oil Strainer

1. Check plunger for clogging and deposition. Use small bladed screw driver to check operation of plunger valve by pushing it down. Clean, or replace if necessary.
2. Check oil strainer ① for dirt and deposition. Clean, or replace if necessary.



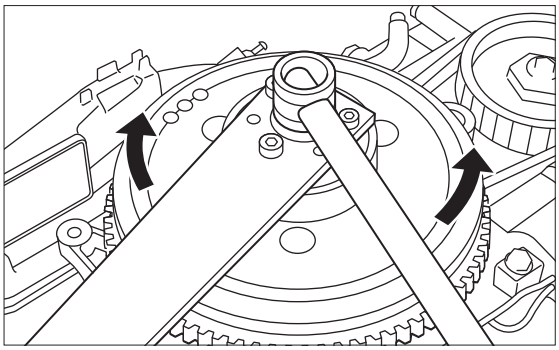
7) Flywheel and Electrical Components

1. Remove recoil starter and belt cover.



2. Loosen flywheel nut.

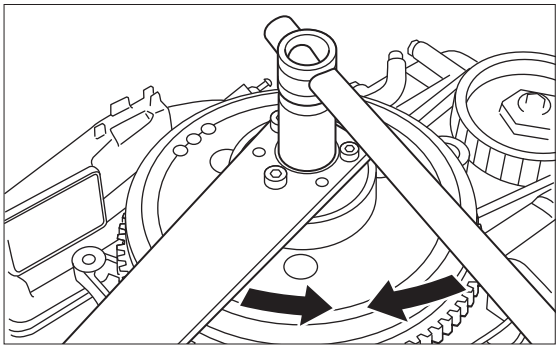
Flywheel puller kit :
P/N. 3V1-72210-0



3. Remove flywheel and key.

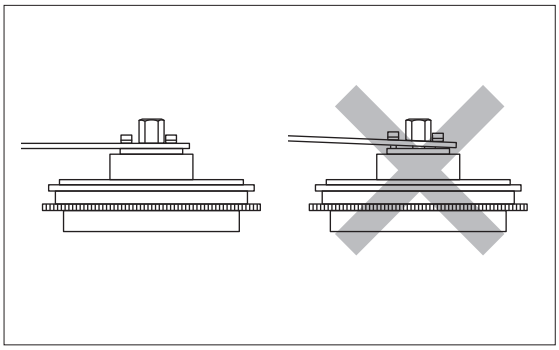
Flywheel puller kit :
P/N. 3V1-72210-0

Screw puller onto crankshaft end until flywheel is disengaged from tapered section of crankshaft.



⚠ CAUTION

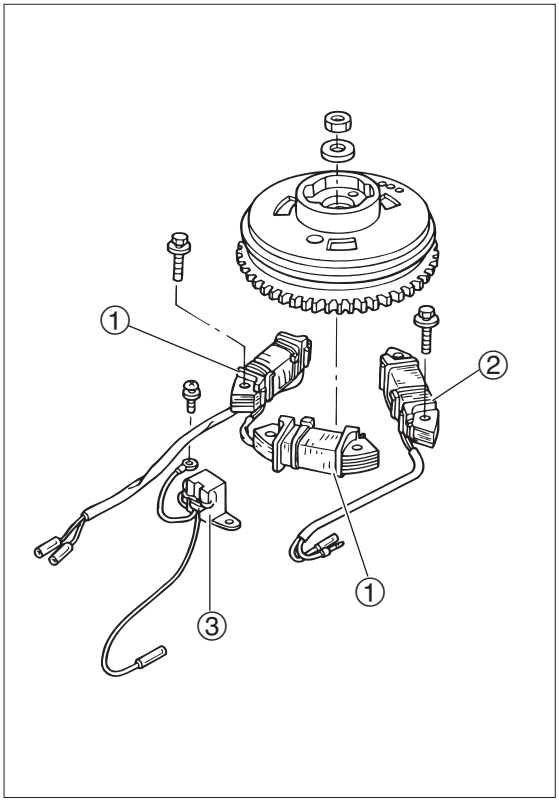
To prevent damages to engine and special tools, tighten flywheel puller set bolts evenly and keep flywheel puller parallel to flywheel while working.



4. Disconnect alternator, exciter coil and pulsar coil lead wires.

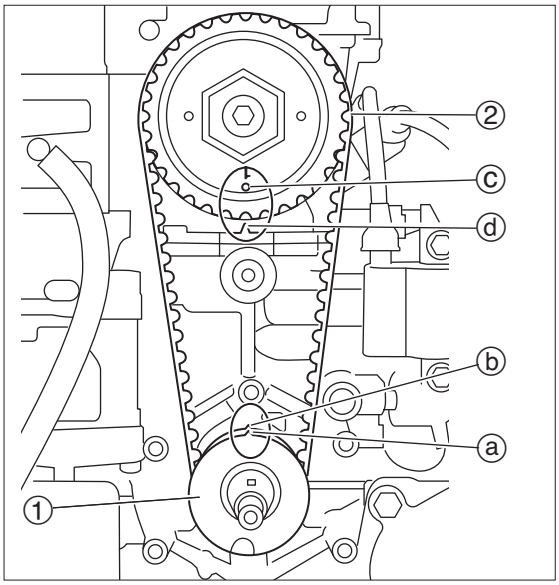
5. Remove bolts of alternator ① and exciter coil ② (2 each), and then, alternator and exciter coil.

6. Remove screws (2) of pulser coil ③, and then, pulser coil.



8) Removing Timing Belt and Pulley

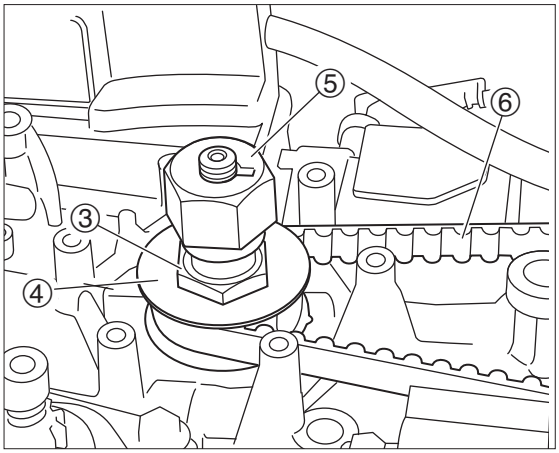
1. Turn timing pulley ① clockwise to bring "▲" mark ⓐ of belt guide to "▲" mark ⓑ of cylinder block, and check that "●1" mark ⓒ of cam shaft pulley ② and "▲" mark ⓓ of cylinder head are aligned with each other.



> No.1 piston is to be at top dead center of compression stroke.

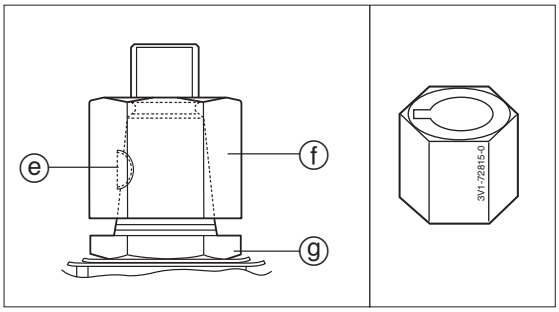
2. Attach crankshaft holder ⑤ to crankshaft and secure it.

3. Loosen timing pulley nut ③.
   Remove belt guide ④.



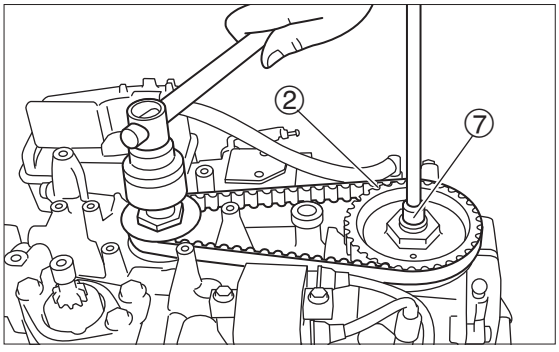
> · Use 32mm socket wrench and 30mm ring wrench for this step.
> · When loosening nut ③ of timing pulley ①, hold cam shaft pulley ② to prevent it from being turned.
> · Keep timing belt ⑥ engaged as a means of precaution.

Crank Shaft Holder ⑤ :
P/N. 3V1-72815-0



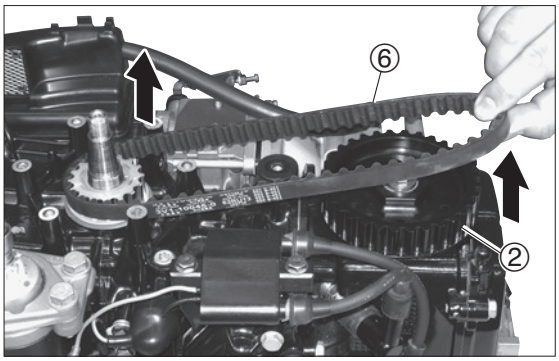
ⓔMagneto key
ⓕCrankshaft holder
ⓖPulley nut

4. Remove bolt ⑦ of cam shaft pulley ②, and then cam shaft pulley.



> When loosening cam shaft pulley bolt, use crank shaft holder to prevent cam shaft pulley from turning.

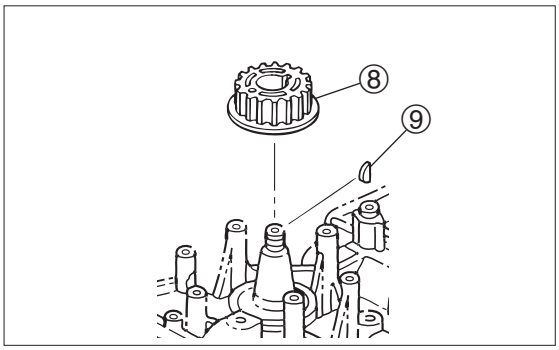
5. Remove timing belt ⑥ from cam shaft pulley ② side, and then, from timing pulley side.



⚠ CAUTION

- **Do not turn timing pulley (crank shaft) or cam shaft pulley with timing belt removed. Doing so can make pistons and valves interfere with each other, possibly resulting in damages to these parts.**
- **If Re-using, pay attention to install belt in the same direction of rotation when removed numbers up or numbers down.**

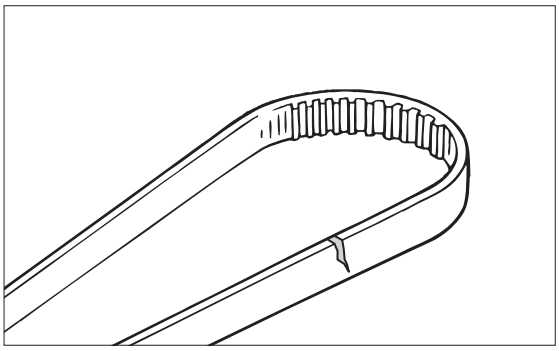
6. Remove timing pulley ⑧ and then key ⑨.



Remove timing pulley and cam shaft pulley while lifting them up horizontally.

9) Inspection of Timing Belt

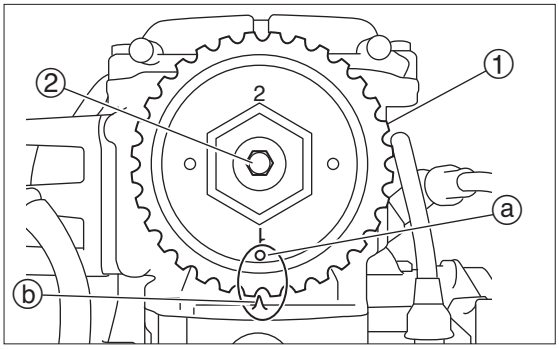
1. Check timing belt for crack, damage and wear on both faces. Replace if necessary.



2. Check timing pulley and cam shaft pulley for crack, damage and wear. Replace if necessary.

10) Installation of Pulley and Timing Belt

1. Install cam shaft pulley, bring "●1" mark ⓐ of cam shaft pulley ① to "▲" mark ⓑ of cylinder head, and then, temporally tighten bolt ②.

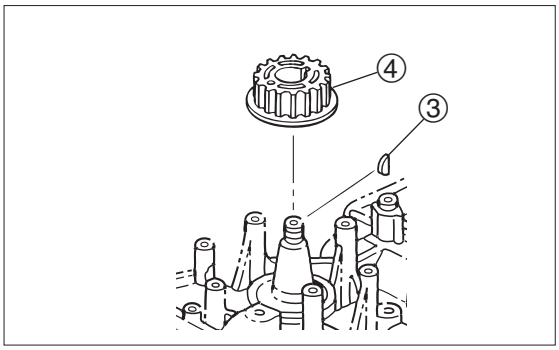


· No.1 piston is to be at top dead center of compression stroke.
· When reusing cam shaft pulley bolt, apply ThreeBond 1342 to thread.

⚠ CAUTION

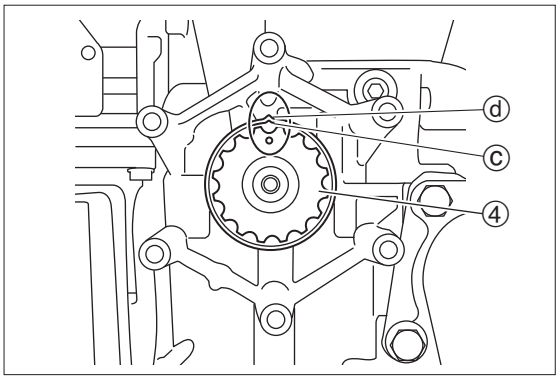
Do not turn timing pulley or cam shaft pulley with timing belt removed. Doing so can make pistons and valves interfere with each other, possibly resulting in damages to these parts.

2. Attach key ③ and then timing pulley ④.



3. Check that "▲" mark ⓒ of timing pulley ④ is aligned with "▲" mark ⓓ of cylinder block.

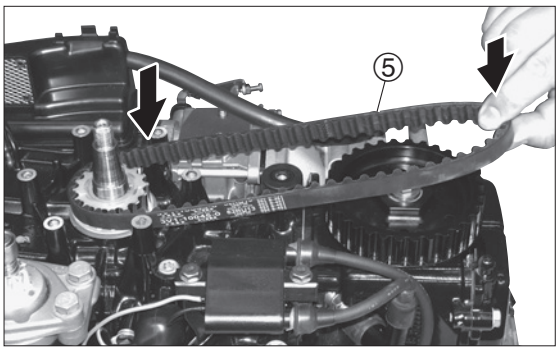
No.1 piston is to be at top dead center of compression stroke.



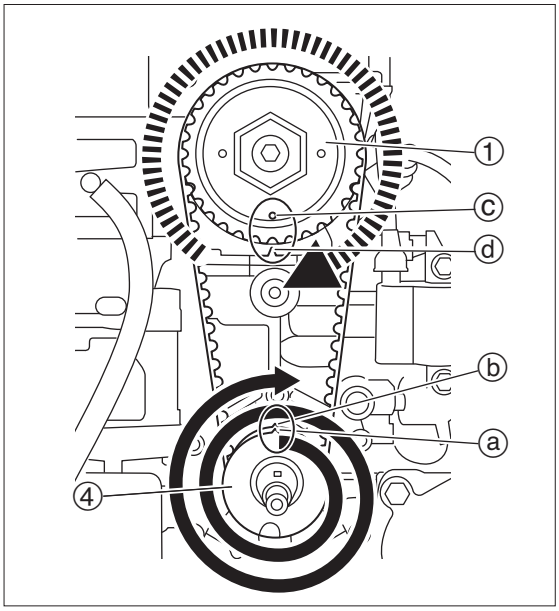
4. Attach timing belt ⑤ to timing pulley with its part number side facing upward, and then to cam shaft pulley.

⚠ CAUTION

- **Be careful not give damage to timing belt when installing.**
- **Do not twist timing belt, bring inside out, or bend sharp, or it may be damaged.**
- **Be careful not to allow oil or grease to adhere to timing belt.**



5. Turn timing pulley ④ clockwise twice, and check that locating marks ⓐⓑ and ⓒⓓ of pulleys ① and ④ are aligned with each other respectively.

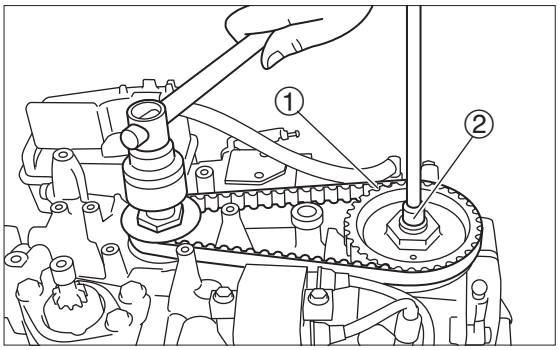


5

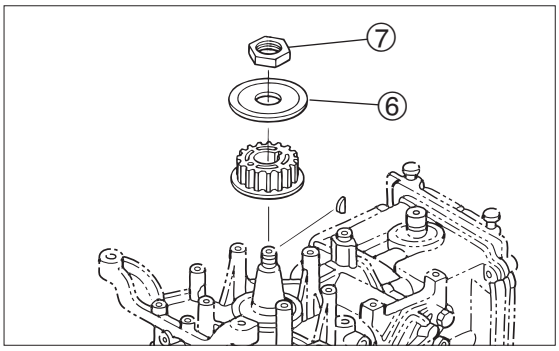
6. Tighten cam shaft pulley ① to specified torque.

Tighten bolt while holding crank shaft with crank shaft holder to fix timing belt.

Cam Shaft Pulley Bolt ②:
11 N · m (8 lb · ft) [1.1 kgf · m]



7. Put belt guide ⑥, and secure it with nut ⑦ by tightening the nut temporarily.

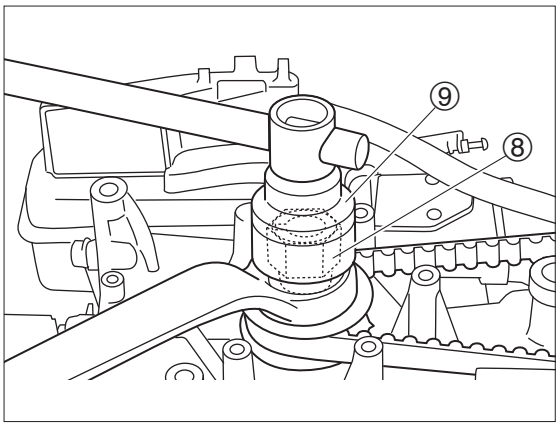


8. Tighten timing pulley nut to specified torque.

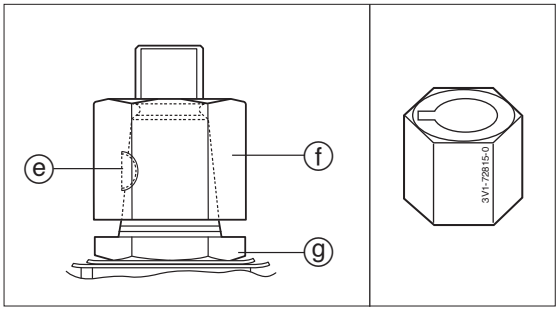
· Put pulley nut with chamfered face down.
· Use 32mm socket wrench ⑨ and 30mm spanner wrench for this step.

Crankshaft holder ⑧ :
P/N. 3V1-72815-0

Timing Pulley Nut :
50 N · m (36 lb · ft) [5.0 kgf · m]



⑧Crankshaft holder
⑨Deep socket 32mm



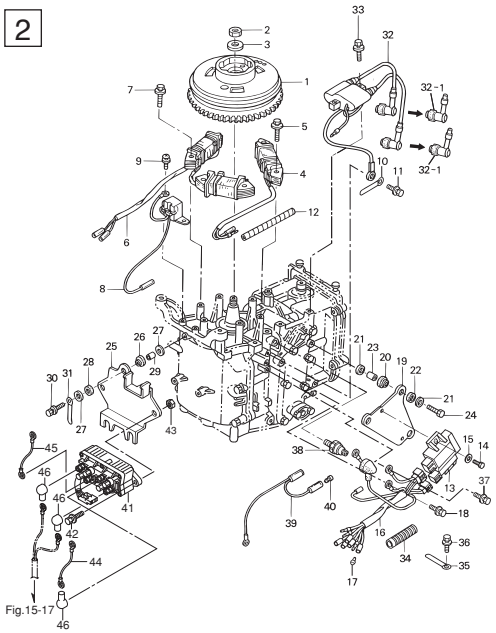
ⓔMagneto key
ⓕCrankshaft holder
ⓖPulley nut

11) Removing Cylinder Head

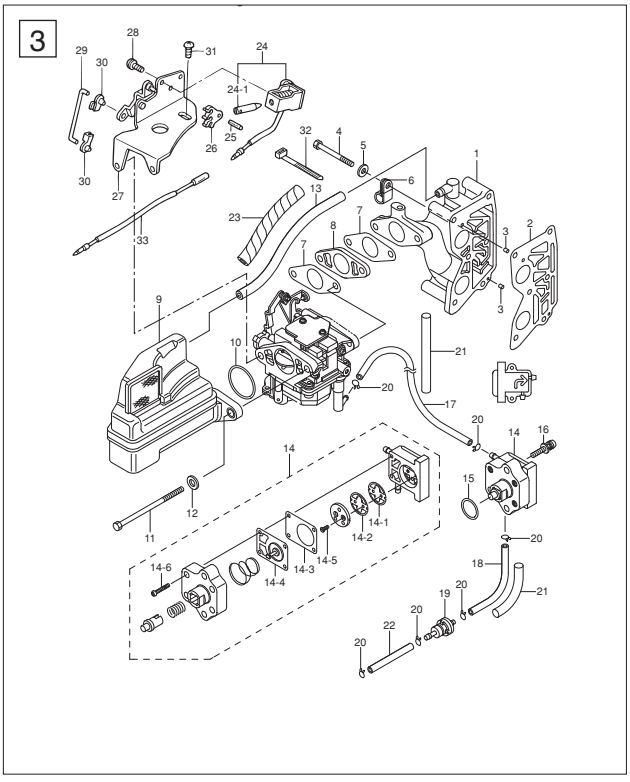
- · No.1 piston is to be at top dead center of compression stroke.
- · Removal or installation of parts can be made easier when some of them are assembled together.

1. Remove power unit. (Refer to the section for removing power unit.)
2. Remove magneto related parts from power unit.
3. Remove intake manifold, carburetor and fuel pump.
4. Remove electrical system parts from power unit.

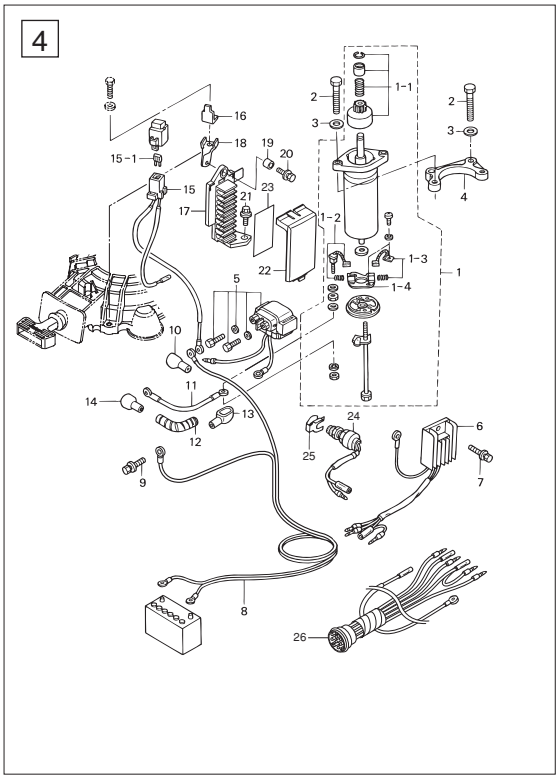
2



3



4



5

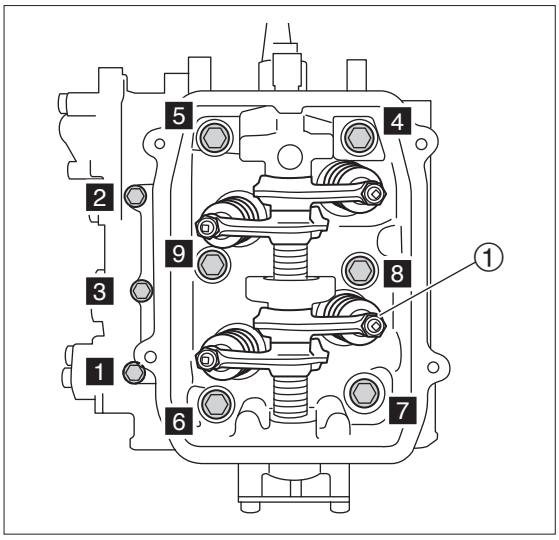
5. Remove cam pulley and cylinder head cover. Remove hose.

> For the procedure, refer to "Removing Timing Belt and Pulley" in Chapter 5.

6. Remove cylinder head bolts in the reverse sequence of order shown, and remove cylinder head.

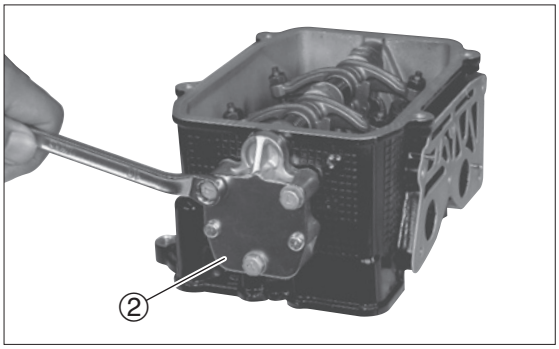
⚠ CAUTION

Do not scratch or give damage to mating surfaces of cylinder head and cylinder block.



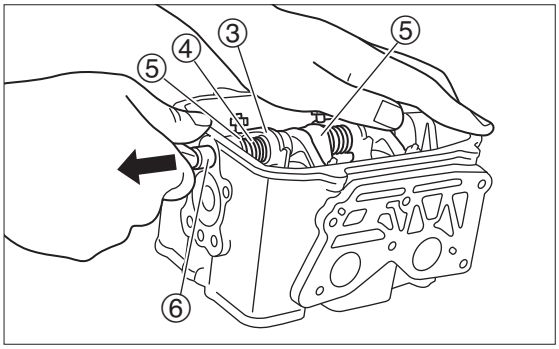
7. Loosen rocker arm lock nut ①, and loosen adjusting screw as much as possible.

8. Remove oil pump ass'y ②.



9. Remove rocker arm ③, spring ④, washer ⑤ and rocker arm shaft ⑥.

> · Push in flat head driver with rag and pull the part out downward slowly.
> · Pull the shaft while holding other parts with a hand.

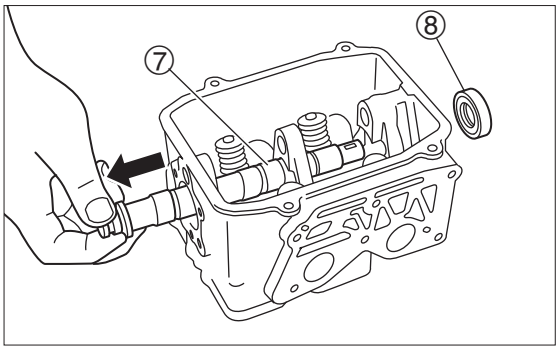


10. Remove cam shaft ⑦.

⚠ CAUTION

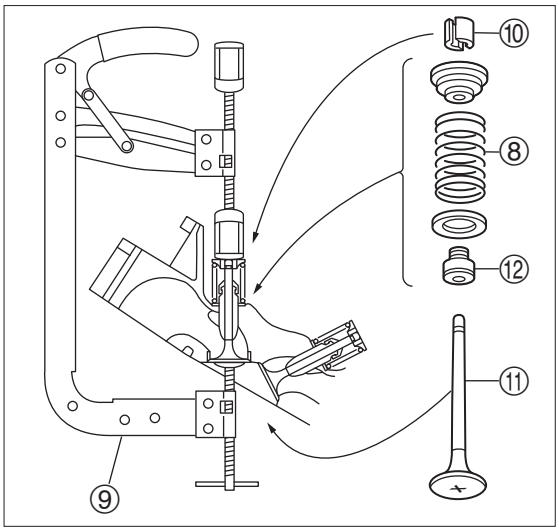
Remove cam shaft slowly taking care not to touch journal.

11. Remove oil seal ⑧.



12. Compress valve spring ⑧ using a commercially available valve spring compressor ⑨, remove cotters ⑩, and then, remove spring ⑧ and valve ⑪.

- Valves, springs and other related parts should be arranged in the order they are removed.
- Use attachment with inner diameter of 23.5mm.
- If valve spring compressor is not used, put cylinder head on the folded rag to prevent valves from being damaged.



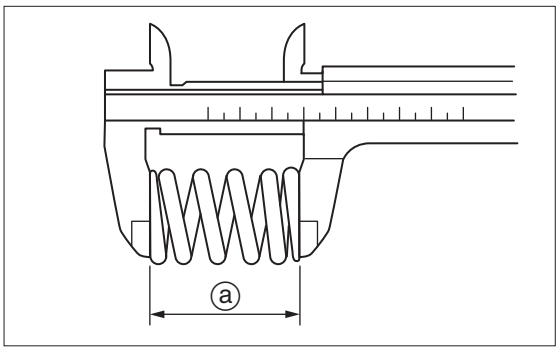
13. Remove stem seal ⑫.

12) Inspection of Valve Spring

1. Measure valve spring free length ⓐ. Replace if the length is less than specified value.

Valve Spring Free Length ⓐ : Standard Value
38.3 mm (1.51 in)

Functional Limit :
38.6 mm (1.45 in)



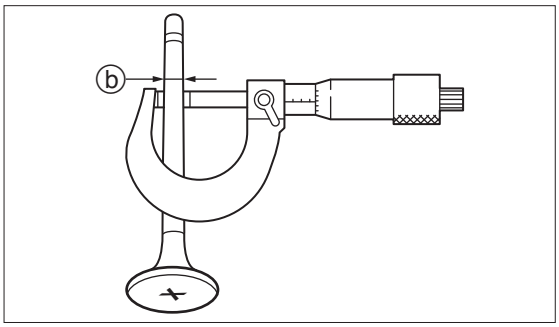
13) Inspection of Valve

1. Check valve for dent and wear on the face. Replace if necessary.

2. Measure valve stem outer diameter ⓑ. Replace if it is less than specified value.

Valve Stem Outer Diameter ⓑ : Standard Value
Intake Side : 5.48 mm (0.2157 in)
Exhaust Side : 5.46 mm (0.2150 in)

Functional Limit :
Intake Side : 5.46 mm (0.2150 in)
Exhaust Side : 5.44 mm (0.2142 in)



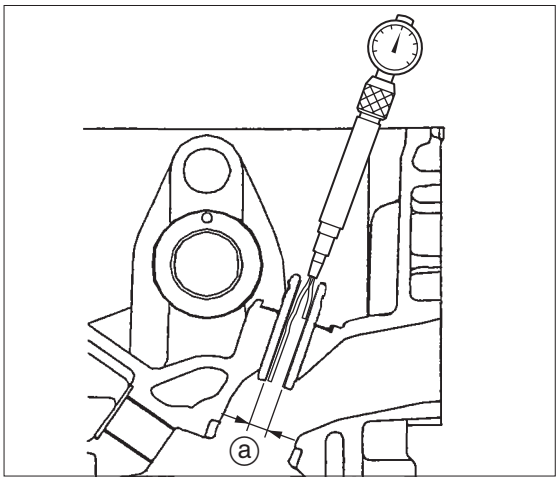
14) Inspection of Valve Guide

Before inspecting valve guide, check that valve stem outer diameter is within specified limit.

1. Measure valve guide inner diameter ⓐ. Replace cylinder head if the inner diameter is over specified value.

Valve Guide Inner Diameter ⓐ : Standard Value
Intake/Exhaust Side : 5.51 mm (0.2169 in)

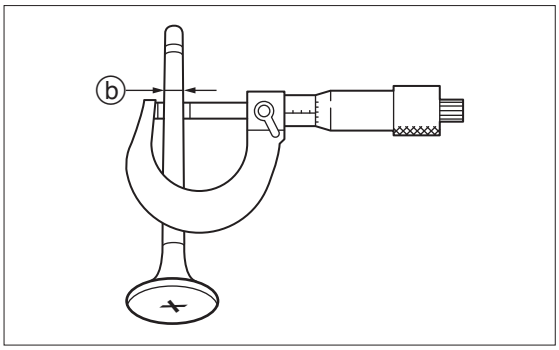
Functional Limit :
Intake Side : 5.55 mm (0.2185 in)
Exhaust Side : 5.57 mm (0.2193 in)



2. Obtain clearance between valve guide and valve stem by calculating as described below. Replace cylinder head and/or valve if the clearance is over specified value.

Clearance between valve guide and valve stem = Valve Guide Inner Diameter ⓐ - Valve Stem Outer Diameter ⓑ :
Intake Side : 0.008-0.040 mm (0.00031-0.00157 in)
Exhaust Side : 0.025-0.057 mm (0.00098-0.00224 in)

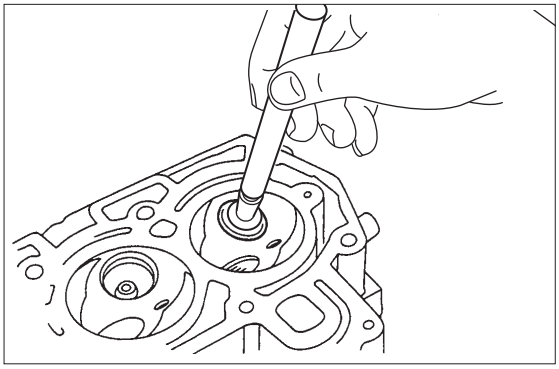
Functional Limit :
Intake Side : 0.070mm (0.00276 in)
Exhaust Side : 0.100 mm (0.00394 in)



15) Inspection of Valve Seat

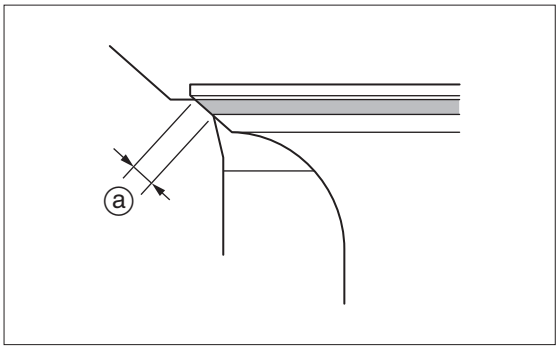
1. Remove carbon built up on the valve.

2. Apply a thin, even layer of Mechanic's blueing dye (Dykem) onto the valve seat.



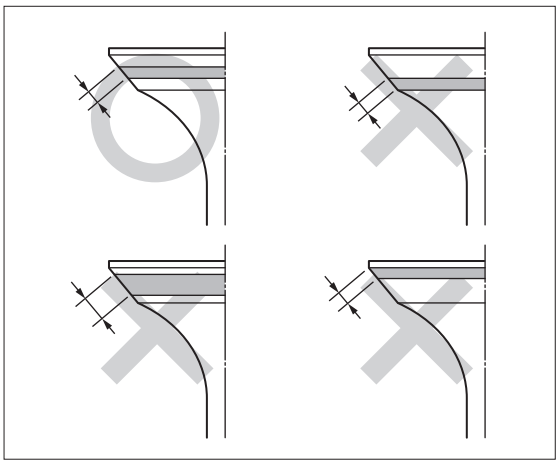
3. Use valve lapper (commercially available item) as shown to push valve onto valve seat lightly.

4. Measure width of area where valve face contacted with valve seat ⓐ that can be identified with red lead adhered to valve face. Correct valve seat if contact area is above or below the center or contact area of valve seat is over specified limit.



Valve Seat Contact Width ⓐ : Standard Value
Intake/Exhaust Side : 1.0 mm (0.04 in)

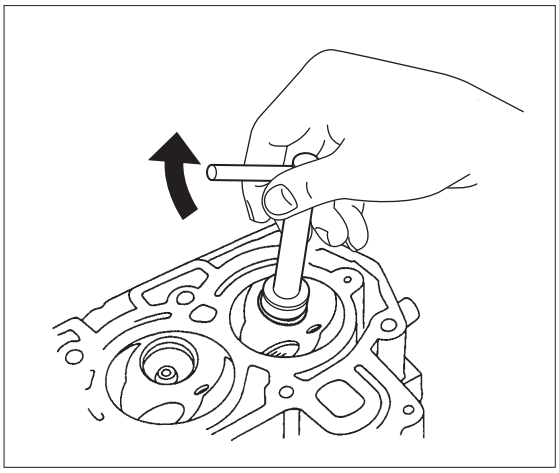
Functional Limit :
Intake/Exhaust Side : 2.0 mm (0.08 in)

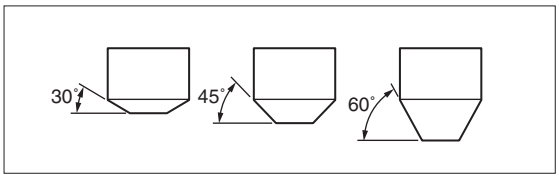


16) Correction of Valve Seat

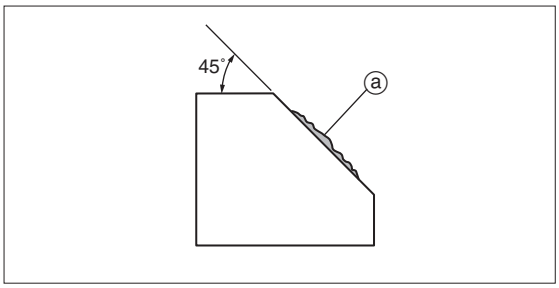
1. Use valve seat cutter (commercially available item) to correct valve seat.

Be careful not to over-cut valve seat. Turn valve seat cutter while pushing down evenly.



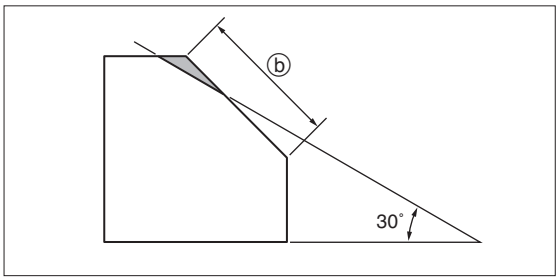


2. Turn 45° degree cutter clockwise to cut valve seat surface to make it smooth.



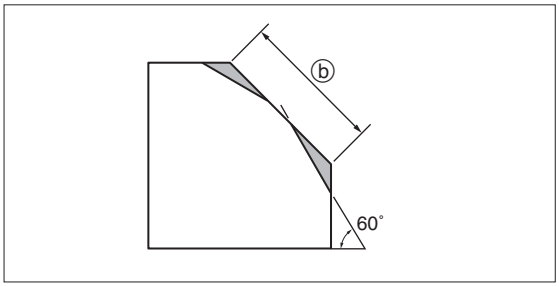
ⓐCarbon or uneven surface

3. Use 30° degree cutter to adjust contact position of valve seat upper end.



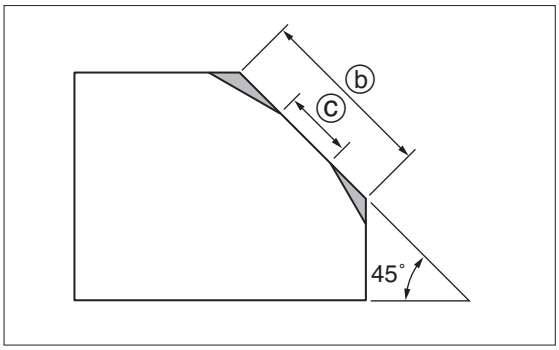
ⓑContact width before correction

4. Use 60° degree cutter to adjust contact position of valve seat lower end.



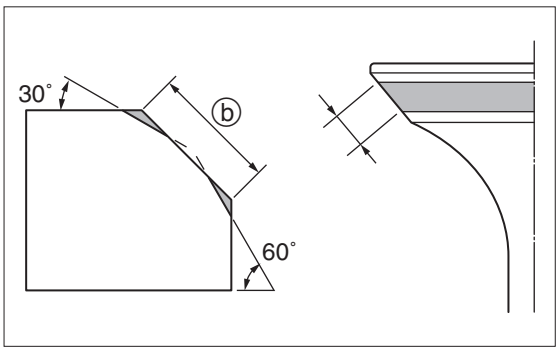
ⓑContact width before correction

5. Use 45° degree cutter to adjust contact width of valve seat ⓒ to specified value.



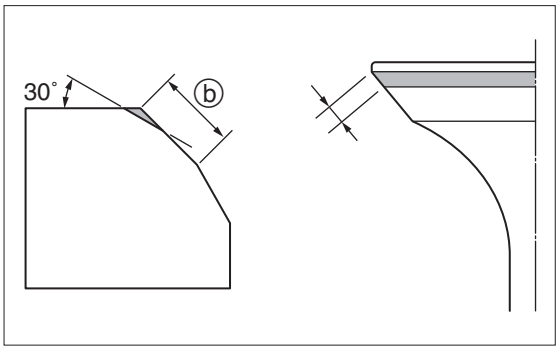
ⓑContact width before correction
ⓒSpecified width

6. Valve seat contact area is located on the center, which should be adjusted to specified value by cutting upper and lower ends by using 30° degree and 60° degree seat cutters respectively if the area is too wide.



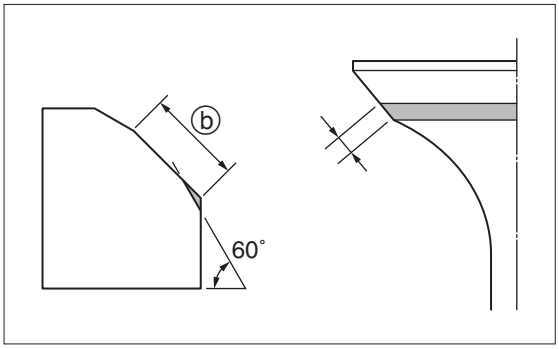
ⓑContact width before correction

7. If valve seat contact area is very narrow and is located nearer to valve face upper end, use 30° degree seat cutter to cut upper end. If necessary, use 45° degree cutter to adjust contact width of valve seat to specified value.



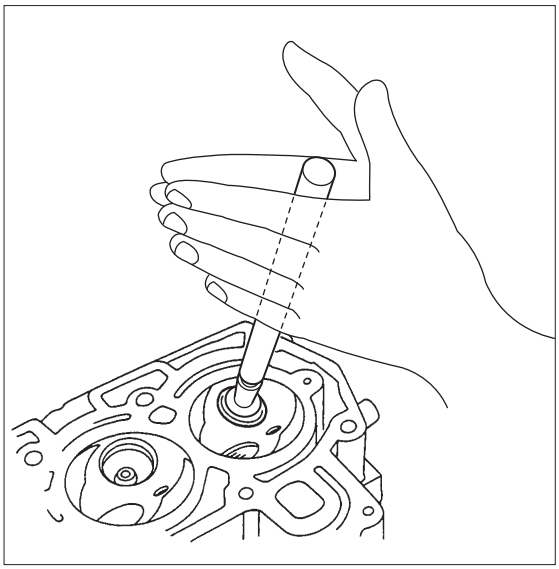
ⓑContact width before correction

8. If valve seat contact area is very narrow and is located nearer to valve face lower end, use 60° degree seat cutter to cut lower end. If necessary, use 45° degree cutter to adjust contact width of valve seat to specified value.



ⓑContact width before correction

9. Apply thin coat of abrasive compound on the overall valve seat contact area, and turn valve lapper (commercially available item) while lapping valve.



⚠ CAUTION

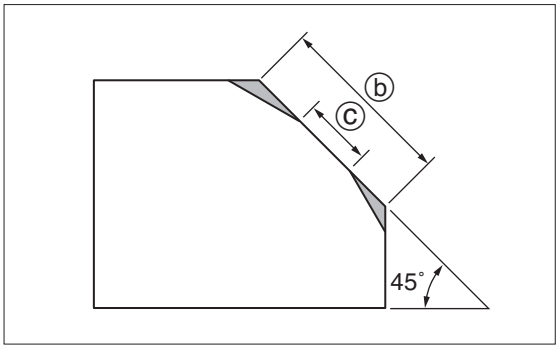
Perform the work by taking care not to allow abrasive compound to adhere to valve stem and valve guide.

- Use finer abrasive compound to finish.
- When changing abrasive compound to finer one, remove present one completely.
- After completion of lapping, wipe off the compound and then clean.

10. After ending the work, remove the compound completely from cylinder head and valve.

11. Check valve seat contact width ⓒ.

Valve Seat Contact Width ⓒ : Standard Value
1.0 mm (0.04 in)

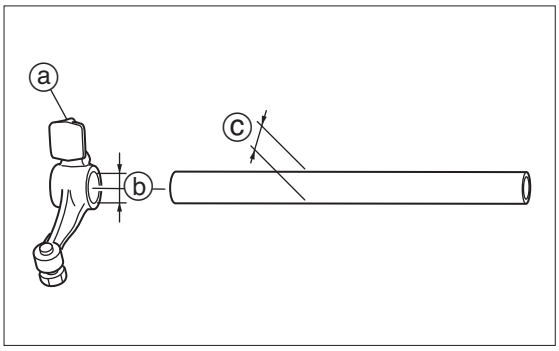


ⓑContact width before correction
ⓒSpecified width

17) Inspection of Rocker Arm and Rocker Arm Shaft

1. Check rocker arm, rocker arm shaft and rocker arm contact area ⓐ for wear. Replace if necessary.

2. Measure rocker arm inner diameter ⓑ and rocker arm shaft outer diameter ⓒ. Calculate oil clearance ⓓ (ⓓ = ⓑ - ⓒ). Replace if out of specification.



ⓓ = ⓑ - ⓒ

Rocker Arm Inner Diameter ⓑ : Standard Value
13.01 mm (0.5122 in)
Rocker Arm Shaft Outer Diameter ⓒ : Standard Value
12.99 mm (0.5114 in)
Oil Clearance Between Rocker Arm Hole and Shaft ⓓ :
0.006 - 0.035 mm (0.00024 - 0.00138 in)

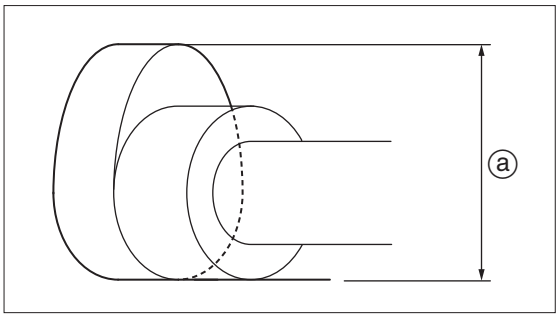
Functional Limit :
ⓑReplace if b is over 13.05 mm (0.5138 in).
ⓒReplace if c is less than 12.94 mm (0.5094 in).
ⓓReplace if b is over 0.060 mm (0.00236 in).

18) Inspection of Cam Shaft

1. Measure cam height. Replace if it is less than specified value.

Cam Height ⓐ at Both Intake and Exhaust Side : Standard Value
23.63 mm (0.9303 in)

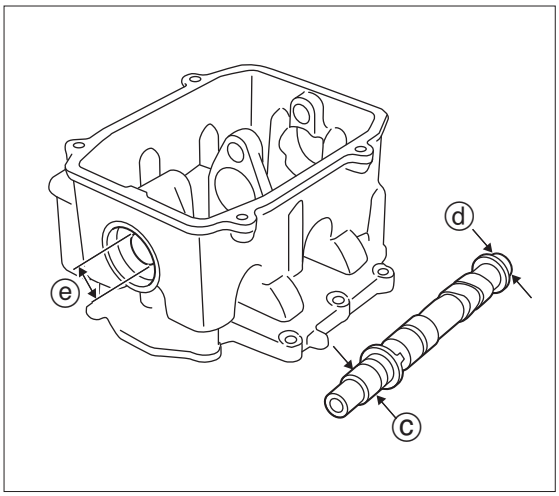
Functional Limit : Cam Height ⓐ at Both Intake and Exhaust Sides
23.38 mm (0.9205 in)



2. Measure cam shaft journal outer diameters ⓒ and ⓓ. Replace cam shaft or cylinder head if either of the diameters is less than specified value.

Cam Shaft Journal Outer Diameter ⓒ : Standard Value
17.98 mm (0.7079 in)
Cam Shaft Journal Outer Diameter ⓓ : Standard Value
15.97 mm (0.6287 in)
Cylinder Head Journal Inner Diameter ⓔ (Upper) :
18.010 - 18.025 mm
(0.7091 - 0.7096 in)

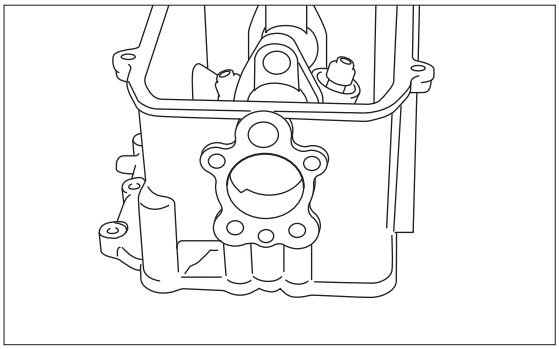
Functional Limit ⓒ :
17.95 mm (0.7067 in)
Functional Limit ⓓ :
15.95 mm (0.6280 in)



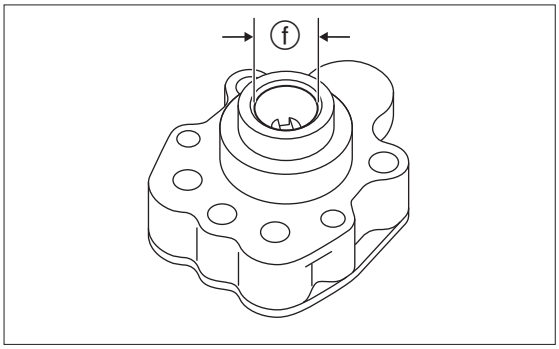
3. Measure cylinder head journal inner diameter ⓔ and oil pump journal inner diameter ⓕ. Calculate oil clearance. Oil clearances are obtained by ⓔ - ⓒ and ⓕ - ⓓ respectively. Replace cam shaft, cylinder head or oil pump if either of the clearances is over specified value.

Oil Clearance : Standard Value :
0.02 - 0.05 mm (0.0008 - 0.0020 in)

Functional Limit :
0.09 mm (0.0035 in)



If oil clearance is over functional limit, replace any of cylinder head, cam shaft and oil pump or all of them as a set, and check that the clearance is within specified range.

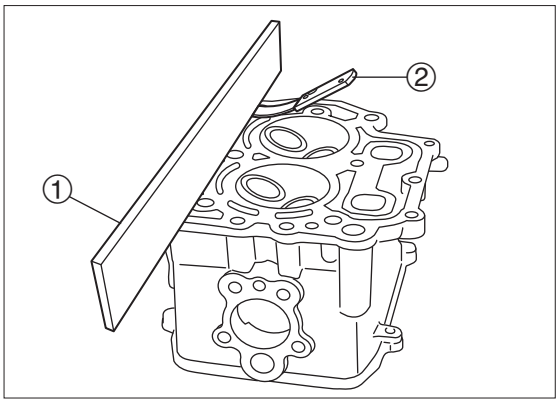


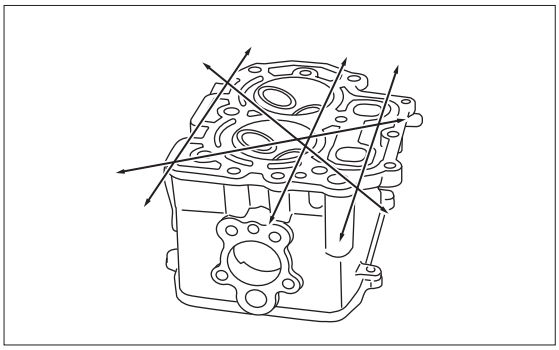
19) Inspection of Cylinder Head

1. Remove carbon build-up of combustion chamber, and check for deterioration.

2. Use straight edge ① and thickness gauge ② to check distortion of cylinder head in the directions shown. Replace if the distortion is over specified value.

Cylinder Head Distortion Limit :
0.10 mm (0.004 in)

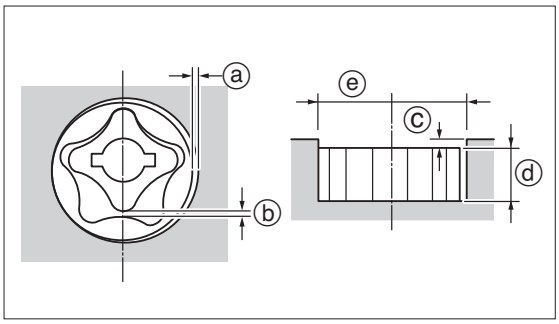


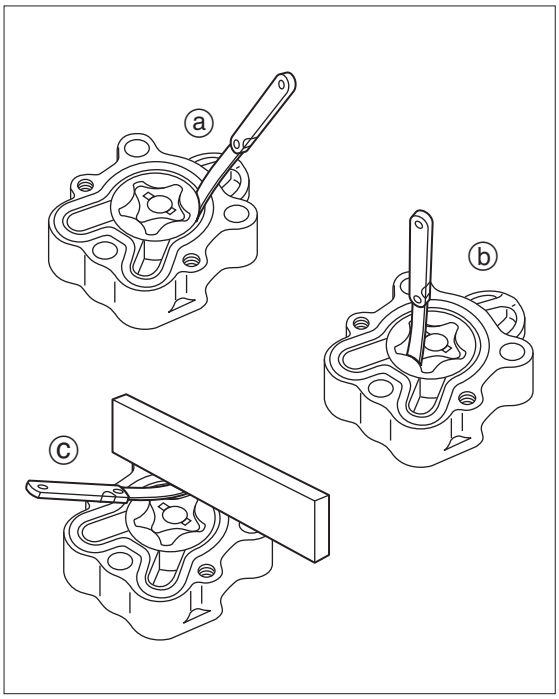


20) Inspection of Oil Pump

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

Functional Limit :
Clearance between Outer Rotor and Body ⓐ :
0.36 mm (0.0142 in)
Clearance between outer and inner rotors ⓑ :
0.16 mm (0.0063 in)
Side clearance between rotor and body ⓒ :
0.11 mm (0.0043 in) (including wear of oil pump cover)
Height of Outer Rotor ⓓ :
9.96 mm (0.3921 in)
Pump Body Inner Diameter ⓔ :
29.04 mm (1.1433in)





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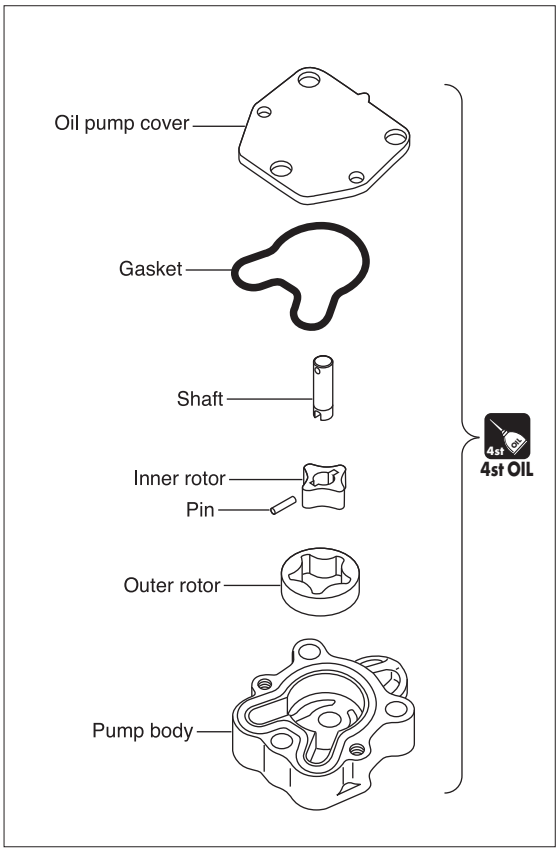
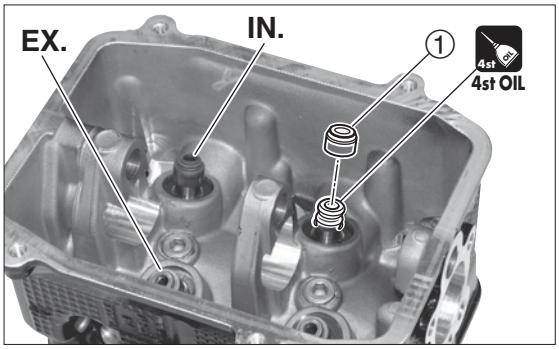


21) Installation of Valves

1. Apply oil to valve guide and attach new valve stem seal ①.

Intake Side : Black
Exhaust Side : Green

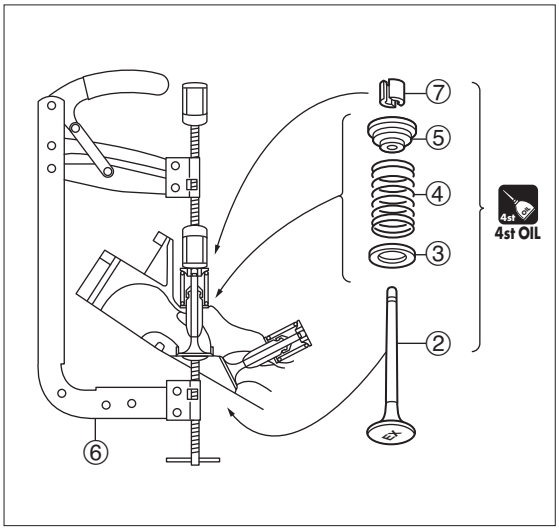
4st OIL



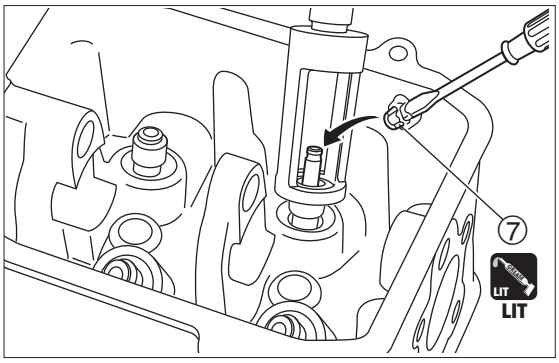
① **Do not reuse.**

2. Install valve ②, valve spring seat ③, valve spring ④ and retainer ⑤ in the order shown, and then, attach commercially available valve spring compressor ⑥.

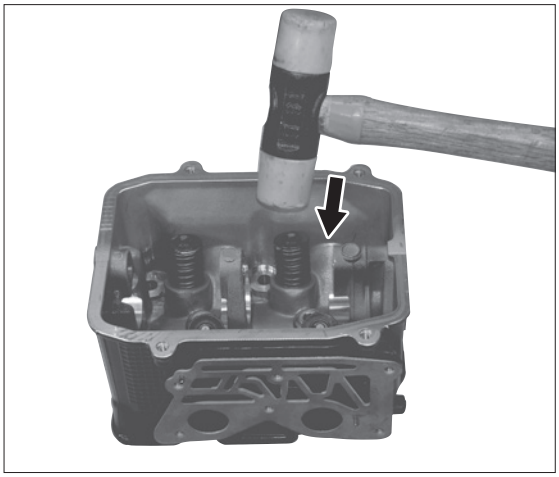
- Valves, springs and other power unit related parts should be arranged in the order they are removed.
- Use attachment with inner diameter of 23.5mm.
- If valve spring compressor is not used, put cylinder head on the folded rag to prevent valves from being damaged.



3. With valve spring ④ being compressed, use small screw driver with small amount of grease at the tip to put cotter ⑦.



4. Tap valve stem end with plastic hammer to fix cotter ⑦ securely.



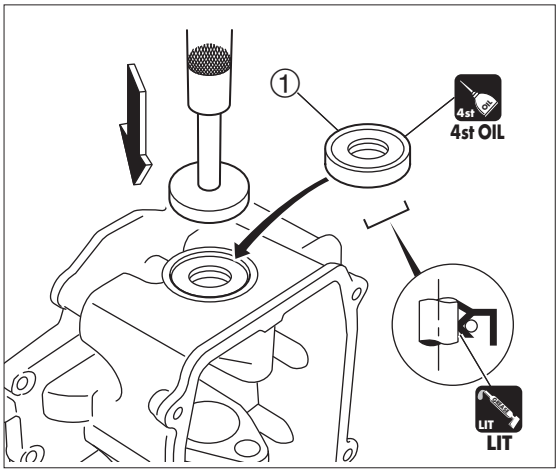
22) Installation of Cam Shaft

1. Apply engine oil to periphery of new oil seal ① and install it.

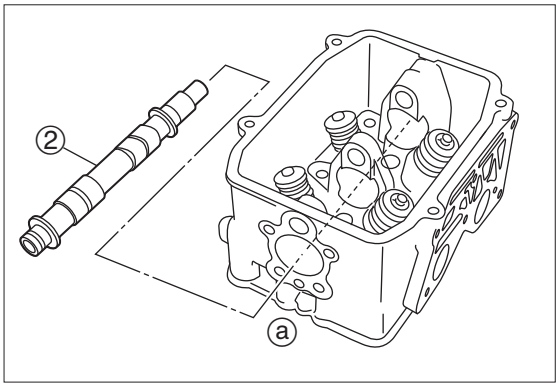
Driver Rod :
P/N. 3AC-99702-0
Oil Seal Attachment :
P/N. 3AC-99820-0

Apply Lithium grease to lip of oil seal before installing it.

LIT



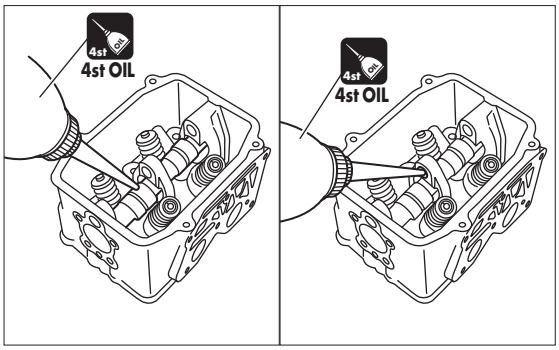
2. Install cam shaft ② from direction ⓐ shown.



23) Installation of Rocker Arm Shaft

1. Apply sufficient amount engine oil to cam surface of cam shaft and journal of rocker arm shaft.

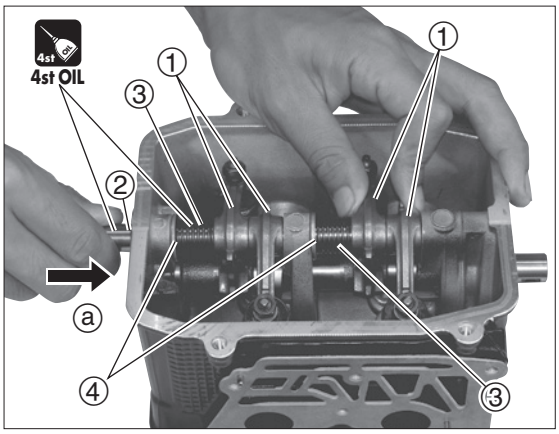
4st OIL



2. Install rocker arms ①, springs ③, washers and collar ④ from lower side of cylinder head ⓐ while installing rocker arm shaft ②.

Apply sufficient amount of engine oil to rocker arm and adjust screw after installing rocker arm.

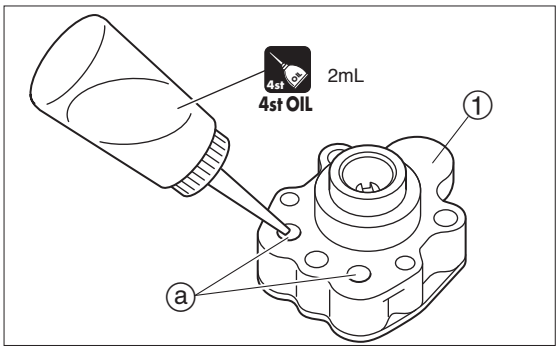
4st OIL



24) Installation of Oil Pump

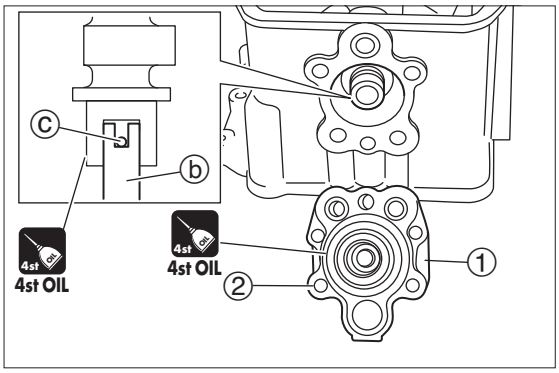
Feed engine oil of approximately 1mL to oil passages ⓐ before installing oil pump.

4st OIL



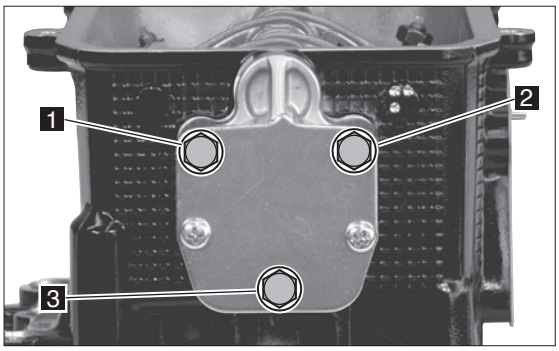
1. Align cuts of oil pump drive shaft ⓑ and cam shaft pin ⓒ with each other to install oil pump ①.

Use new gasket ②.



2. Secure oil pump using three M6 bolts by tightening them to specified torque in the order specified below.
Order of tightening : 1 → 2 → 3

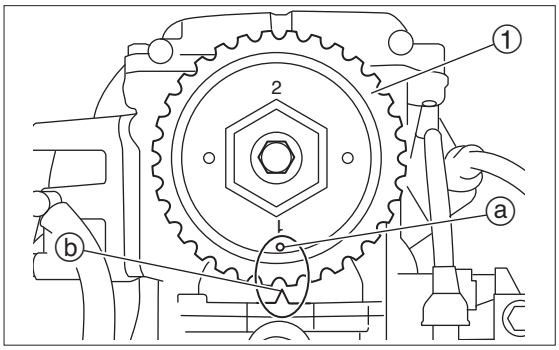
Oil Pump Bolts :
First tightening torque: 4 N · m (3 lb · ft) [0.4 kg · m]
Second Tightening Torque : 9 N · m (7 lb · ft) [0.9 kg · m]



25) Installation of Cylinder Head

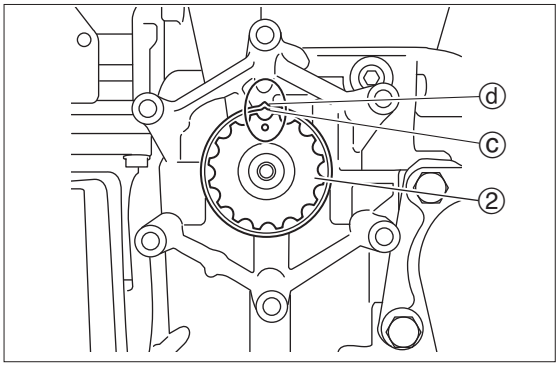
· Degrease mating surfaces of cylinder head and cylinder block.
· No.1 piston is to be at top dead center of compression stroke.

1. After installing cam shaft pulley, bring "●1" mark ⓐ of pulley ① to "▲" mark ⓑ of cylinder head.



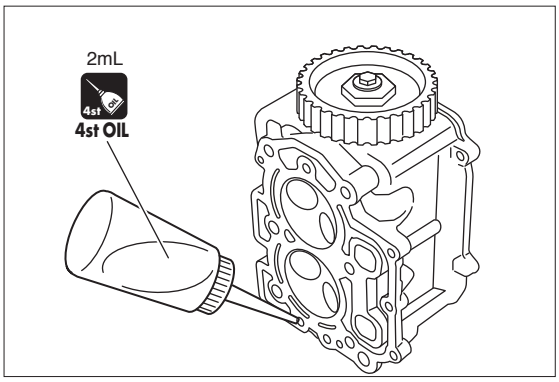
2. Check that "▲" mark ⓒ of timing pulley ② and "▲" mark ⓓ of cylinder block are aligned with each other.

No.1 piston is to be at top dead center.



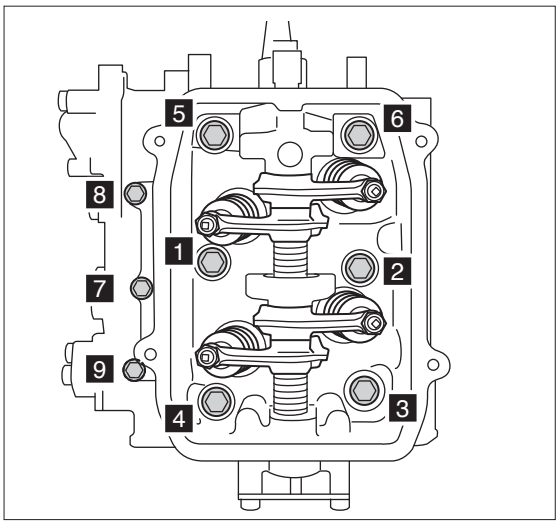
3. Before installing cylinder head, fill oil passages and oil pump again with engine oil as shown.

4st OIL



5

4. Install cylinder head with new gasket, and tighten bolts in the order shown in two steps to specified torque.



⚠ CAUTION

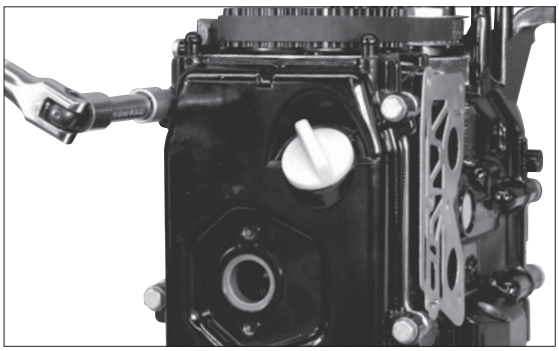
- **Do not reuse cylinder head gasket. Be sure to replace with new one.**
- **Do not turn timing pulley or cam shaft pulley with timing belt removed. Doing so can make pistons and valves interfere with each other, possibly resulting in damages to these parts.**

· First, tighten M8 bolts in two steps to specified torque.
· Then, tighten M6 bolts in two steps to specified torque.
· After installing cylinder head, install timing belt and check valve clearance. Refer to “Chapter 5 Checking Valve Clearance".

Cylinder head bolts (M8) 1 to 6
First Tightening Torque : 10 N · m (7 lb · ft) [1.0 kgf · m]
Second Tightening Torque : 30 N · m (22 lb · ft) [3.0 kgf · m]
Cylinder head bolts (M6) 7 to 9
First Tightening Torque : 6 N · m (4 lb · ft) [0.6 kgf · m]
Second Tightening Torque : 10N · m (7 lb · ft) [1.0 kgf · m]

5. Put new O ring and then cylinder head cover, and tighten bolts coated with ThreeBond 1342.

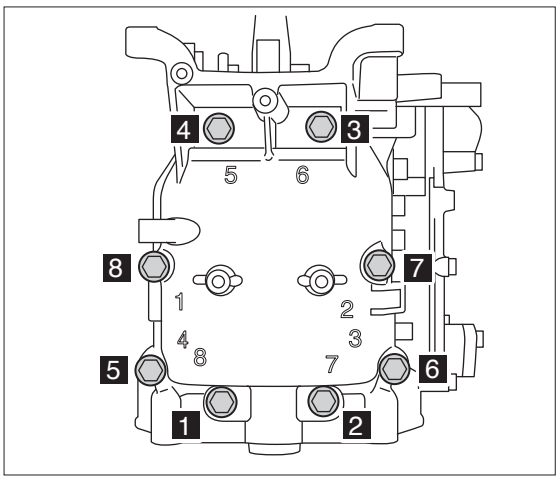
1342



ⓔ Install downward.

26) Disassembly of Cylinder Block

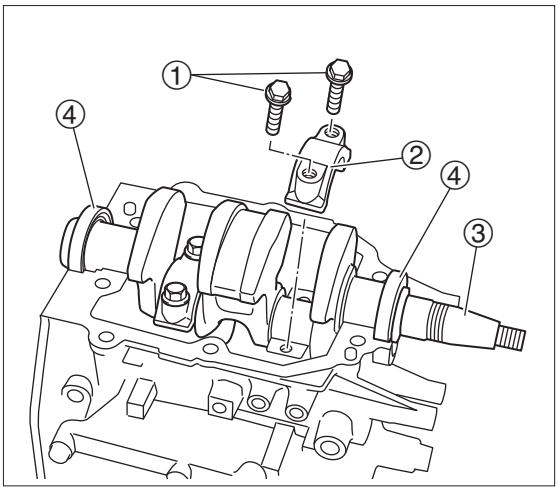
1. Loosen crank case bolts in several steps in the reverse sequence of order shown, and remove crank case. 1 to 8



⚠ CAUTION

Do not scratch or give damage to mating surfaces of crank case.

2. Remove connecting rod bolts ① and connecting rod cap ②, and then, crank shaft ③ and oil seal ④.



The mating connecting rods and caps should be arranged as pairs in the order they are removed. Removed parts should be marked and arranged so that they can be reassembled in their original positions and orientations.

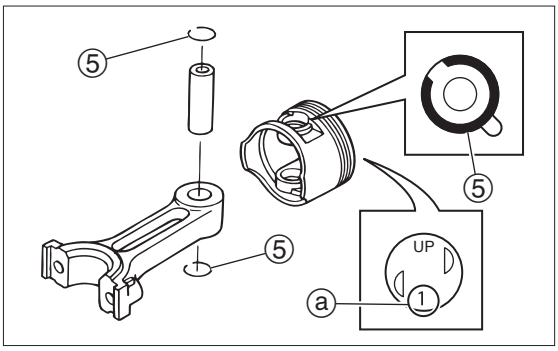
3. Remove connecting rod and piston ass'y from cylinder block.

4. Remove bearings from cylinder block and crank case.

⚠ CAUTION

Take special care when reassembling connecting rod and connecting rod cap. Incorrect combination of the parts may cause burn of big end.

5. Remove piston pin clips ⑤ and piston pin, and then, piston.



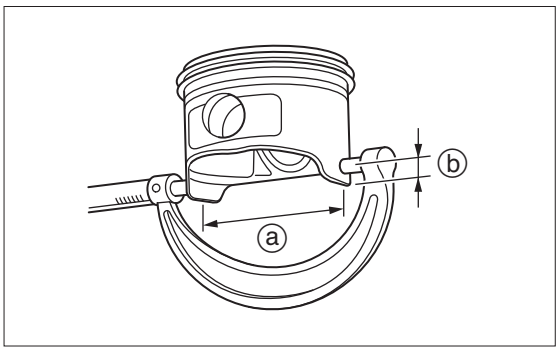
Write cylinder number ⓐ on the mating piston.

Do not reuse piston pin clips. Be sure to replace with new ones.

⑥ Do not reuse.

27) Inspection of Piston Outer Diameter

1. Measure piston outer diameter between points specified. Replace if it is less than specified value.



Piston Outer Diameter ⓐ : Standard Value
54.96 mm (2.1638 in)
Measurement point ⓑ: on the line at right angle to piston pin.
7mm (0.28 in) above piston skirt bottom

Functional Limit :
54.90 mm (2.1614 in)

28) Inspection of Cylinder Inner Diameter

1. Measure cylinder inner diameters (D1 to D6) at ⓐ, ⓑ and ⓒ in crank shaft directions ⓓ (D1, D3 and D5 respectively), and in crank web directions ⓔ (D2, D4 and D6 respectively).

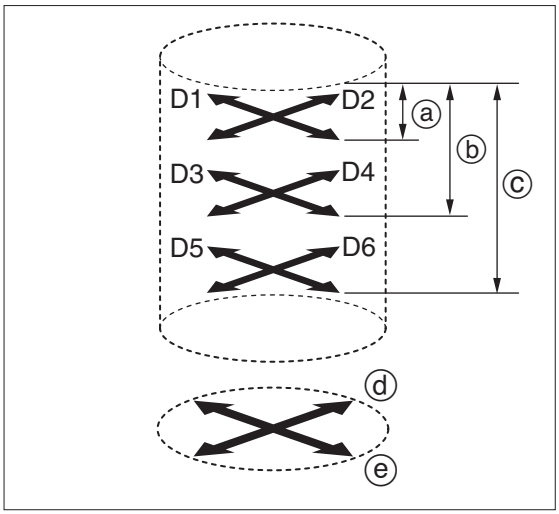
Cylinder Inner Diameters (D1 to D6) : Standard Value
55.00 mm (2.1654 in)

Functional Limit :
55.06 mm (2.1677 in)
Maximum value – Minimum value = 0.06mm
If serviceable limit is exceeded, replace, or bore to ø55.5 ± 0.01mm and hone, and replace pistons and piston rings with oversize parts.

Note : Measure at the maximum wear points.

2. Check inner surface of cylinders.
If any flaw is found, remove by using sand paper in number 400 to 600 range.

⚠ CAUTION
If use of sand paper cannot remove the flaw, bore and hone, and use oversize pistons and piston rings.



ⓐ 15mm (0.6in)
ⓑ 35mm (1.4in)
ⓒ 55mm (2.2in)
ⓓ Crankshaft direction
ⓔ Crank web direction

29) Inspection of Piston Clearance

1. Obtain piston clearance through calculation described below.
If piston clearance is over specified limit, replace cylinder block, or piston and piston rings as a set, or both cylinder block, piston and piston rings.

Piston clearance = Cylinder inner diameter (maximum) - Piston outer diameter ⓐ
0.020 - 0.055 mm (0.00079 - 0.00217 in)

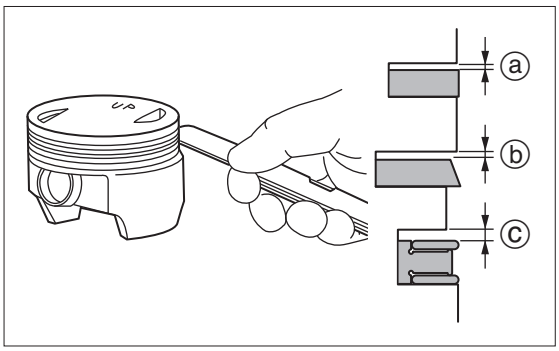
Functional Limit :
0.150 mm (0.00591 in)

30) Inspection of Piston Ring Side Clearance

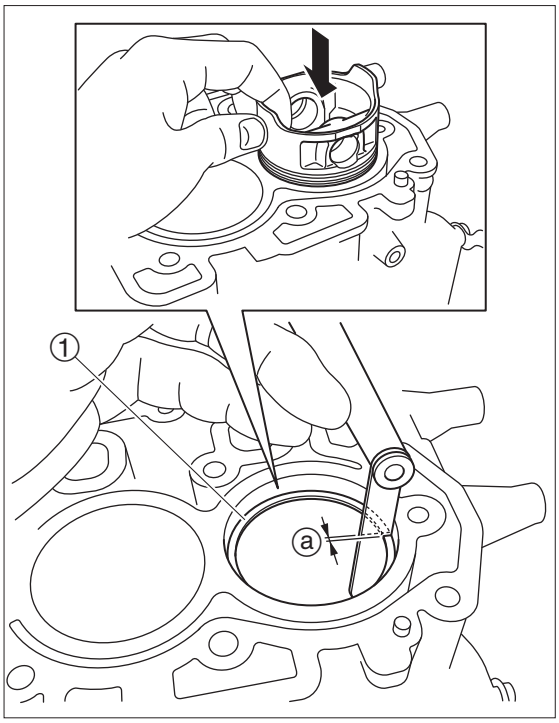
1. Measure piston side clearance. Replace piston and piston rings as a set if the clearance is over specified value.

Piston Ring Side Clearance :
Top Ring ⓐ : 0.04 - 0.08mm (0.0016 - 0.0031 in)
Second Ring ⓑ : 0.03 - 0.07mm (0.0012 - 0.0028 in)
Oil Ring ⓒ : 0.05 - 0.15mm (0.0019 - 0.0059 in)

Functional Limit :
Top Ring ⓐ : 0.10 mm (0.0039 in)
Second Ring ⓑ : 0.09 mm (0.0035 in)
Oil Ring ⓒ : 0.18 mm (0.0071 in)



31) Inspection of Piston Rings



1 Push piston ring ① into ring gauge 55.000mm (2.1654in) parallel to top edge.

2. When ring gauge is not available, use piston crown to push piston ring ① into to cylinder.

Measure at the top or bottom of cylinder bore with no wear.

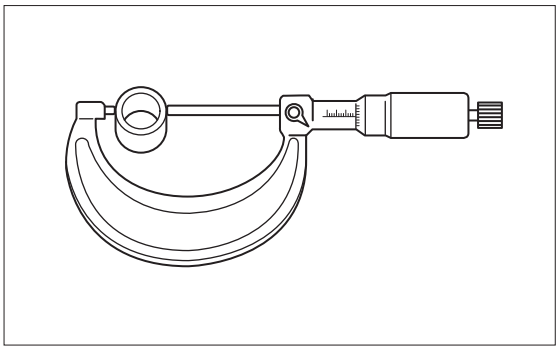
3. Measure piston ring closed gap ⓐ. Replace if it is over specified value.

Piston Ring Closed Gap ⓐ :
Top Ring : 0.15 - 0.30 mm (0.0059 - 0.0118 in)
Second Ring : 0.35 - 0.45 mm (0.0138 - 0.0177 in)
Oil Ring : 0.20 - 0.70 mm (0.0079 - 0.0276 in)

Functional Limit :
Top Ring : 0.50 mm (0.0197 in)
Second Ring : 0.70 mm (0.0276 in)

Replace oil ring when top ring or second ring is replaced.

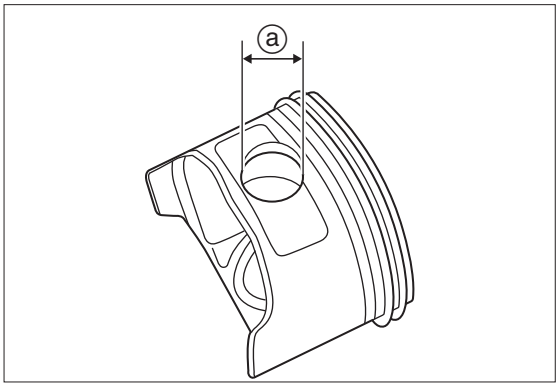
32) Inspection of Piston Pins



1. Measure piston pin outer diameter. Replace piston pin if outer diameter is less than specified value.

Piston Pin Outer Diameter : Standard Value
14.00 mm (0.5512in)

Functional Limit :
13.97 mm (0.5500 in)



2 Measure piston pin boss inner diameter ⓐ, and calculate clearance between piston pin and pin hole. Replace piston pin or piston if the clearance is over specified value.

Clearance Between Piston Pin and Pin Boss :
0.002 - 0.012 mm (0.00008 - 0.00047 in)

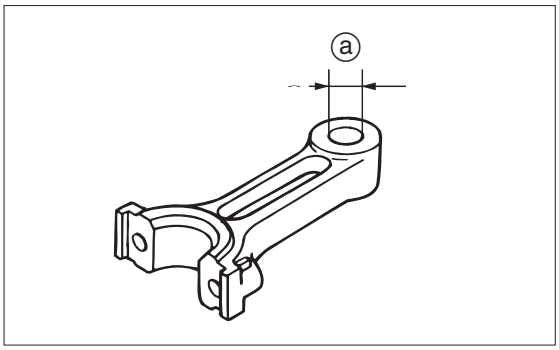
Functional Limit :
0.040 mm (0.00157 in)

33) Inspection of Connecting Rod Small End Inner Diameter

1. Measure connecting rod small end inner diameter ⓐ. Replace connecting rod if the diameter is over specified value.

Connecting Rod Small End Inner Diameter ⓐ : Standard Value
14.01 mm (0.5516 in)

Functional Limit :
14.04 mm (0.5526 in)

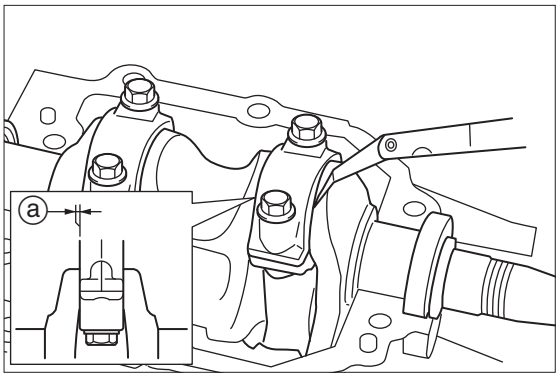


34) Inspection of Connecting Rod Big End Side Clearance

1. Measure connecting rod big end side clearance ⓐ. Replace connecting rod and/or crank shaft if the clearance is over specified value.

Connecting Rod Big End Side Clearance ⓐ :
0.10 - 0.25 mm (0.0039 - 0.0098 in)

Functional Limit :
0.60 mm (0.0236 in)

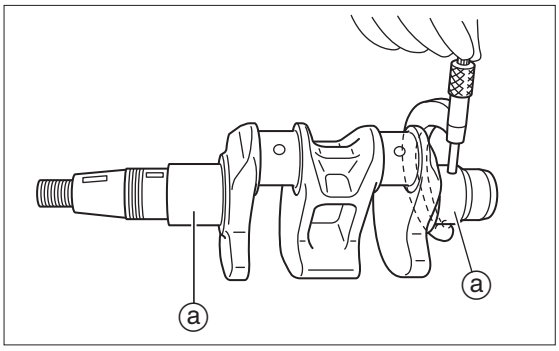


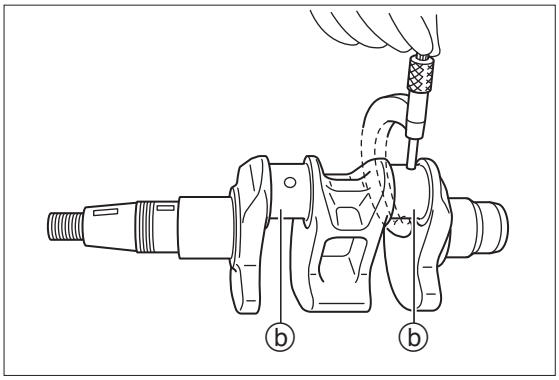
35) Inspection of Crank Shaft

1. Measure crankshaft journal outer diameter ⓐ and crank pin outer diameter ⓑ. Replace crankshaft if either outer diameter is less than specified value.

Crankshaft Journal Outer Diameter ⓐ : Standard Value
29.99 mm (1.1807 in)
Crank Pin Outer Diameter ⓑ : Standard Value
26.98mm (1.0622 in)

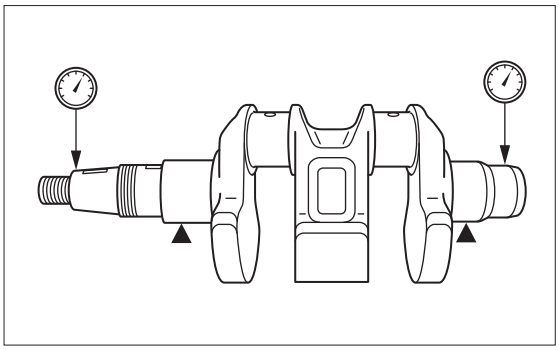
Functional Limit :
Crankshaft Journal Outer Diameter ⓐ :
Replace if less than 29.97 mm (1.1799 in).
Crank Pin Outer Diameter ⓑ :
Replace if less than 26.95mm (1.0610 in).





2. Measure crankshaft runout. Replace crankshaft if runout is over specified value.

Crankshaft Runout Limit :
0.05 mm (0.0020 in)



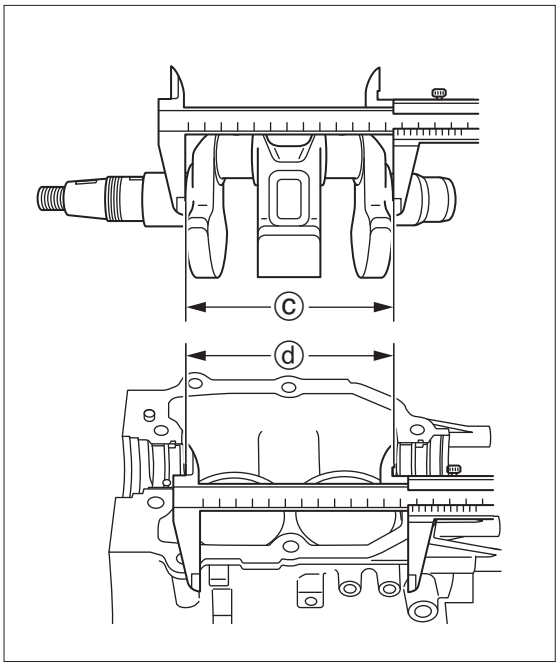
3. Use commercially available thickness gauge to measure side clearance.

Side Clearance :
0.10 - 0.30 mm (0.0039 - 0.0118 in)

Functional Limit :
0.6 mm (0.024 in)

If side clearance is over specified value, measure crank case (cylinder side) width ⓓ and crankshaft width ⓒ, and replace the part of which width is out of specified range.

Crankshaft Width ⓒ : Standard Value
117.8 - 117.9 mm (4.6378 - 4.617 in)
Crank Case Width ⓓ : Standard Value
118.0 - 118.1 mm (4.6457 - 4.6496 in)



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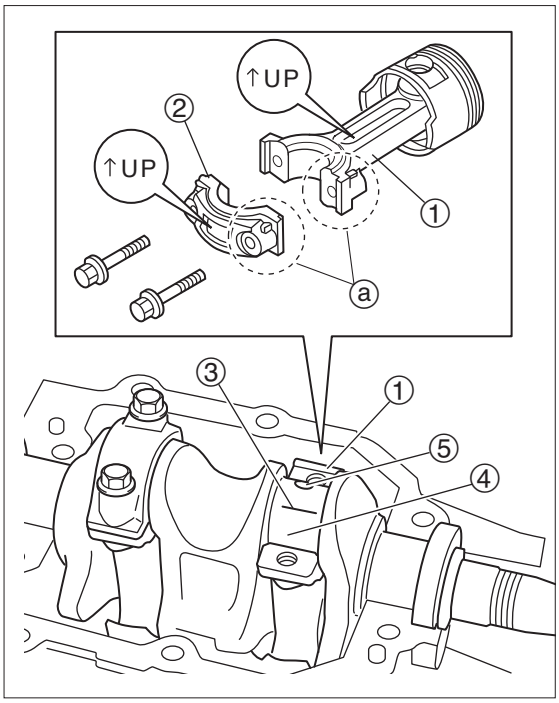
36) Inspection of Crank Pin Oil Clearance

1. Clean connecting rod.

2. Place cylinder block upside down on the work bench. Install piston to connecting rod ①, and install the assembly to cylinder block.

> Piston rings are not to be attached to piston.



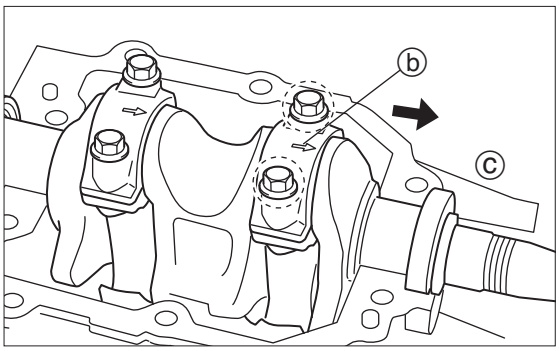
3. Install crankshaft on the cylinder block.

4. Place plasti-gauge ③ on each crank pin ④ parallel to crankshaft.

> Do not place plasti-gauge ③ on the oil hole ⑤ of crank pin ④.

5. Install connecting rod and cap ② to crank pin ④.

> · Be sure that individual cap is installed to their original connecting rod.
> · Check that "UP" mark ⓑ of connecting rod is at crankshaft flywheel side ⓒ.



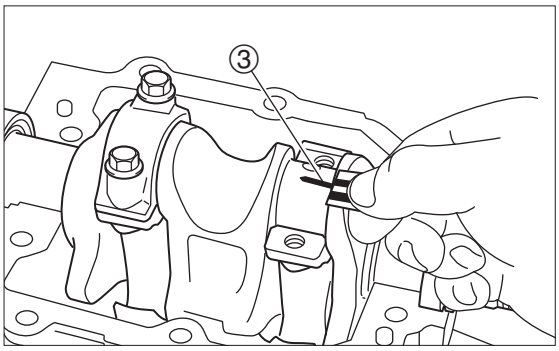
6. Tighten connecting rod bolts in two steps to specified torque.

> Do not move connecting rod and crankshaft until oil clearance measurement is completed.

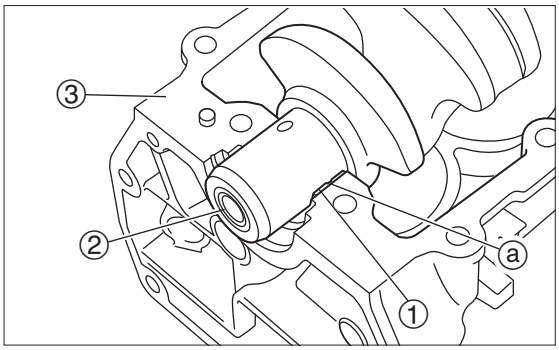
> **Connecting Rod Bolts :**
> First Tightening Torque : 6 N · m (4 lb · ft) [0.6 kgf · m]
> Second Tightening Torque : 12 N · m (9 lb · ft) [1.2 kgf · m]

7. Remove connecting rod cap and measure width of crushed plasti-gauge ③ on each crank pin. Replace connecting rod or crankshaft if the width is over specified value.

> **Crank Pin Oil Clearance :**
> 0.015 - 0.041 mm (0.00059 - 0.00161 in)
>
> **Functional Limit :**
> 0.060 mm (0.00236 in)



37) Inspection of Crankshaft Main Journal Oil Clearance

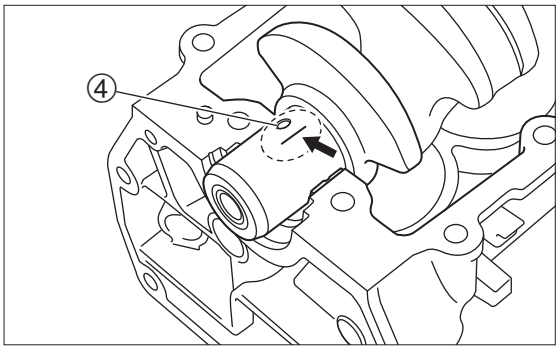


1. Clean bearings, crankshaft main journal, and bearing installation areas of crank case and cylinder block.

2. Place cylinder block on the work bench with cylinder head side facing downward.

3. Install bearing ① and crankshaft ② to cylinder block ③.

   · Be sure that individual bearings are installed to their original locations.
   · Install bearings with their projection ⓐ fit into cylinder block groove.



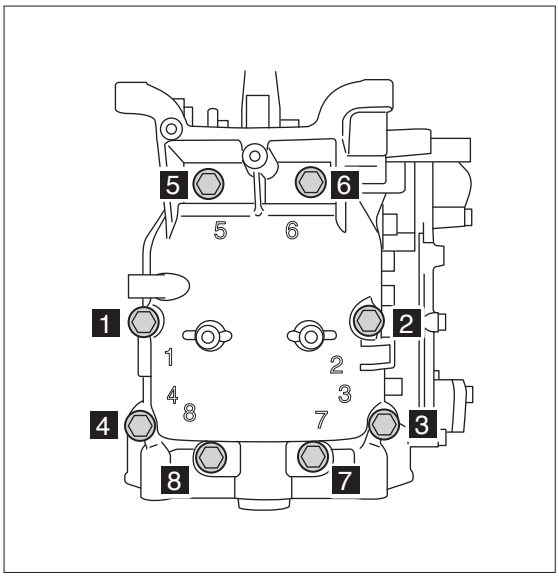
4. Place plasti-gauge ④ on each crankshaft main journal parallel to crankshaft.

   Do not place plasti-gauge ④ on the oil hole of crankshaft main journal.

5. Install bearings to crank case.

   · Be sure that individual bearings are installed to their original locations.
   · Install bearings with their projection fit into crank case groove.

6. Install crank case to cylinder block.



7. Tighten crankcase bolts in the order of numbers shown in two steps to specified torque.

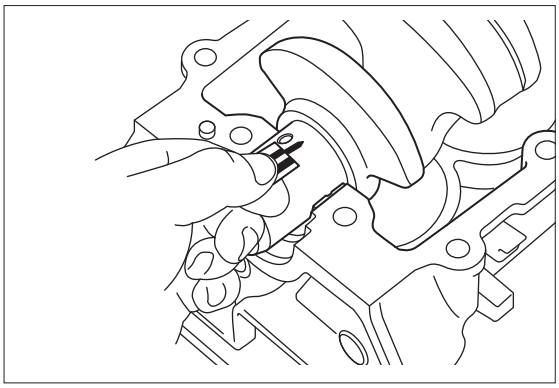
   Crank Case Bolts : 1 to 8
   First Tightening Torque : 10 N · m (7 lb · ft) [1.0 kgf · m]
   Second Tightening Torque : 23.5 N · m (17 lb · ft) [2.4 kgf · m]

8. Loosen bolts in reverse order in several steps. Remove crank case and measure width of crushed plasti-gauge on each main journal. Replace bearing if the width is over specified value.

Crankshaft Main Journal Oil Clearance :
0.012 - 0.044 mm (0.00047 - 0.00173 in)

Functional Limit :
0.060 mm (0.00236 in)

If the clearance is less than specified value, check that inner diameter code is as shown below.



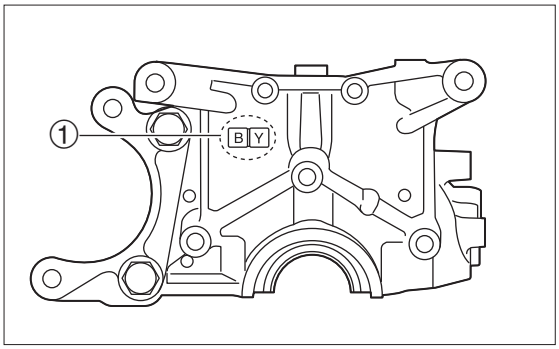
38) Inner Diameter of Cylinder/Crank Case Bearing Holder (Inner Diameter Code)

Cylinder is marked on its upper section with inner diameter code ① that indicates inner diameter of each bearing holder. There are the following two types of bearings that are indicated with the inner diameter code, which is to be used for identification of proper size part.

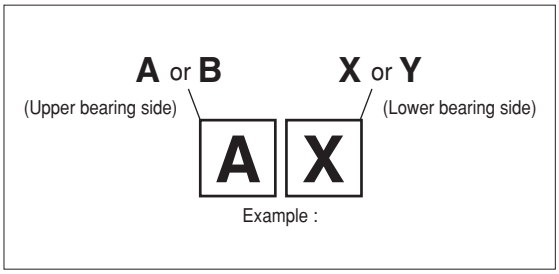
Inner diameter code ①	Standard value	Coloring of bearing
A or X	33.000 - 33.008 mm (1.2992 - 1.2995 in)	Brown
B or Y	33.008 - 33.016mm (1.2995 - 1.2998 in)	Black

Inner diameter codes A and B or X and Y represent size of each bearing section.

Remarks When cylinder/crank case is purchased as a part, fitting bearing comes with it.



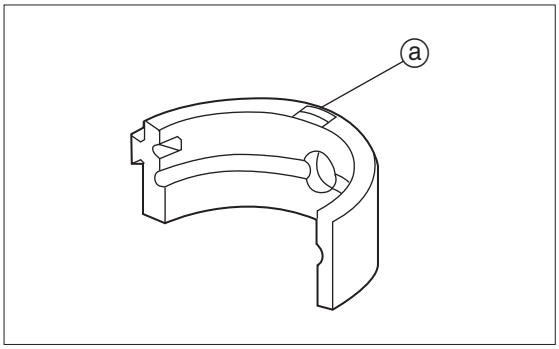
① Inner diameter code



39) Thickness of Metal Bearing (Color of Inner Diameter Code)

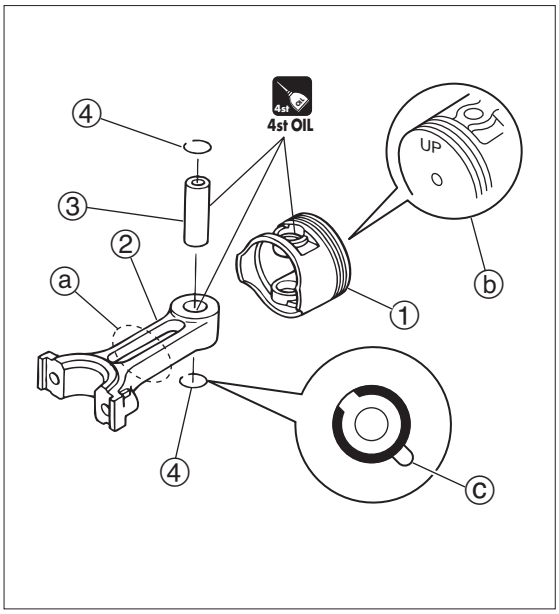
Bearing is painted with color ⓐ that represents thickness. There are the following two types of bearings that are to be selected properly.

[Coloring (Inner Diameter Code)]	Thickness
Brown	1.488 - 1.494 mm (0.05858 - 0.05882 in)
Black	1.494 - 1.500 mm (0.05882 - 0.05906 in)



40) Assembling Piston and Connecting Rod

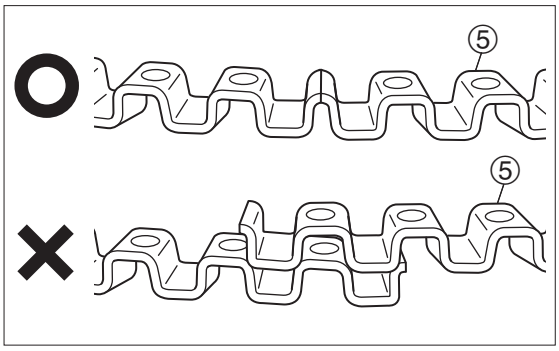
1. Install connecting rod ②, piston pin ③, and piston pin clip ④ to piston ①.



④ Do not reuse.

- Point "3V1-UP" mark ⓐ of connecting rod and "UP" mark ⓑ of piston at the same direction.
- Be sure to use new piston pin clip, and place clip gap away from piston pin groove ⓒ as shown.
- Be sure that individual connecting rod cap is installed to their original connecting rod.

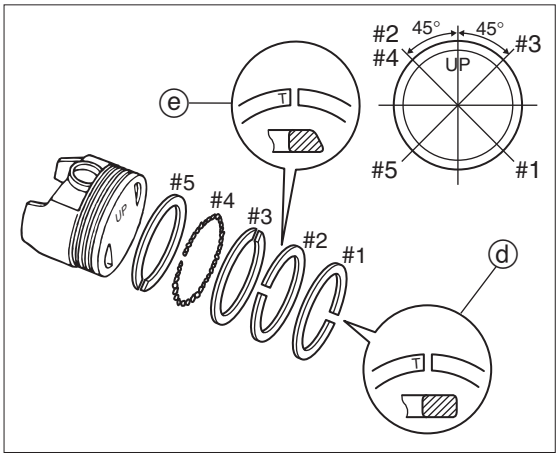
2. Put expander ⑤ (#4) into oil ring groove, and check that ring ends meet correctly as shown.



3. While holding expander ⑤ (#4) gap with thumb, put upper side rail (#3) end into the groove so that the gap is away from gap of expander ⑤ (#4) to the left by 90° degrees.

4. In similar way, put lower side rail (#5) into the groove so that the gap is away from gap of expander ⑤ (#4) to the right by 90° degrees.

5. Install second ring (#2 taper) and top ring (#1) to piston. Install the rings so that their side with manufacturer's identification ⓓⓔ (T) faces upward.



6. Bring their gaps are away from each other as shown.

⚠ CAUTION

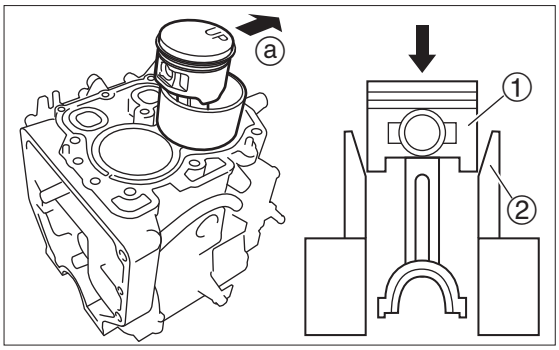
Be careful not to scratch piston surface and damage rings.

- Install piston rings so that their gaps are away also from thrust direction of piston and direction piston pin.
- After installing piston rings, check that they move smoothly.

5

41) Assembling Cylinder Block

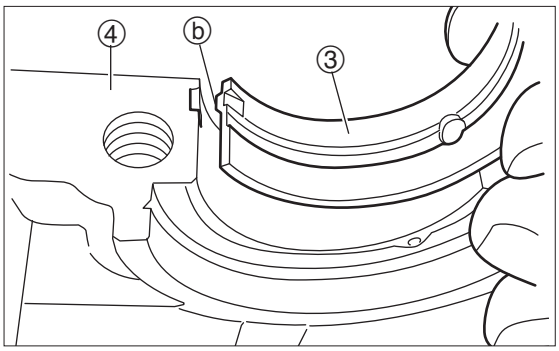
1. Put pistons into cylinder with piston crown ① "UP" mark directing flywheel side ⓐ, set pistons on the piston slider ②, install the piston into the cylinder.



Before installing, apply engine oil to piston peripheral surfaces, piston rings and piston sliders.

Piston Slider ② :
P/N. 3V1-72871-0

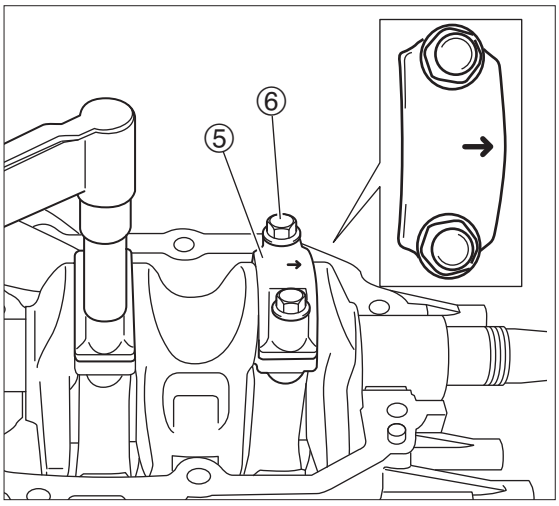
2. Install bearing half ③ to cylinder block ④.



- Be sure that individual bearings are installed to their original locations.
- Install bearings with their projection ⓑ fit into cylinder block groove.

3. Apply engine oil to bearings and crankshaft, then install crankshaft.

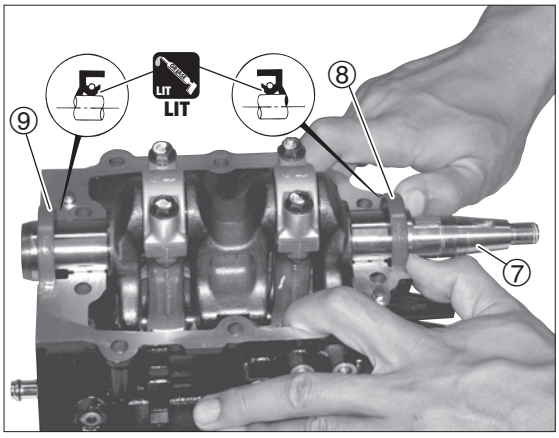
4. Attach connecting rod cap ⑤ to connecting rod, and tighten connecting rod bolts ⑥ in two steps to specified torque.



- Bring each piston to bottom dead center position.
  Be sure that individual connecting rod caps are installed to their original connecting rod.
- Be careful of orientation of connecting rod cap.
- After installing connecting rod cap, apply engine oil to connecting rod side clearance.

Connecting rod bolt ⑥ :
First Tightening Torque : 6 N · m (4 lb · ft) [0.6 kgf · m]
Second Tightening Torque : 12 N · m (9 lb · ft) [1.2 kgf · m]

5. Install oil seals ⑧ and ⑨ to crankshaft ⑦ as shown.



Apply Lithium grease to lip of oil seals before installing them.

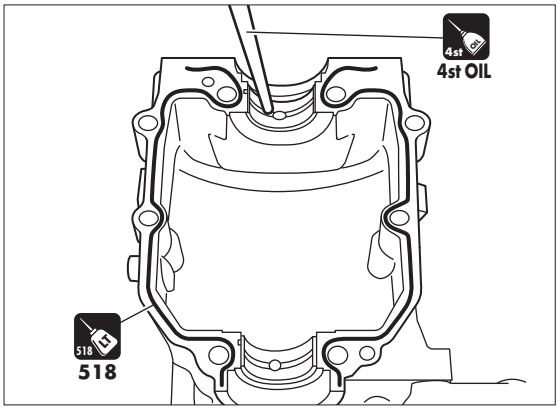
LIT

6. Install bearing half to crank case.

· Be sure that individual bearings are installed to their original locations.
· Install bearings with their projection fit into crank case groove.

7. Apply engine oil to bearings.

4st OIL

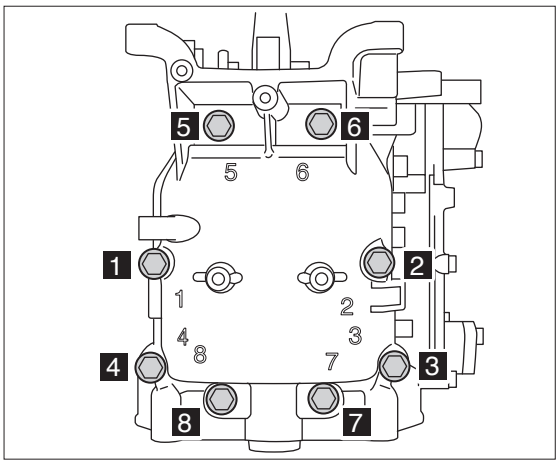


8. Apply sealing agent to mating surface of crank case (one side).

· Degrease mating surfaces of cylinder and crank case.
· Be careful not to allow sealing agent to adhere to bearing.
· Apply Loctite 518 to mating surface of one of crank case halves, taking care not to apply the agent excessively.

518

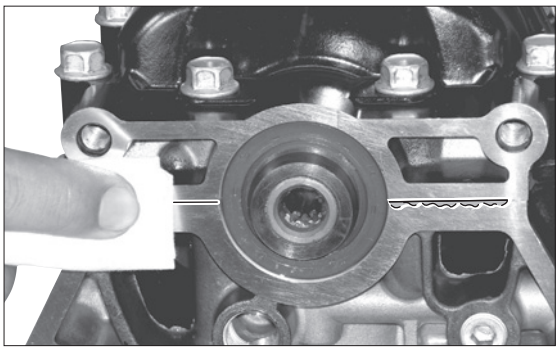
9. Install dowel pin and crank case on the cylinder block.



10. Tighten crank case bolts in two steps to specified torque in the order shown.

Crank Case Bolts :
First Tightening Torque : 10 N · m (7 lb · ft) [1.0 kgf · m]
Second Tightening Torque : 23.5 N · m (17 lb · ft) [2.4 kgf · m]

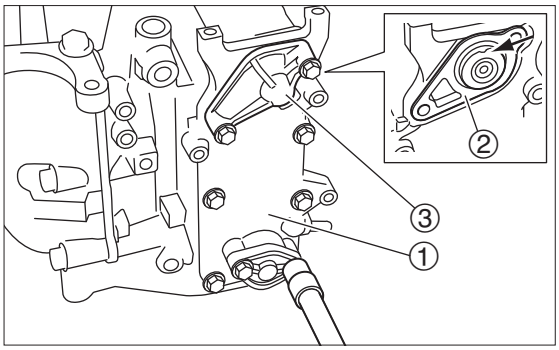
11. Wipe off excess Loctite 518 from lower mating surface of crankcase.



5

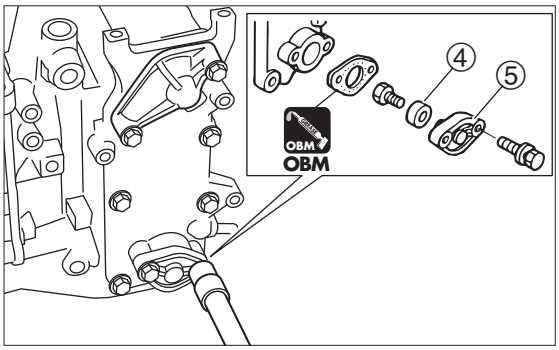
42) Assembling Power Unit

1. Install exhaust cover ①, and then install thermostat ②, new gasket and thermostat cover ③.



- For air bleeding, install the part with concave of valve facing upward.
- When reusing thermostat, check the part by referring to Chapter 3.

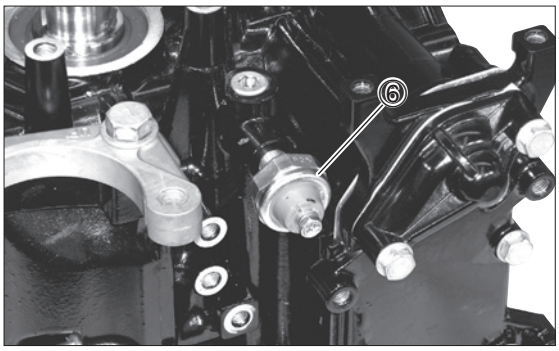
2. Install new gasket, anode ④ and anode cap ⑤.



Apply thin coat gasket with grease before attaching it.

OBM

3. Install oil pressure switch ⑥, and tighten to specified torque.

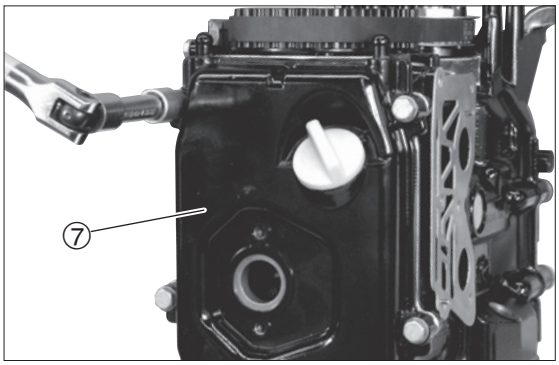


- Before installing oil pressure switch, coat the thread with ThreeBond 1342.
- Use socket wrench of which width between two parallel faces is 24mm.

Oil Pressure Switch:
8 N · m (6 lb · ft) [0.8 kgf · m]

1342

4. Install cylinder head and cylinder head cover ⑦.



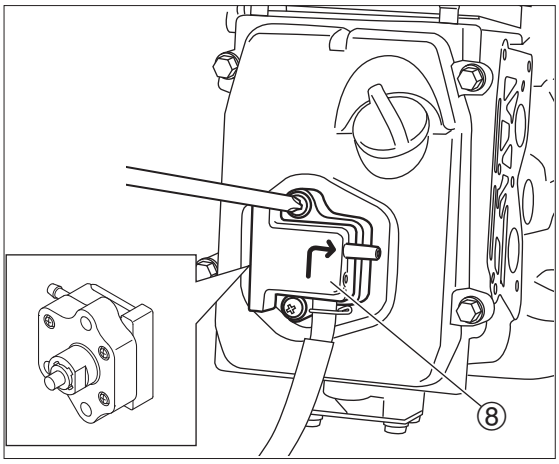
For installation procedure, refer to "Chapter 5 Installation of Cylinder Head".

5. Install fuel pump ⑧.

Apply engine oil to fuel pump cam surface.

6. Attach timing belt to crankshaft pulley and cam shaft pulley.

· For installation procedure, refer to "Installation of pulley and timing belt" in Chapter 5.
· Ensure crankshaft rotates with no binding.



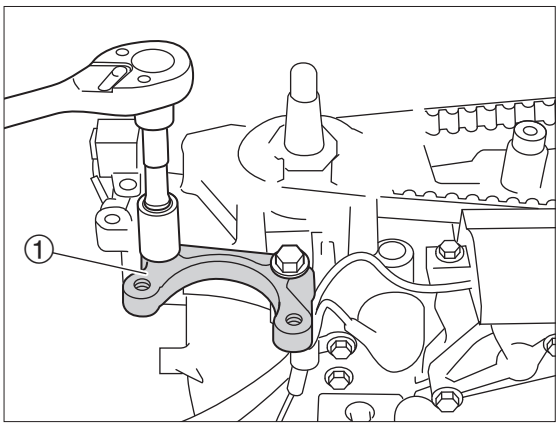
43) Installation of Electrical Parts

1. Install starter motor bracket ① and tighten bolts to specified torque. (E Model)

· Install starter motor bracket with “UP” mark facing upward.
· Before installing starter motor bracket, coat the bolts with ThreeBond 1342.

Starter Motor Bracket Installation Bolt :
23.5 N · m (17 lb · ft) [2.4 kgf · m]

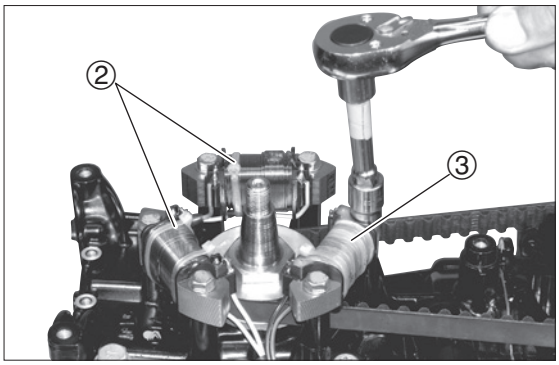
1342



2. Install alternator ② and exciter coil ③.

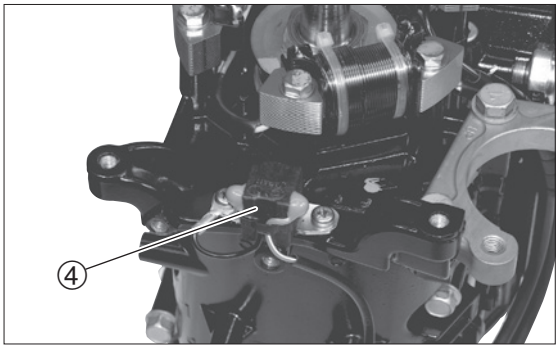
Before alternator and exciter coil, coat the bolts with ThreeBond 1342.

1342



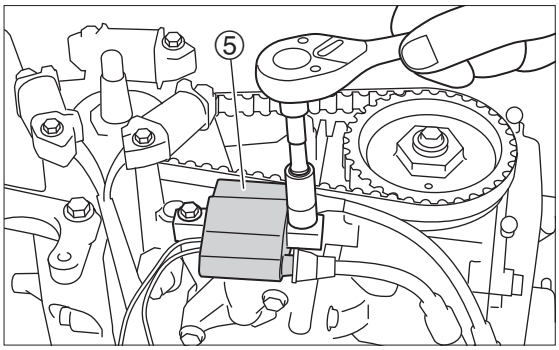
3. Install pulser coil ④ on crank case.

Use starboard side mounting screw for securing ground wire.

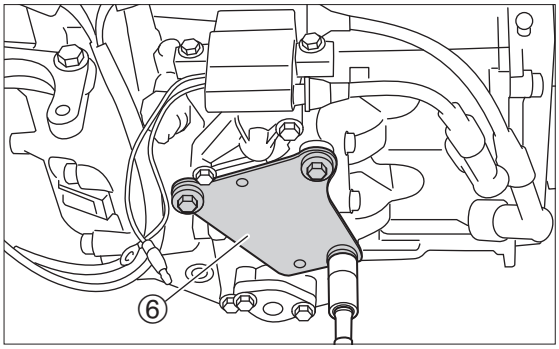


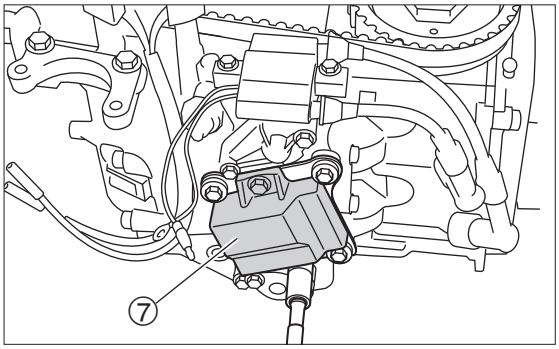
5

4. Install ignition coil ⑤.



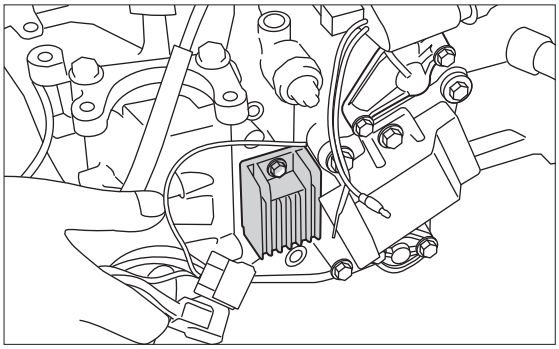
5. Install CD unit bracket ⑥ and secure CD unit ⑦ using bolts.





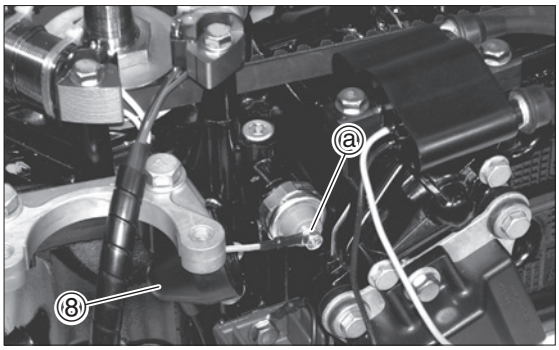
6. Install rectifier and attach ground wire from main harness. (Other than MF model)

- Use rectifier mounting bolt to secure ground wire.
- Direct ground wire to stern side.



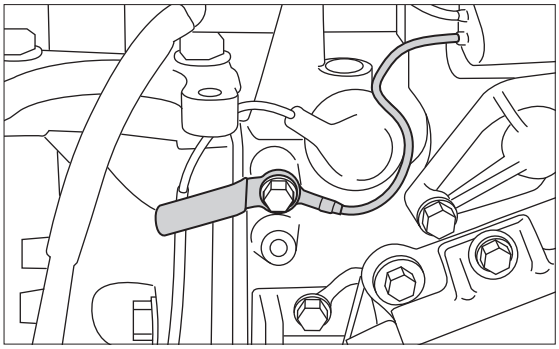
7. Connect main harness coupler to CD unit.

8. Attach sensor wire to oil pressure sensor, and install grommet ⑧.

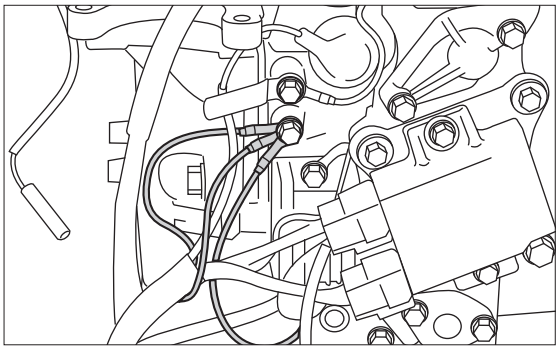


· When installing grommet, be careful not to plug small hole ⓐ of switch with grease.
· Direct ground wire to Bow side.

9. Use clamp bolt to secure ground wire from ignition coil.

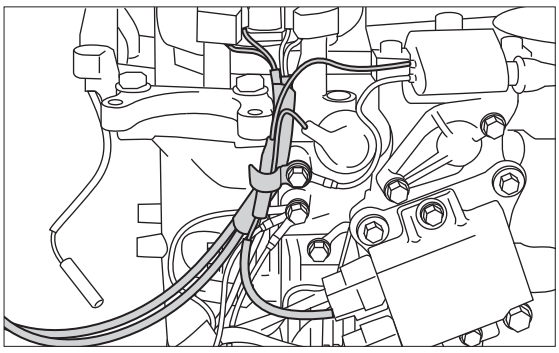


10. Use crank case bolt to secure main harness ground wires (black and light green) and rectifier ground wire.



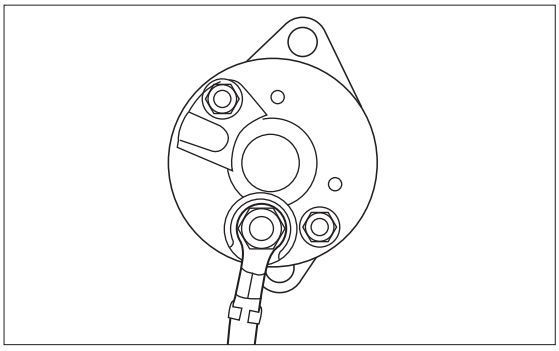
For MF model, use crank case bolt to secure only main harness ground wires (black and light green).

11. Connect CD unit lead wire (orange) with ignition coil lead wire (orange), bundle the wires with sensor wire from oil pressure switch and cords from alternator, and secure them using clamp.

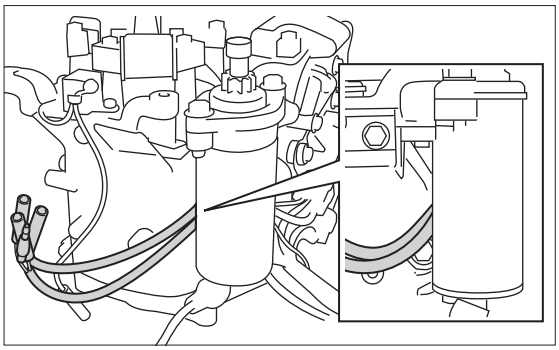


44) Installation of Starter Motor (Electric Start Model)

1. Attach starter cord to starter motor as shown, and then, terminal cap to starter cord.



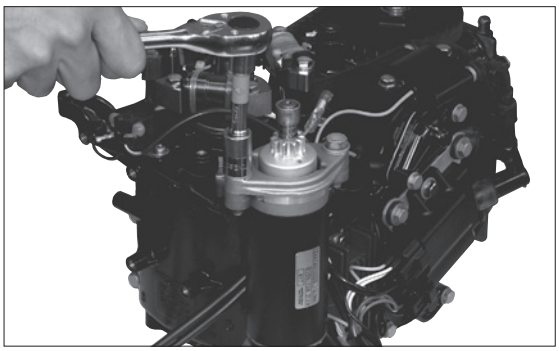
2. Run two cords from alternator through back of starter motor, install starter motor and secure temporarily with bolts.



· Install starter motor with sticker side directing toward you.
· Before installing bolts, coat the thread with ThreeBond 1342.
· Check that two cords from alternator are not caught between starter motor and crank case.

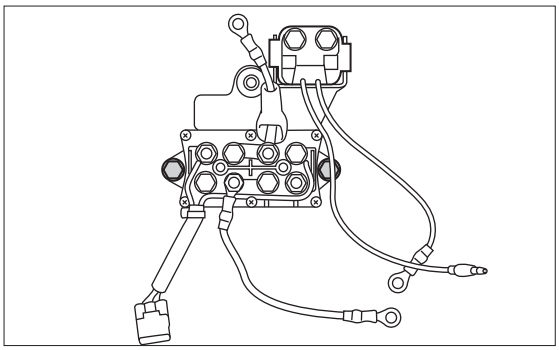
1342

3. Tighten temporarily secured bolts to specified torque.



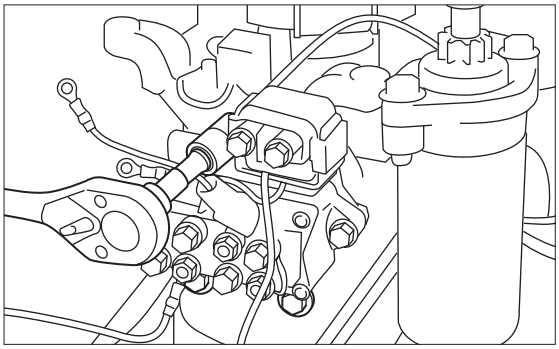
Starter motor bolt :
23.5 N · m (17 lb · ft) [2.4 kgf · m]

4. Install starter solenoid and PT solenoid (PT model) to solenoid stay by using bolts and nuts.



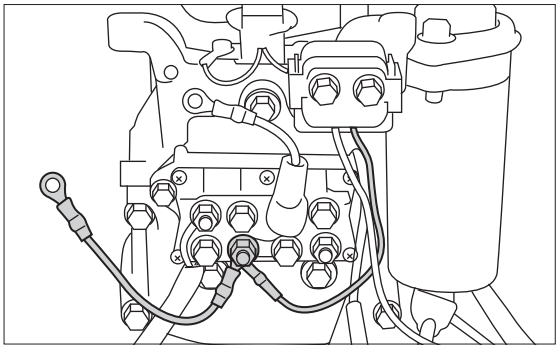
Install PT solenoid in direction as shown.

5. Install solenoid stay on crank case.



Install lower two bolts to the case with bushing.

6. Secure both ground lead from starter solenoid and ground cord together by using PT solenoid terminal (black). (PT Model)



Arrange ground wires as shown.

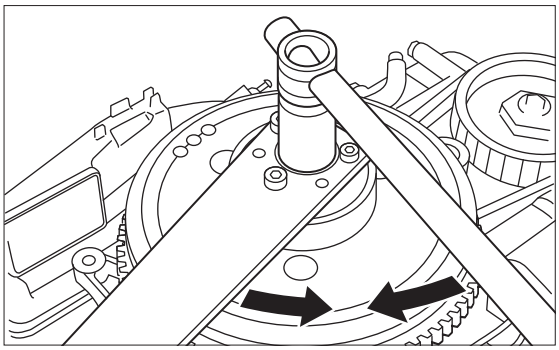
45) Installation of Flywheel

1. Install flywheel with flywheel engaged with crankshaft key.

2. Tighten flywheel nut to specified torque.

Flywheel Puller Kit
P/N. 3V1-72211-0

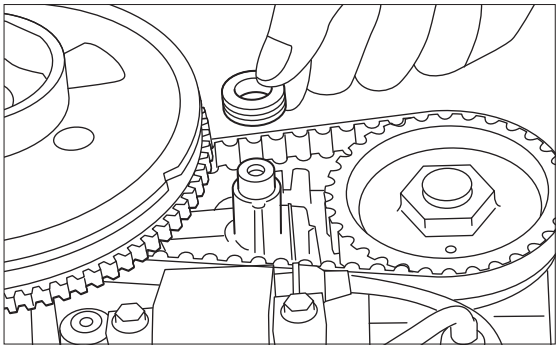
Flywheel Nut :
55 N · m (40 lb · ft) [5.5 kgf · m]

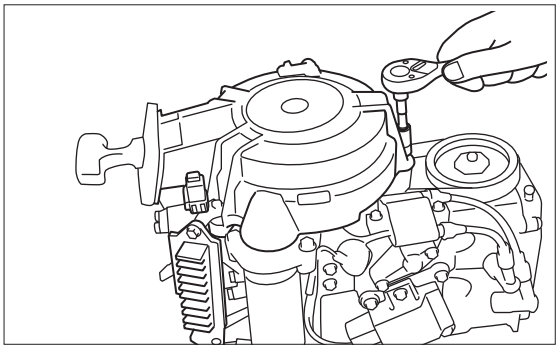


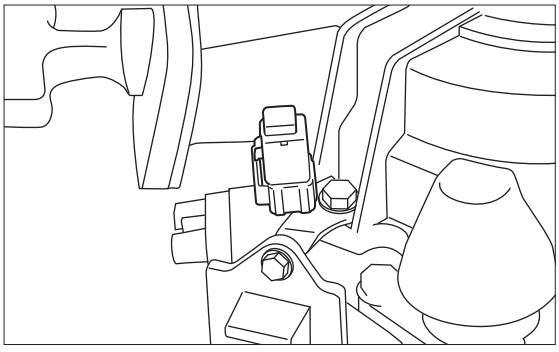
46) Installation of Recoil Starter

1. Attach grommet to crank case, and then, install recoil starter, fuse holder, and cable terminal holder.

- Use port side bolt to secure fuse holder and cable terminal holder.
- Install fuse holder with hook face directed bow side.

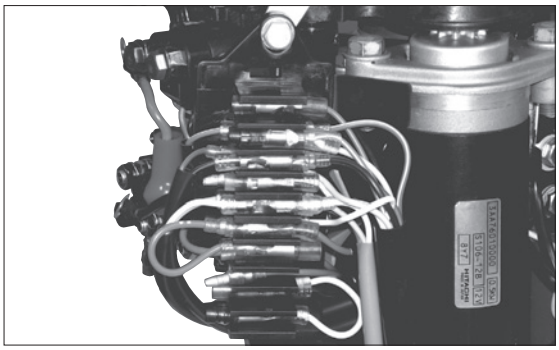


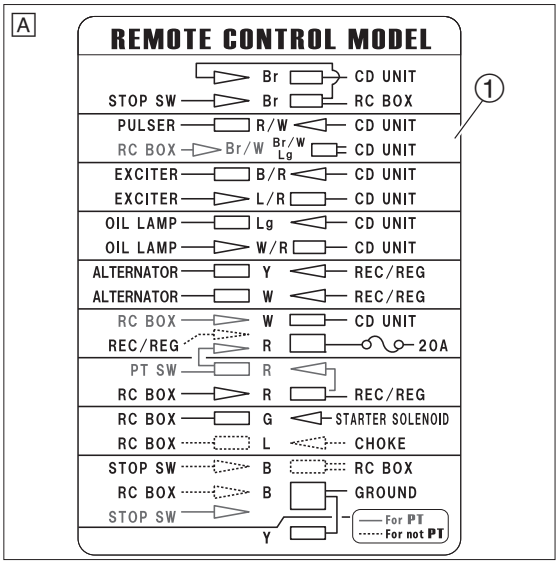




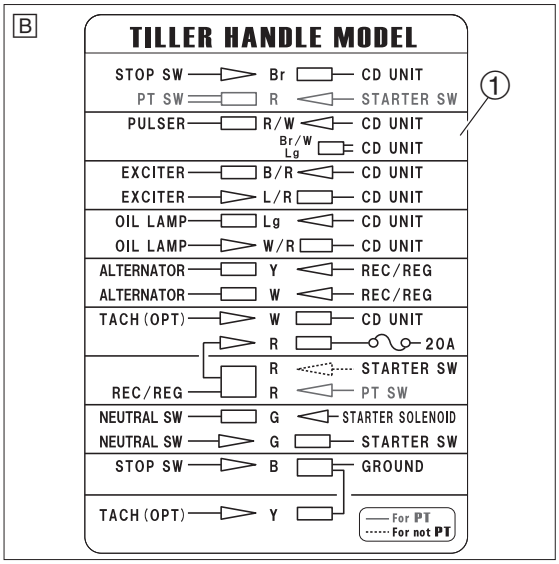
5

2. Put cable terminal in the holder in accordance with description on the sticker ① located on the back of holder cover.





A Remote Control Model

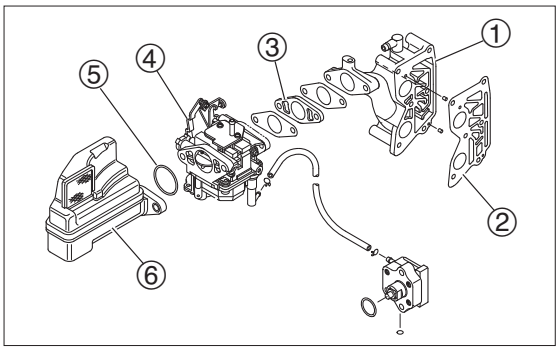


B Tiller Handle Model

47) Installation of Intake Manifold

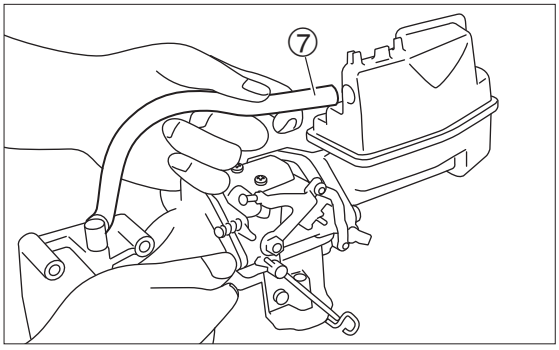
1. Install gasket ②, insulator ③, carburetor ④, O ring ⑤ and intake silencer ⑥ to intake manifold ① in this order and secure with bolts.

For EP model, put bracket for choke solenoid between carburetor ④ and intake silencer.

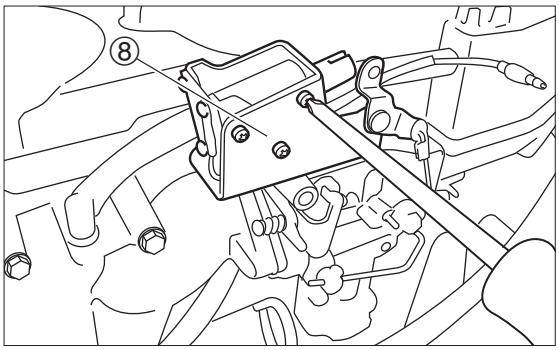


2. Attach breather hose ⑦.

Put breather hose on the nipples of intake silencer and intake manifold.

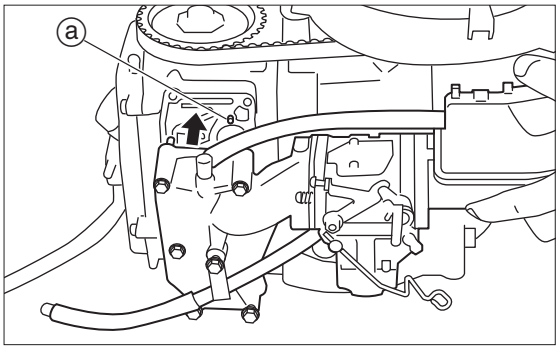


3. Install choke solenoid bracket ass'y ⑧ to intake manifold by using screws. (Remote Control Model)



4. Attach new gasket and intake manifold ass'y to cylinder block.

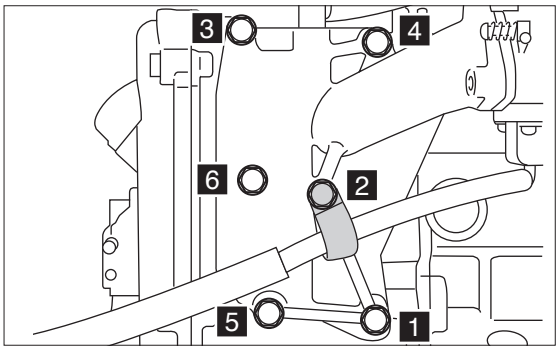
Use dowel pin ⓐ to locate intake manifold ass'y on the cylinder block.



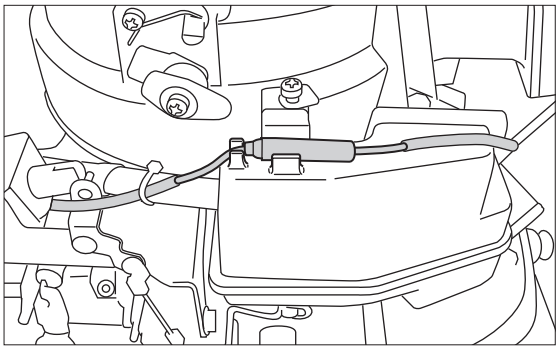
5. Secure intake manifold ass'y by tightening bolts in the specified order to specified torque.

Use central bolt 2 to secure fuel hose holder.

Intake manifold ass'y mounting bolts :
First Tightening Torque : 4 N · m (3 lb · ft) [0.4 kgf · m]
Second Tightening Torque : 9 N · m (7 lb · ft) [0.9 kgf · m]



6. Connect choke solenoid cord (blue) and cord (blue) to coupler, and put them in air intake silencer holder.



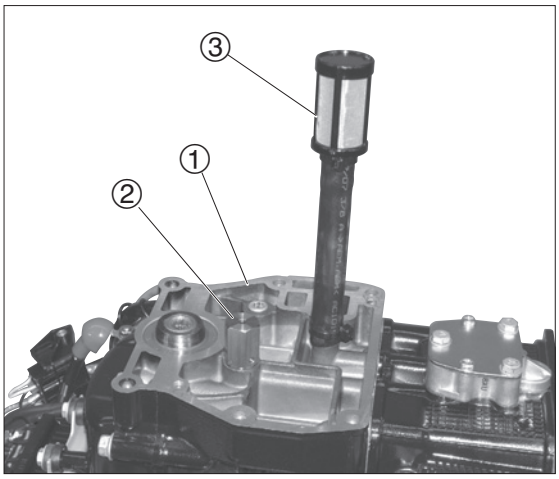
5

48) Installation of Plunger and Oil Strainer

1. With power unit and recoil starter attached, put power head ass'y ① upside down on the work bench, and install plunger ② and oil strainer ③.

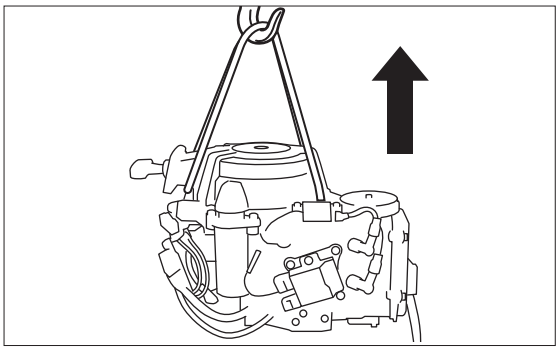
Complete this work in a short period. Doing this work for long time can cause engine oil to flow from breather pipe.

Plunger :
30 N · m (22 lb · ft) [3.0 kgf · m]



49) Installation of Power Unit

1. Hoist power unit with rope as shown.



2. Clean surface of power unit that contacts with the engine base, and install dowel pin ① and new gasket ②.

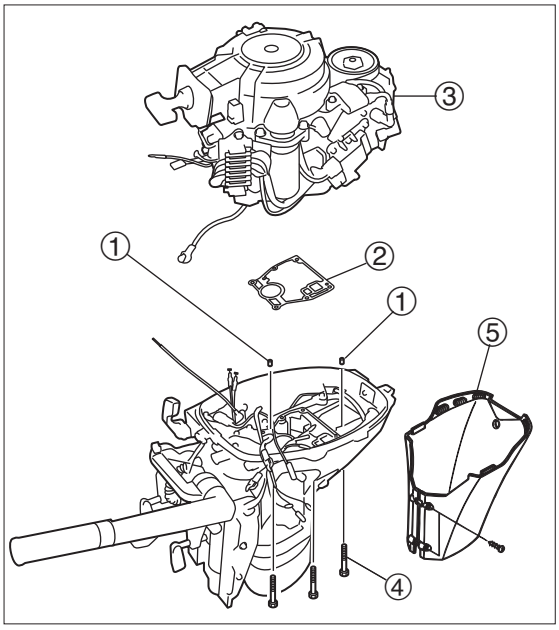
3. Install power unit ③, and tighten bolts ④ in two or three steps to specified torque.

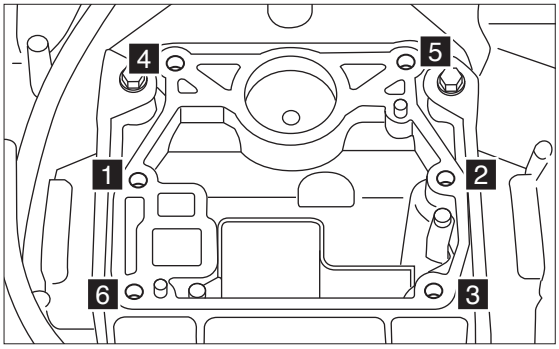
Be careful not to catch wires and hoses and other parts between power unit and engine base.

Power Unit Installation Bolt :
First Tightening Torque : 12 N · m (9 lb · ft) [1.2 kgf · m]
Second Tightening Torque : 23.5 N · m (17 lb · ft) [2.4 kgf · m]

4. Attach drive shaft housing cover ⑤.

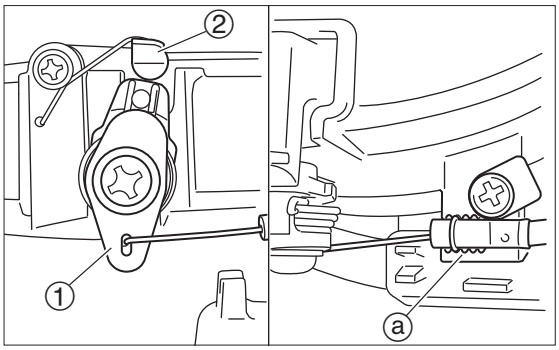
5. Install other parts by reversing the procedure described in "Chapter 5 Removing Power Unit".





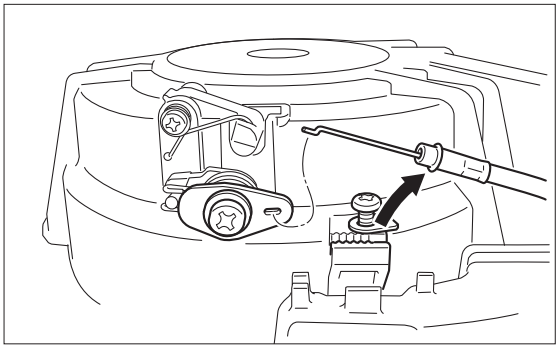
50) Removing Recoil Starter

Adjustment of Starter Lock Cable

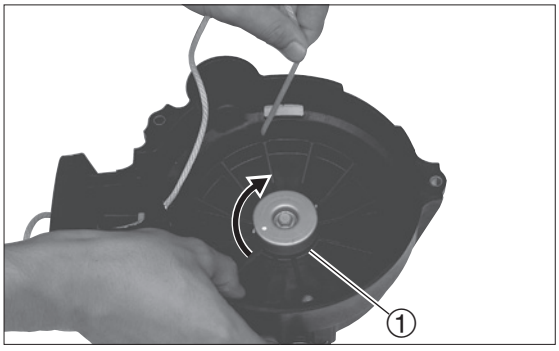


1. Shift gear into neutral (N).
2. Check that starter lock lever ① pushes up starter lock ②.
3. If the state described in 2. does not exist, use starter lock wire adjusting groove ⓐ to adjust.
4. Perform shift operation to check that recoil starter is locked at other than neutral (N) position.

51) Disassembly of Recoil Starter

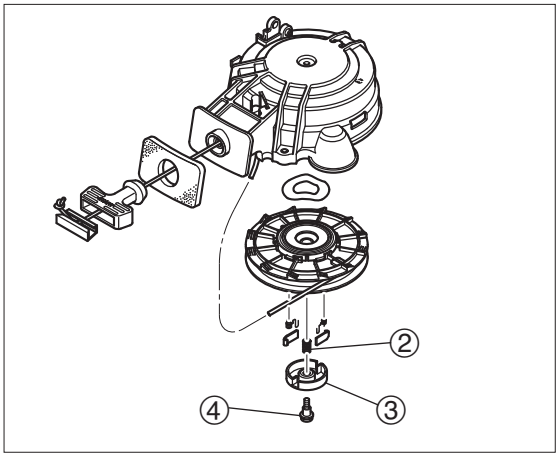


1. Loosen screw and disconnect starter lock cable (upper).
2. Remove bolts, and then, recoil starter.



① Reel

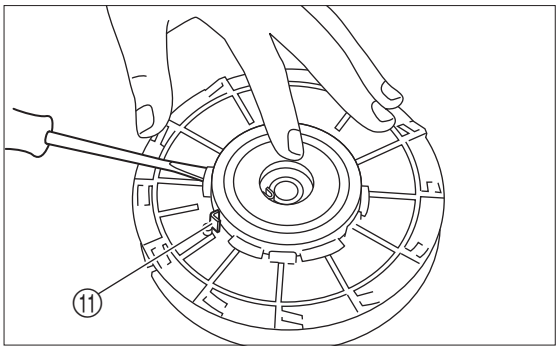
3. Put rope in the groove of reel ① and gently turn reel ① clockwise to release tension of starter spring.



② Friction Spring
③ Friction Plate
④ Starter Shaft Bolt

4. Remove starter shaft bolt ④, and then, friction plate ③, friction spring ②, ratchet, and return spring.
5. Take out reel carefully.

6. Remove starter spring ⑪.
   Insert tool like bladed screw driver to remove starter case containing starter spring.



⑪ Starter Spring

> It is not necessary to remove starter spring from starter case if it is not necessary to replace it. Starter spring can be inspected without removing from starter case.

52) Inspection of Recoil Starter

1. Check ratchet, starter lock and all springs. Replace if any deformation, wear or damage is found.

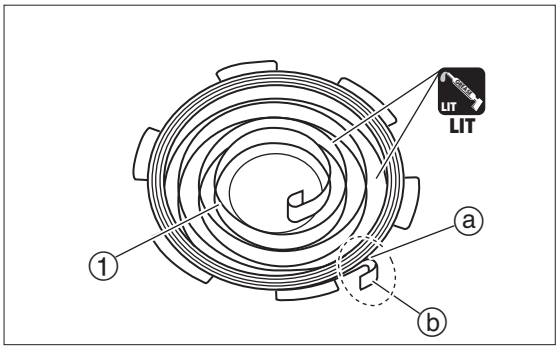
2. Check reel and starter case. Replace if any crack or damage is found.

3. Check starter rope. Replace if any wear, unraveling or damage is found.

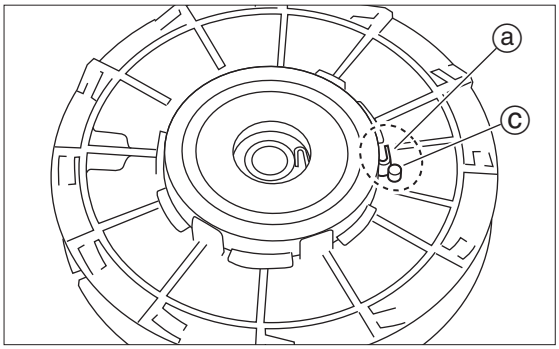
53) Assembling of Recoil Starter

Reverse disassembly procedure to assemble by taking care of the following matters.

- When setting starter spring ① into starter case, face starter spring outer edge hook ⓐ to the right and set it into peripheral cut ⓑ of starter case.
  Since newly delivered starter spring is bound by wire, cut the wire to release the tension after setting outer end hook in the case.

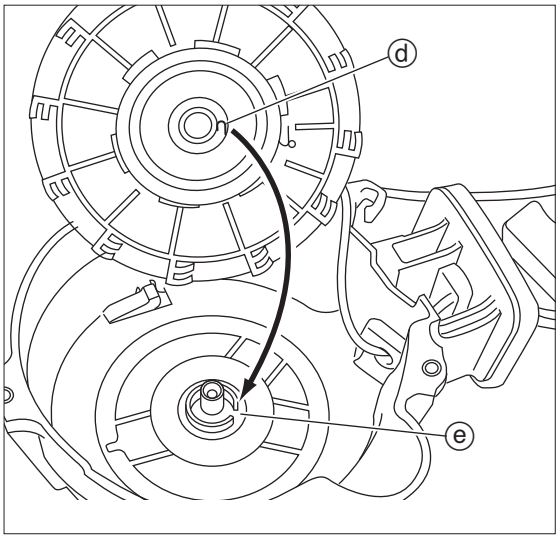


- When attaching starter spring and case to starter reel, align outer end hook ⓐ of starter spring with position of round projection ⓒ of starter reel.



- Run starter rope through rope guide.

• When attaching reel to starter case, put starter spring inner end hook ⓓ in the notch ⓔ of starter case bearing.



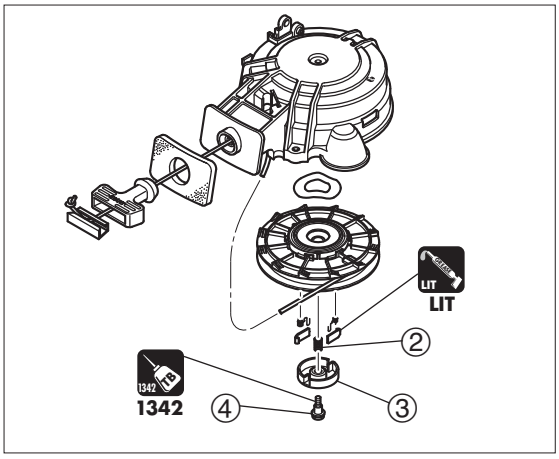
• Apply cold resistance lithium grease to the following parts.
  · Starter Spring
  · Reel Center Hole
  · Ratchet
  · Starter Lock
  · Friction Plate

• Apply "Three Bond" 1342 to starter shaft bolt, and tighten the bold to specified torque.

Starter Shaft Bolt :
6 N · m (4 lb · ft) (0.6 kgf · m)

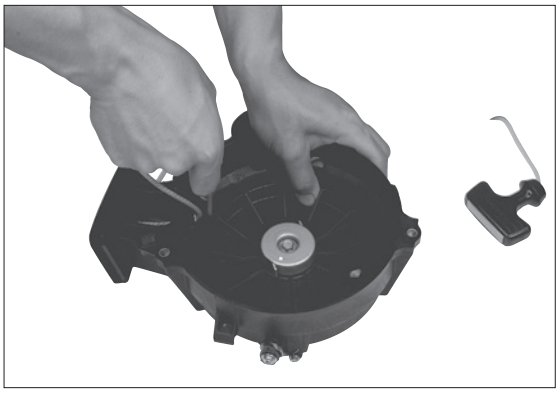
1342

LIT



② Friction Spring
③ Friction Plate
④ Starter Shaft Bolt

• When winding starter spring, turn reel 4 to 5 times to direction to which the reel rotates when pulling out starter rope (counterclockwise) . Then, set the spring so that the reel additionally turns 1/4 of a rotation to one rotation and 1/4 when the rope is fully pulled out. (approximately 5 to 6 rotations)



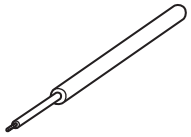
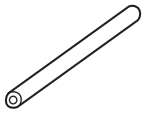
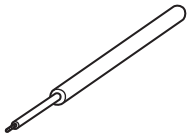
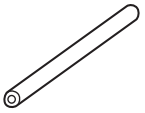
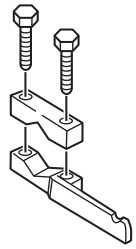
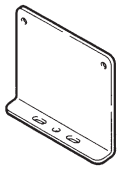
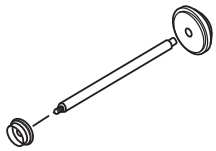
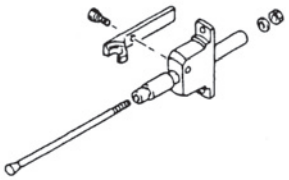
• After installing recoil starter to outboard motor, perform shift operation to check that recoil starter is locked at other than neutral (N) position.

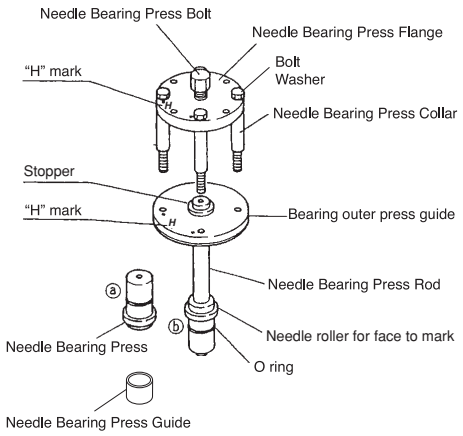
5

6

Lower Unit

1. Special Tools

			
Spring Pin Tool A (ø3.0) P/N. 345-72227-0	Spring Pin Tool B (ø3.0) P/N. 345-72228-0	Spring Pin Tool A (ø3.5) P/N. 369-72227-0	Spring Pin Tool B (ø3.5) P/N. 369-72228-0
Removing spring pin	Installing spring pin	Removing spring pin	Installing spring pin
			
Backlash Measuring Tool Clamp P/N. 3B7-72720-0	Dial Gauge Plate P/N. 3B7-72729-0	Bearing Outer Press Kit P/N. 3B7-72739-1	Backlash Measuring Tool Kit P/N. 369-72740-0
Measuring backlash	Used to attach dial gauge when measuring backlash	Installing forward gear (A) bearing outer race	Measuring gap between forward and pinion gears (A and B gears)

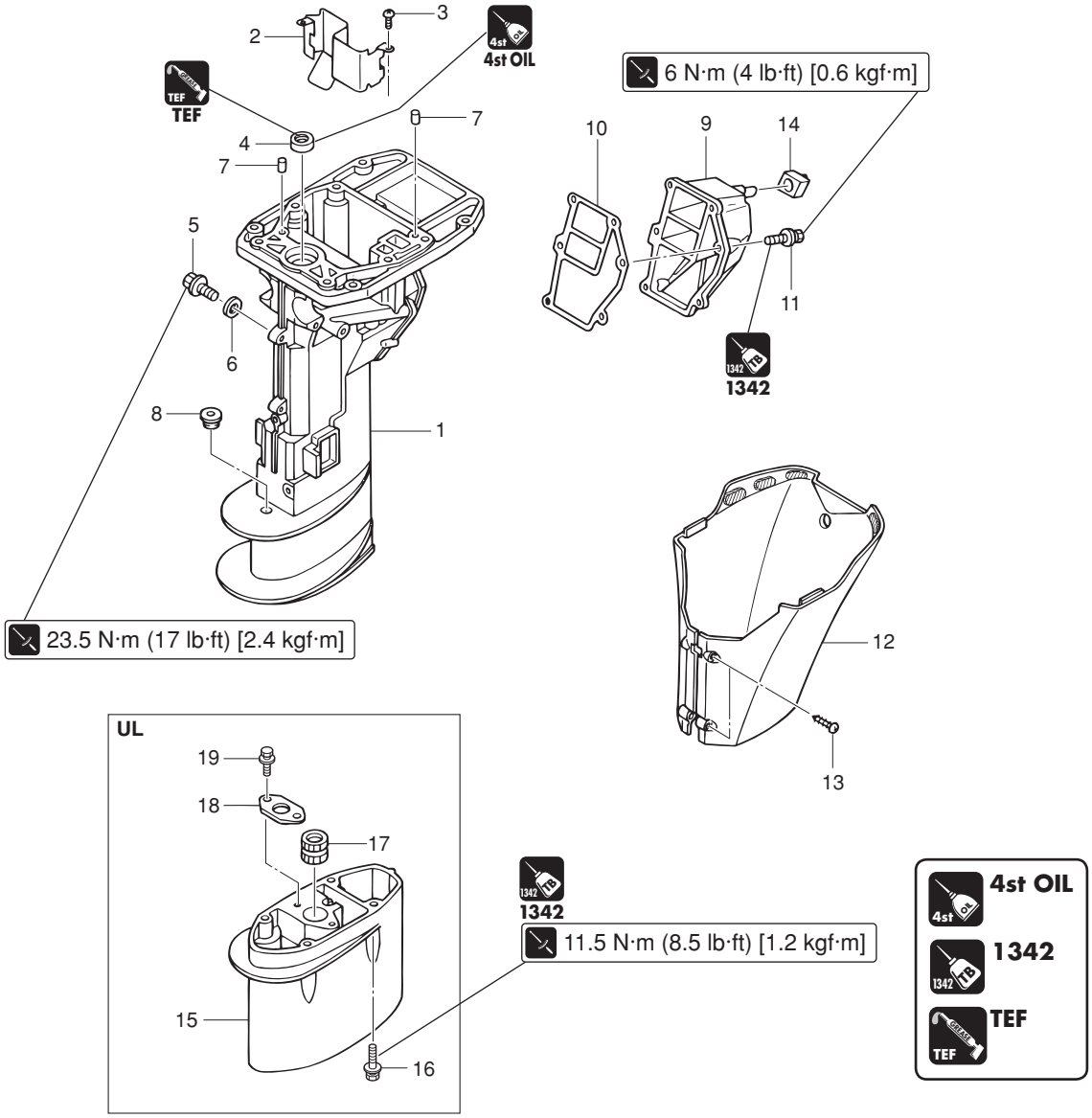


Needle bearing press Ass'y
P/N. 3AC-72900-1

Installing/attaching drive shaft housing

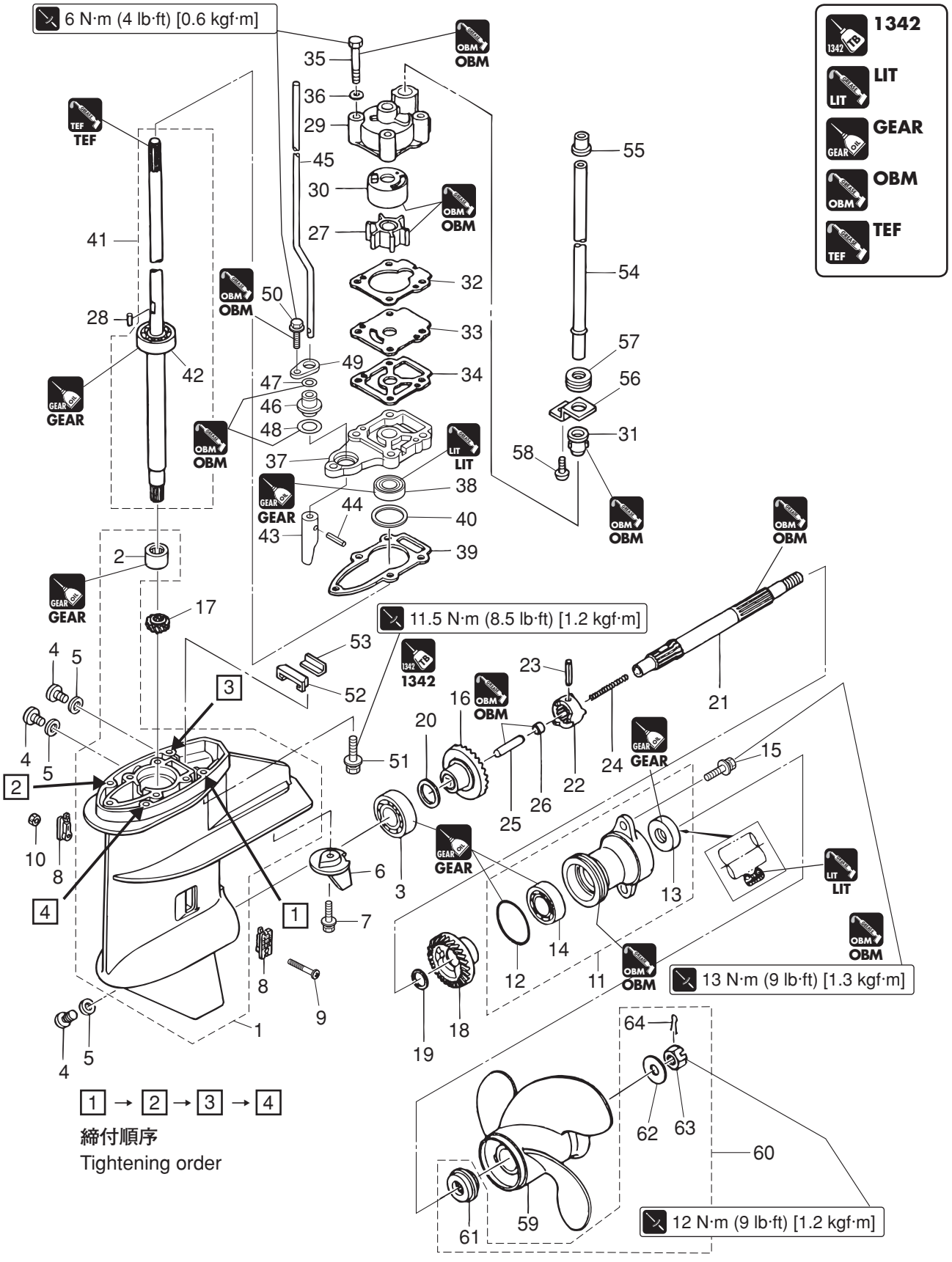
2. Parts Layout

Drive Shaft Housing

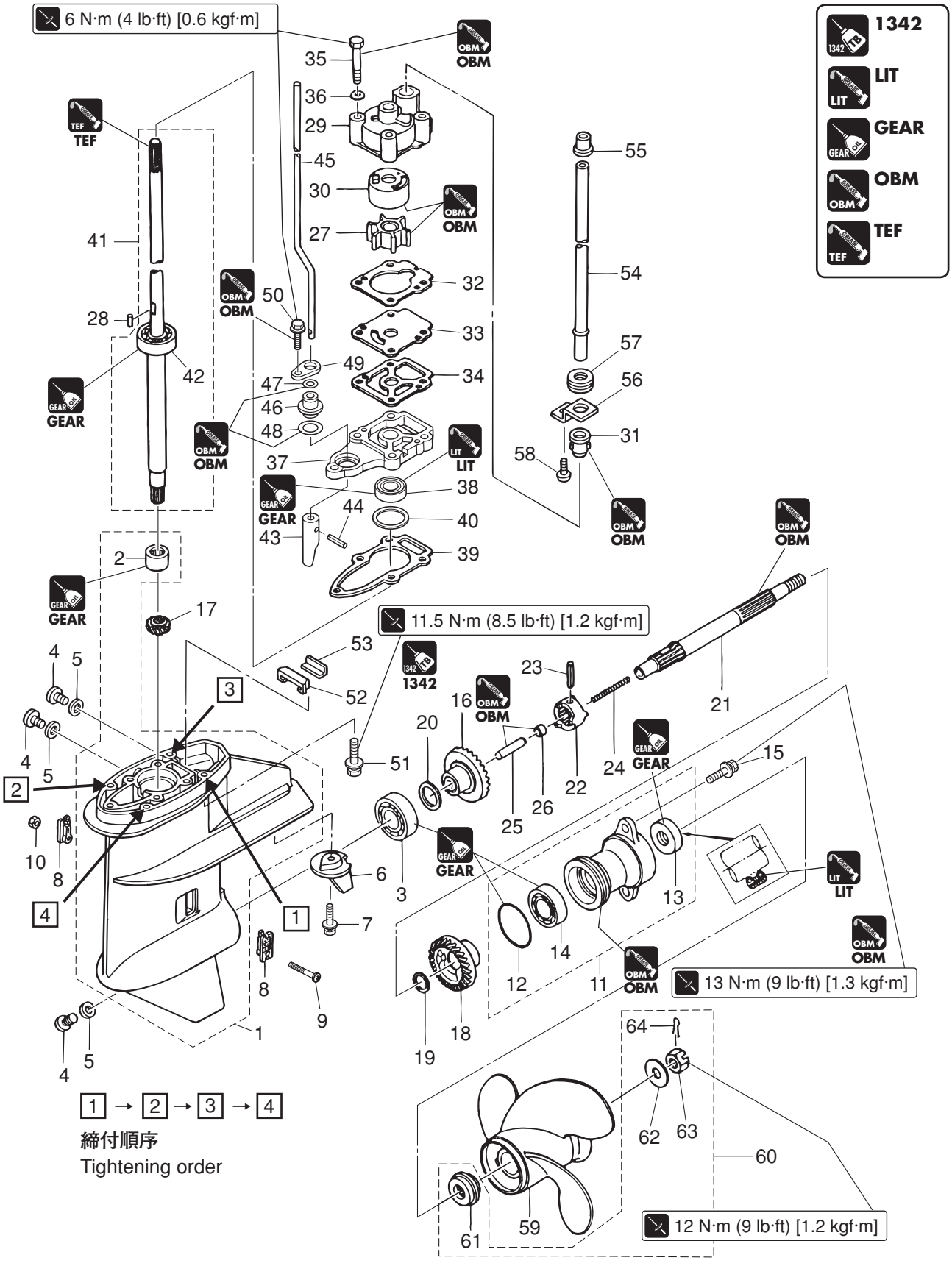


Ref. No.	Description	Q'ty	Remarks
1	Drive Shaft Housing Ass'y (S)	1	for Transom S
	Drive Shaft Housing Ass'y (L)	1	for Transom L&UL
2	Guide Plate	1	
3	Screw	2	
4	Oil Seal 12-28-5	1	Do not reuse.
5	Drain Bolt 14-14	1	
6	Washer 14.5-24-1	1	
7	Dowel Pin 6-12	2	
8	Grommet 10.7-3.5	1	
9	Idle Exhaust Port Cover	1	
10	Idle Exhaust Port Gasket	1	Do not reuse.
11	Bolt	6	
12	Apron Ass'y	1	
13	Tapping Screw 5-30	2	
14	Grommet 12.7-16.2	1	
15	Extension Housing	1	for Transom UL
16	Bolt 6-35	4	for Transom UL
17	Drive Shaft Bushing (UL)	1	for Transom UL
18	Stopper	1	for Transom UL
19	Bolt	2	for Transom UL

Gear Case


6 N·m (4 lb·ft) [0.6 kgf·m]
11.5 N·m (8.5 lb·ft) [1.2 kgf·m]
13 N·m (9 lb·ft) [1.3 kgf·m]
12 N·m (9 lb·ft) [1.2 kgf·m]
1342
LIT
GEAR
OBM
TEF
1 → 2 → 3 → 4
締付順序
Tightening order

Ref. No.	Description	Q'ty	Remarks
1	Gear Case Ass'y	1	
2	Roller Bearing 15-21-16	1	
3	Ball Bearing 6204	1	Do not reuse.
4	Plug 8-8	3	
5	Gasket 8.1-15-1	3	Do not reuse.
6	Trim Tab	1	
7	Bolt	1	
8	Water Strainer W=17	2	Mark A
9	Screw	1	
10	Nylon Nut 4-P0.7	1	
11	Propeller Shaft Housing Ass'y	1	
12	O-ring 3.2-47	1	Do not reuse.
13	Oil Seal 15-28-10	1	Do not reuse.
14	Ball Bearing 6004	1	
15	Bolt	2	
16	Bevel Gear Ass'y (A)	1	
17	Bevel Gear B	1	
18	Bevel Gear C	1	
19	Washer 15.2-19-1.9	1	
20	Shim 21-28-0.1	A	
	Shim 21-28-0.15	A	
21	Propeller Shaft	1	
22	Clutch	1	
23	Pin 3.5-28	1	
24	Spring	1	
25	Push Rod	1	
26	Spring Retainer	1	
27	Water Pump Impeller	1	
28	Key ø3-11	1	Pump Impeller
29	Pump Case (Upper)	1	
30	Pump Case Liner	1	
31	Water Pipe Seal (Lower)	1	
32	Pump Case Gasket	1	Do not reuse.
33	Water Pump Guide Plate	1	
34	Guide Plate Gasket	1	Do not reuse.
35	Bolt	4	
36	Washer	4	
37	Pump Case (Lower)	1	
38	Oil Seal 12-24-8	1	
39	Pump Case Gasket (Lower)	1	
40	Shim 28-36.8-0.1	A	
	Shim 28-36.8-0.15	A	
	Shim 28-36.8-0.3	A	
41	Drive Shaft Ass'y (S)	1	for Transom S
	Drive Shaft Ass'y (L)	1	for Transom L
	Drive Shaft Ass'y (UL)	1	for Transom UL
42	Ball Bearing 6301	1	Do not reuse.
43	Clutch Cam	1	
44	Spring Pin 3-10	1	Do not reuse.
45	Cam Rod (S)	1	for Transom S
	Cam Rod (L)	1	for Transom L
	Cam Rod (UL)	1	for Transom UL

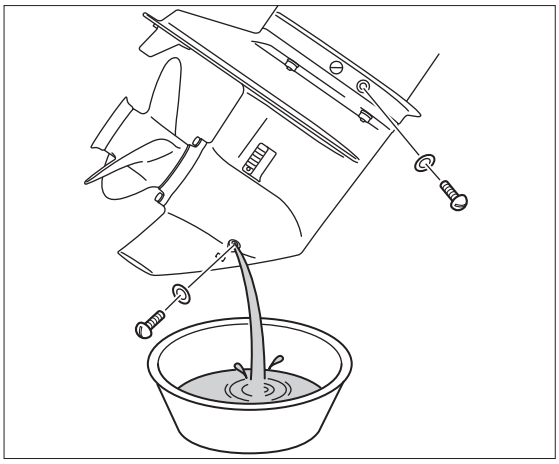

6 N·m (4 lb·ft) [0.6 kgf·m]
11.5 N·m (8.5 lb·ft) [1.2 kgf·m]
13 N·m (9 lb·ft) [1.3 kgf·m]
12 N·m (9 lb·ft) [1.2 kgf·m]
1342
LIT
GEAR
OBM
TEF
1 → 2 → 3 → 4
締付順序
Tightening order

Ref. No.	Description	Q'ty	Remarks
46	Cam Rod Bushing	1	
47	O-ring 2.5-4.9	1	Do not reuse.
48	O-ring 2.4-15.4	1	Do not reuse.
49	Stopper	1	
50	Bolt	1	
51	Bolt 6-35	4	
52	Water Seal Rubber	1	
53	Water Seal Plate	1	
54	Water Pipe (S)	1	for Transom S
	Water Pipe (L)	1	for Transom L
	Water Pipe (UL)	1	for Transom UL
55	Water Pipe Seal (Upper)	1	
56	Lock Plate	1	
57	Water Pipe Auxiliary Mount 13-2.5	1	
58	Screw	1	
59	Propeller Ass'y (6.5)	1	6 : L 3 x 216 x 165
	Propeller Ass'y (7)	1	(USA:8ps S/L, 9.8ps L) 3 x 226 x 178
	Propeller Ass'y (7.5)	1	8:S/L/UL, 9.8:L/UL 3 x 216 x 190
	Propeller Ass'y (8.5)	1	9.8:S 3 x 226 x 211
	Propeller Ass'y (9.5)	1	OPT 3 x 226 x 255
	Propeller Ass'y (5)	1	(USA:9.8 UL) 4 x 221 x 127
	Propeller Ass'y (7)	1	(USA:9.8:EFTL/EPTL) 4 x 216 x 178
60	Propeller Hardware Kit	1	
61	Thrust Holder	1	
62	Washer 10.5-28-2	1	
63	Propeller Nut	1	
64	Split Pin 3-18	1	Do not reuse.

3. Inspection Items

1) Draining Gear Oil

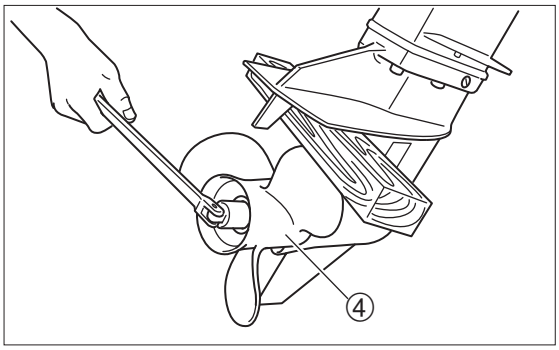
1. Drain gear oil. Refer to "Replacement of Gear Oil" in Chapter 3.



2) Removing Propeller

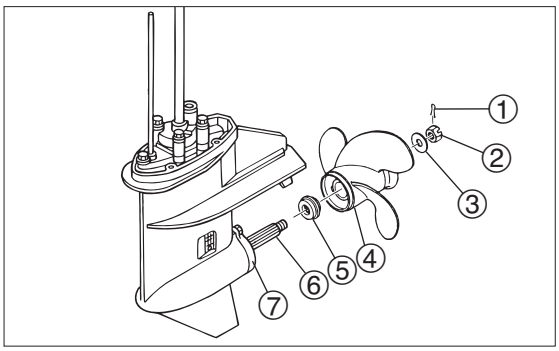
⚠ WARNING

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



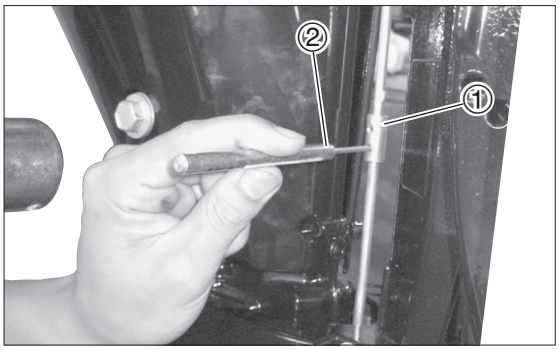
1. Shift gear into neutral (N).

2. Put a piece of wooden block between anti-cavitation plate and propeller ④ to prevent rotation of propeller ④, and then remove propeller nut ② and then propeller ④.



① Split pin
② Propeller nut
③ Washer
④ Propeller
⑤ Thrust holder
⑥ Propeller shaft
⑦ Propeller shaft housing

3) Removing Lower Unit

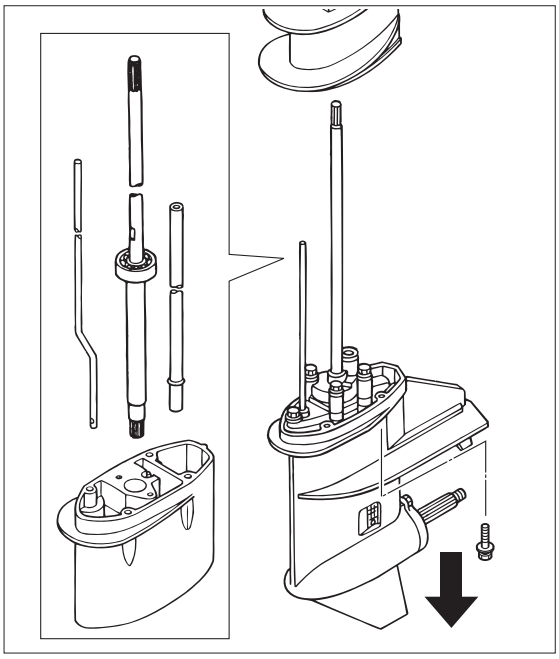


⚠ WARNING

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

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

1. Remove spring pin and disconnect shift rod.

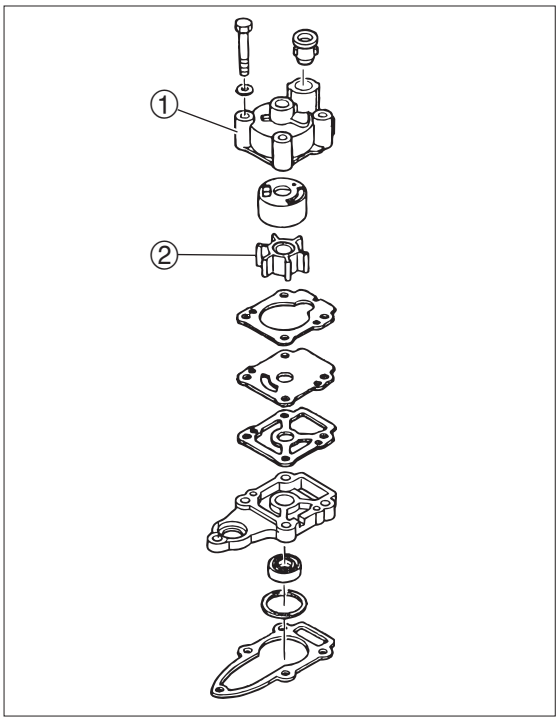


- Disconnect shift rod at lower side of shift rod joint ①.
- Use spring pin tool A② to remove spring pin.
- Do not reuse removed spring pin.
- To hold lower unit, keep spring pin tool inserted until the step of removal of lower unit.

Spring pin tool A ② (ø3.0) :
P/N. 345-72227-0

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

4) Disassembly of Water Pump

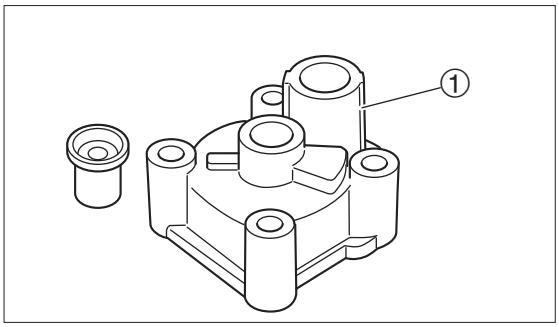


1. Remove pump case (Upper) ①.

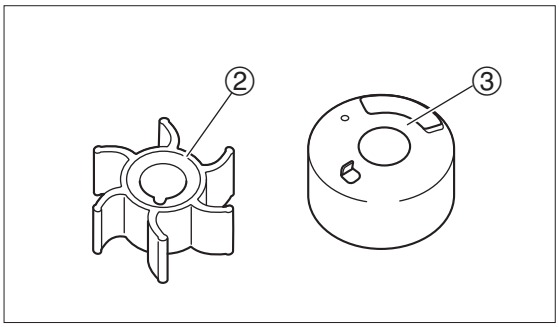
2. Remove impeller ②.

5) Inspection of Water Pump

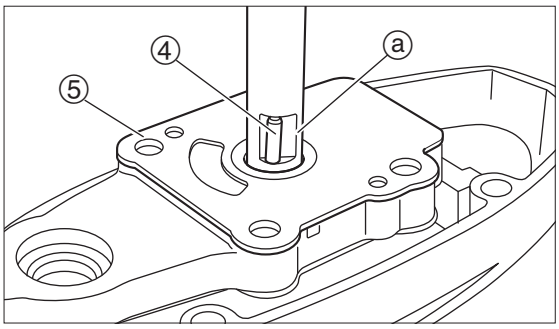
1. Check pump case (upper) ① for deformation. Replace if necessary.



2. Check impeller ② and pump case liner ③ for crack and wear. Replace if necessary.

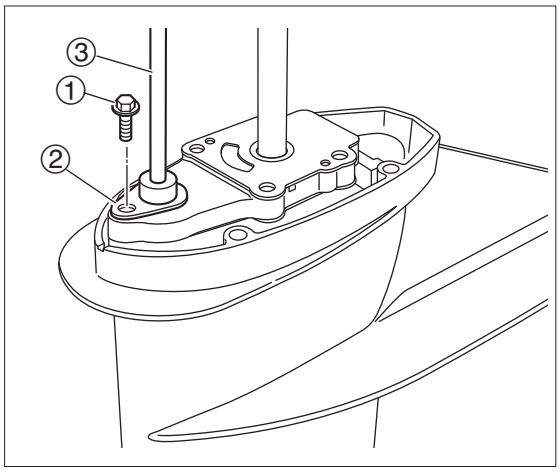


3. Check key ④, water pump guide plate ⑤ and drive shaft groove ⓐ for wear. Replace if necessary.



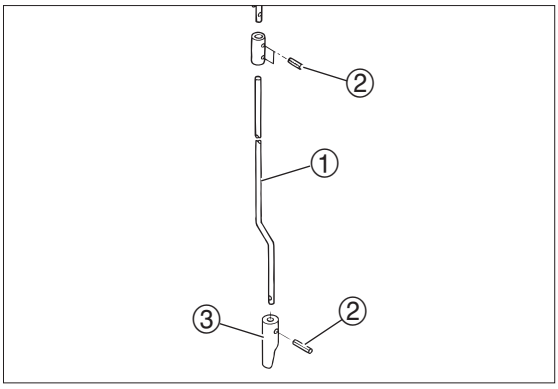
6) Removing Clutch Cam and Cam Rod

1. Remove cam rod bushing bolt ①, plate ②, and pull cam rod ass'y ③ upward to remove.



7) Disassembly of Clutch Cam and Cam Rod

1. Remove spring pin ②, clutch cam ③ and cam rod bushing from cam rod ①.

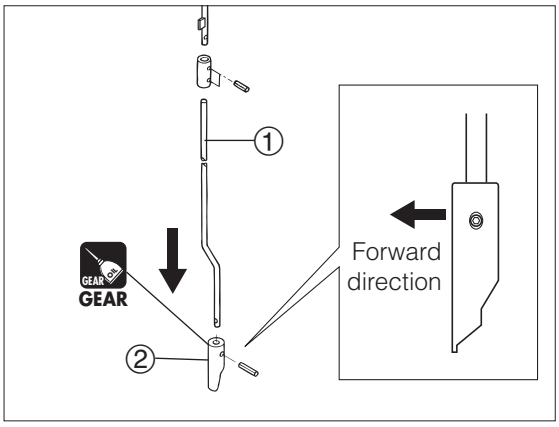


- Use spring pin tool A to remove spring pin.
- Do not reuse removed spring pin.

Spring Pin Tool A (ø3.0) :
P/N. 345-72227-0

8) Inspection of Cam Rod and Clutch Cam

1. Check cam rod ① and clutch cam ② for crack and wear. Replace if necessary.



9) Assembly of Cam Rod and Clutch Cam

1. Reassemble.

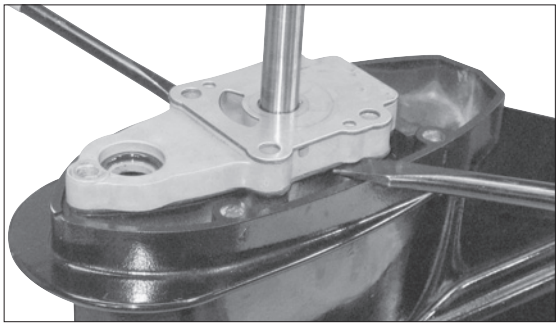
Be careful of direction of cam rod.

- Use spring pin tool B to install spring pin.
- Do not reuse removed spring pin.

Spring Pin Tool B (ø3.0) :
P/N. 345-72228-0

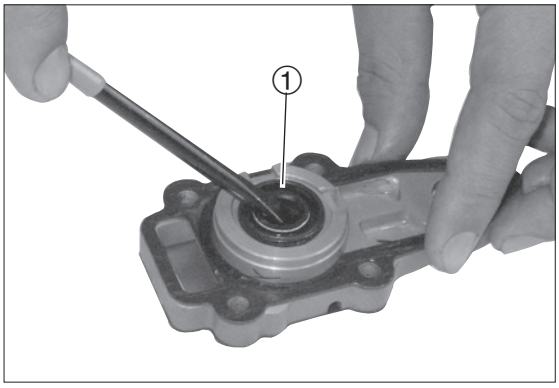
10) Removing Pump Case (Lower)

1. Remove pump case (lower).



11) Disassembly of Pump Case (Lower)

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



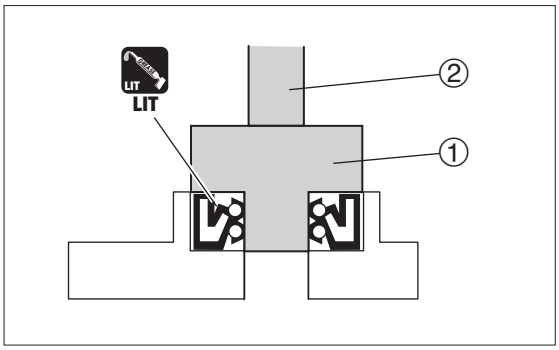
① Oil seal **Do not reuse.**

12) Assembly of Pump Case (Lower)

1. Apply gear oil to periphery of new oil seal, and install into pump case (lower) with number side facing downward.

2. Apply LITHIUM grease to lip of oil seal.

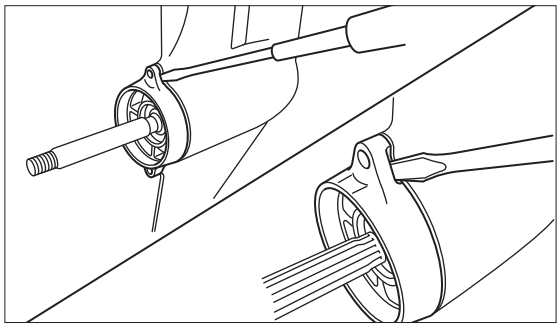
LIT



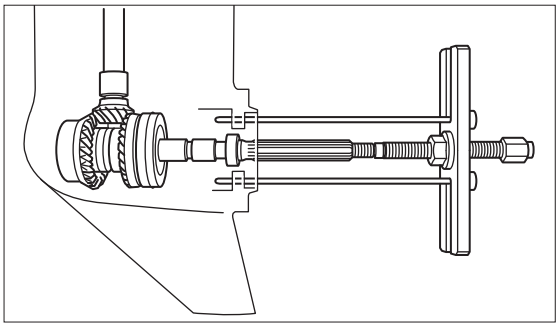
13) Removing Propeller Shaft Housing Ass'y

1. Remove propeller shaft ass'y.

> Use a plastic hammer to remove the part if it cannot be removed by inserting a bladed screw driver.



2. Use commercially available puller to remove.

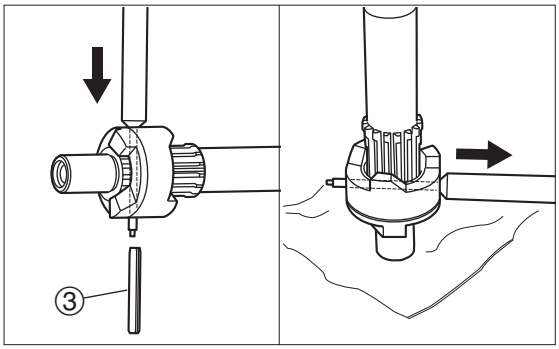


14) Disassembly of Propeller Shaft Ass'y

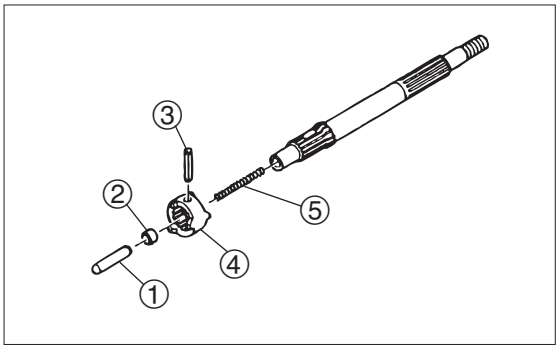
1. Fix propeller shaft ass'y with vice, remove push rod ① and spring retainer ② first, and then, drive out spring pin ③ and remove clutch ④ and spring ⑤.

> • While driving out spring pin, be careful not to let spring pop out.
> • Use spring pin tool A.
> • Do not reuse removed spring pin.

Spring Pin Tool A (ø3.5) :
P/N. 369-72227-0



2. Check clutch ③, spring retainer ⑤, ball, and push rod ④ for crack and wear. Replace if necessary.

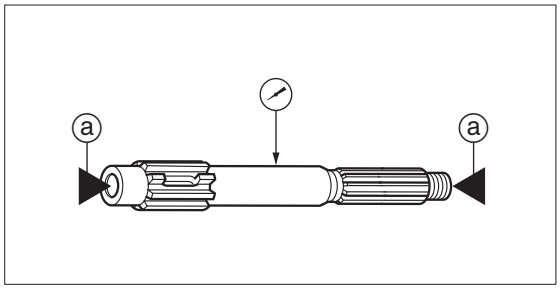


15) Inspection of Propeller Shaft

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

2. Measure propeller shaft runout.

Runout Limit :
0.05 mm (0.0020 in)

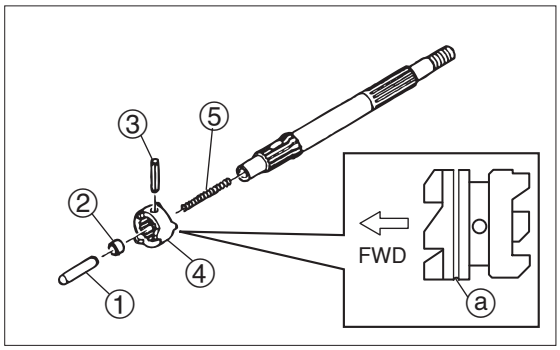


ⓐ Support point

16) Assembly of Propeller Shaft Ass'y

1. Fix propeller shaft with vice, and attach spring ⑤ and clutch ④.

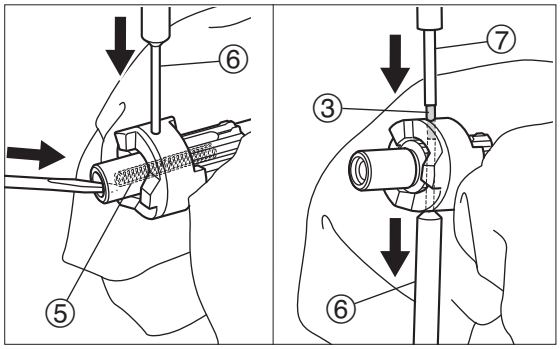
- Install clutch with groove ⓐ facing push rod side.
- Set spring pin with groove directing 90 degrees from axial direction of propeller shaft.
- Apply gear oil before assembling.



2. Using bladed screw driver, shorten spring ⑤ by referring to illustration, insert spring pin tool A ⑥ into hole of clutch ④ to secure spring. Slowly press fit new spring pin ③ from the other side, putting it on the spring pin tool A and by using spring pin tool B ⑦.

⚠ CAUTION

Do not reuse removed spring pin.

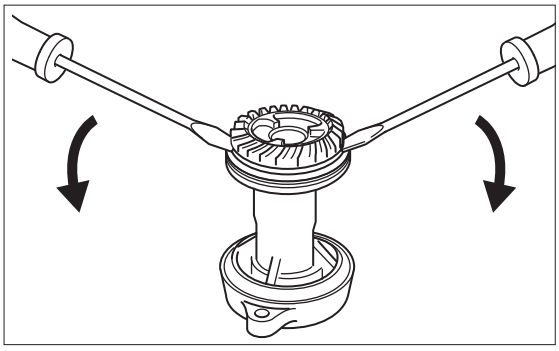


- Drive spring pin into clutch hole to depth of approximately 0.5mm from the surface.
- After setting spring pin, check operations of clutch.

Spring Pin Tool A (ø3.5) :
P/N. 369-72227-0
Spring Pin Tool B (ø3.5) :
P/N. 369-72228-0

17) Disassembly of Propeller Shaft Housing

1. Remove reverse gear (C gear) ass'y by putting two bladed screw drivers into the gap to force the gap to open.

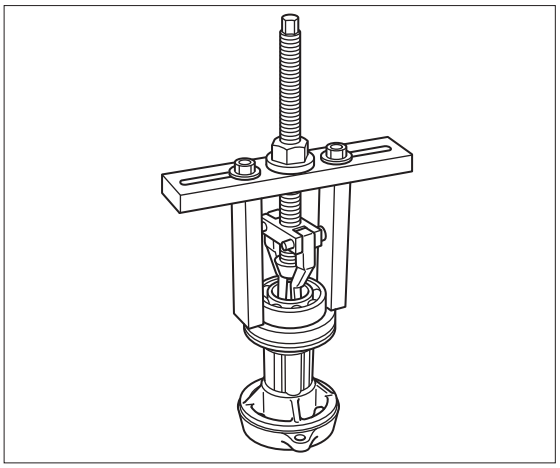


2. Use commercially available universal puller plate to remove ball bearing.

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

⚠ CAUTION

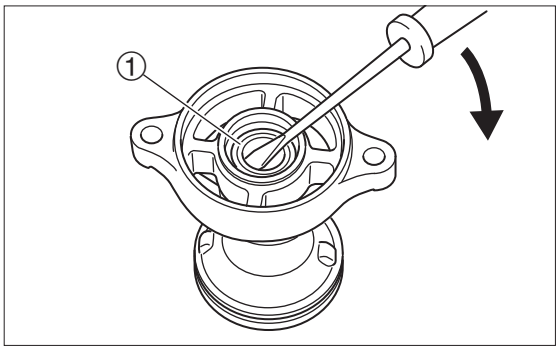
Do not reuse removed bearing.



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

⚠ CAUTION

Do-not-reuse-removed-oil-seal.



① Oil seal **Do not reuse.**

18) Inspection of Propeller Shaft Housing

1. Use cleaning oil and cleaning brush to clean propeller shaft housing, and check it for crack or damage. Replace if necessary.

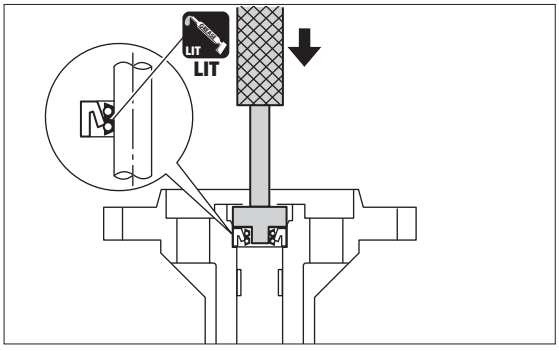
2. Check reverse (C) gear teeth and clutch for crack or damage. Replace if necessary.

3. When reusing bearing without removing it, check it for play or deflection. Replace if necessary.

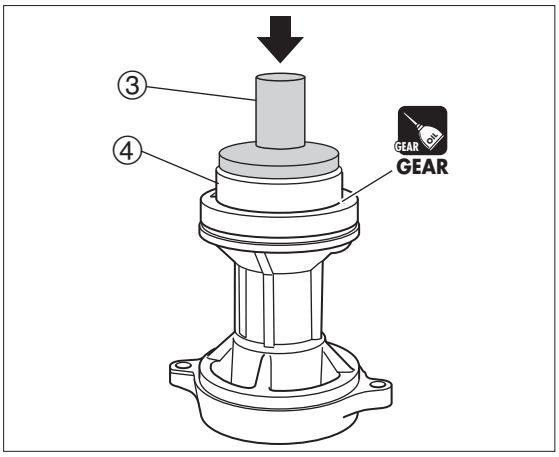
19) Assembly of Propeller Shaft Housing

1. Apply engine oil to periphery of new oil seal, and install into propeller shaft housing with number side facing upward by using proper mandrel.
   Apply lithium grease to lip of oil seal after installing it.

LIT



2. Use a press and suitable mandrel ③ to install new ball bearing ④ onto propeller shaft housing.

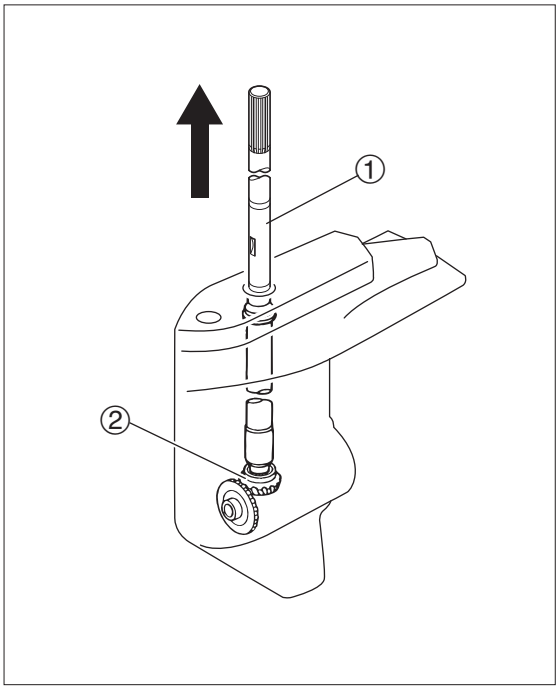


> Install ball bearing with manufacturer's marking facing attachment side.

3. Install reverse (C) gear ass'y onto propeller shaft housing.

20) Removing Drive Shaft

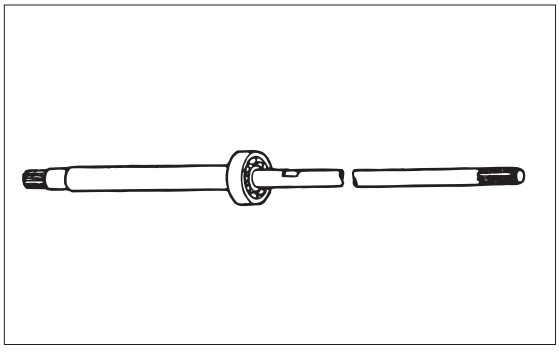
1. Remove pinion (B) gear nut, remove drive shaft ass'y ① and pinion (B) gear ②, and draw out forward (A) gear.



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

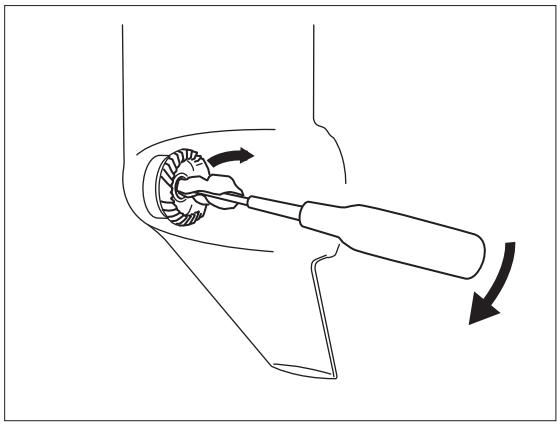
21) Inspection of Drive Shaft

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



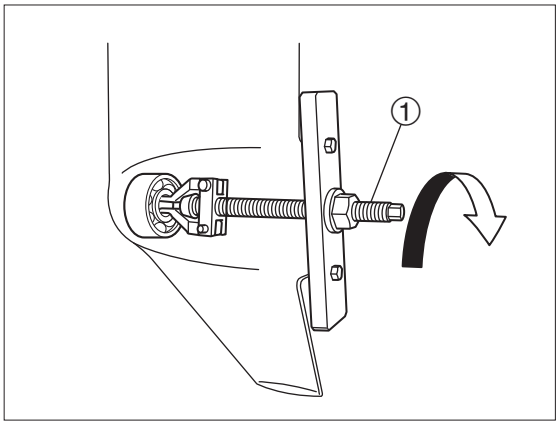
22) Removing forward (A) gear and bearing

1. Pull out forward (A) gear by using bladed screw driver with the tip covered with rag and putting it on inner surface of forward (A) gear bushing.



- When removing forward (A) gear, be careful not to give damage to shim placed between gear and ball bearing and not to lose the part.
- Replace shim with new one of the same thickness if any deformation or damage is found on it.

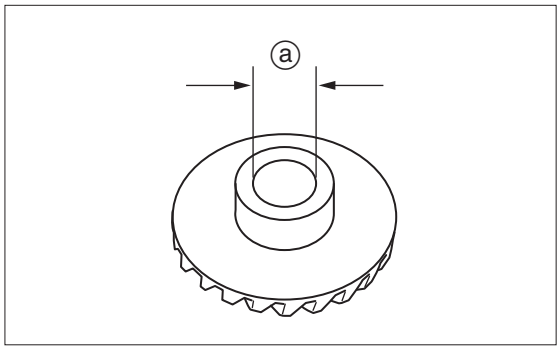
2. Use commercially available bearing puller ① to remove forward (A) gear from gear case.



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

1. Check pinion (B) gear and forward (A) gear teeth and clutch for crack and wear. Replace if necessary.

2. Measure forward (A) gear bushing inner diameter ⓐ. If worn severely, replace gear with new one.



Forward (A) gear bushing inner diameter ⓐ:
Standard value
16.013 - 16.077 mm (0.6304 - 0.6332 in)

3. When replacing shims placed between gear and ball bearing, measure thickness of original shims and use shims with the same thickness.

Sizes of Adjusting Shims :
Shims for forward (A) gear: 0.1 and 0.15mm
Since the shims are for canceling machining error, use the ones with thickness of original parts.

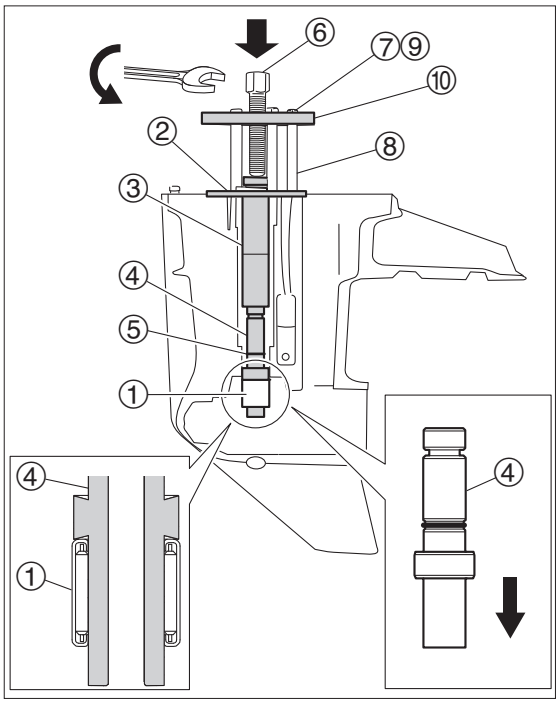
24) Disassembly of Gear Case

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

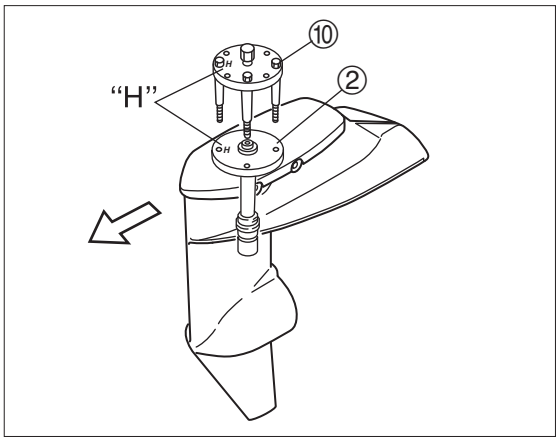
Needle bearing press Ass'y :
P/N. 3AC-72900-1
Bearing outer press guide ② :
Needle Bearing Press Rod ③ :
Needle Bearing Press ④ :
O ring ⑤ :
Needle Bearing Press Bolt ⑥ :
Bolt M8-110 ⑦ :
Collar ⑧ :
Washer ⑨ :
Needle Bearing Press Flange ⑩ :

⚠ CAUTION

When installing guide ② and flange ⑩, face "H" mark forward direction.

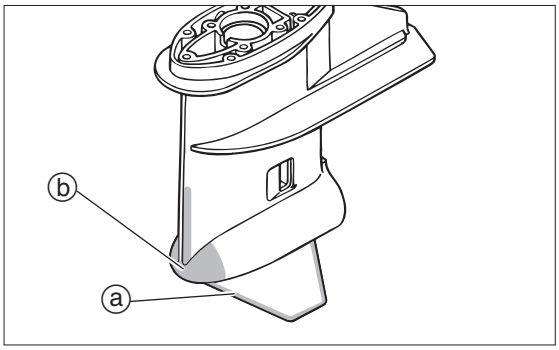


① Needle Bearing



25) Inspection of Gear Case

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



26) Assembly of Gear Case

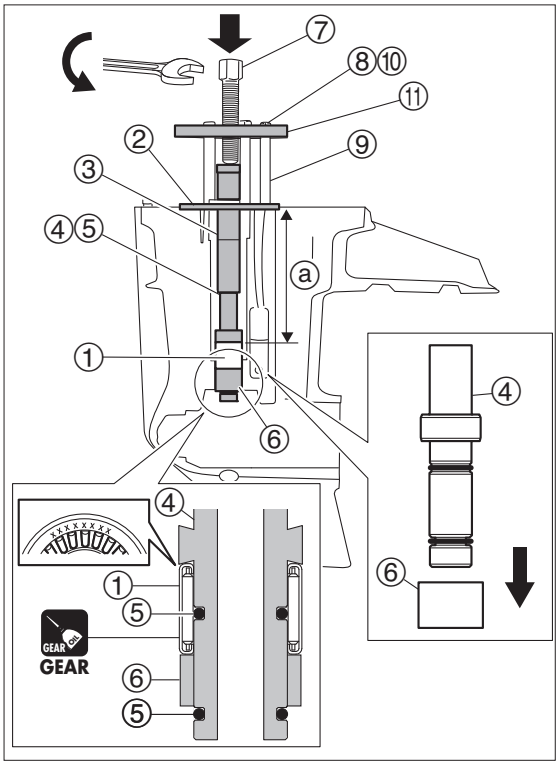
Perform shim adjustment when ball bearing, gear, drive shaft, propeller shaft or gear case is replaced.

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

Needle Bearing Press Ass'y :
P/N. 3AC-72900-1
Bearing Outer Press Guide ② :
Needle Bearing Press Rod ③ :
Needle Bearing Press ④ :
O ring ⑤ :
Needle Bearing Press Guide ⑥ :
Needle Bearing Press Bolt ⑦ :
Bolt M8-110 ⑧ :
Collar ⑨ :
Washer ⑩ :
Needle Bearing Press Flange ⑪ :

⚠ CAUTION

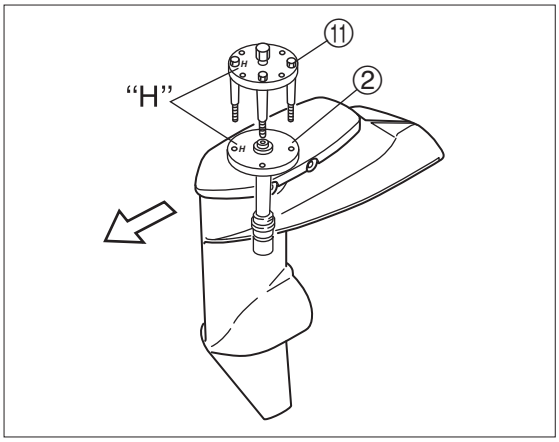
- **When installing guide ② and flange ⑪, face "H" mark forward direction.**
- **Install bearing so that marked side faces upward.**



① Needle bearing **Do not reuse.**

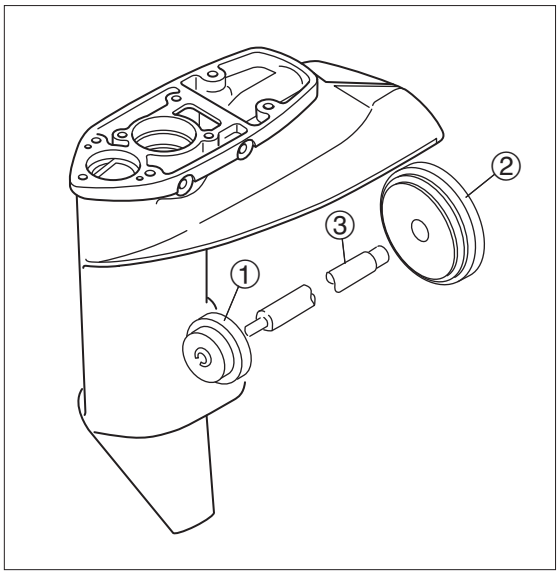
- Before installing needle bearing, be sure to clean bearing installation face and apply gear oil.
- Do not reuse needle bearing. Use new item.

Push In Depth ⓐ (Reference) :
189.75 ±0.3 mm (7.4705±0.0118 in)



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

Bearing Outer Press Kit :
P/N. 3B7-72739-1
Bearing Outer Press Plate ① :
Bearing Outer Press Guide ② :
Bearing Outer Press Rod ③ :

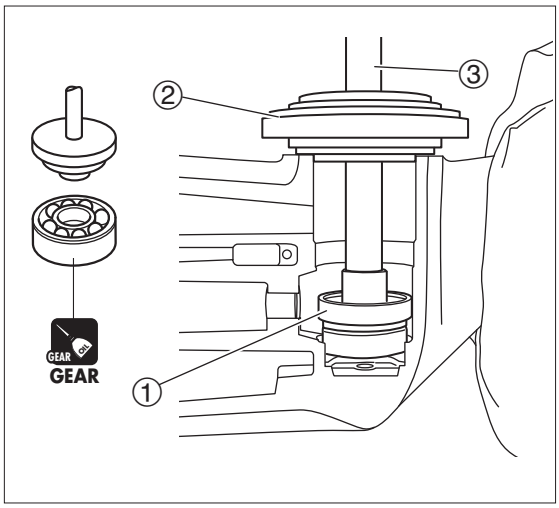


3. Fix gear case on the vice with its propeller shaft opening facing upward.

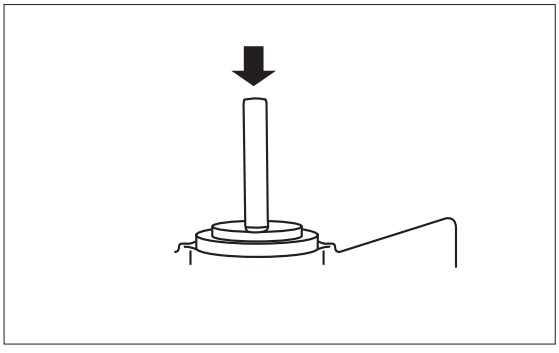
4. Clean outer race installation face in the gear case and apply gear oil.

Gear OIL

5. 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.



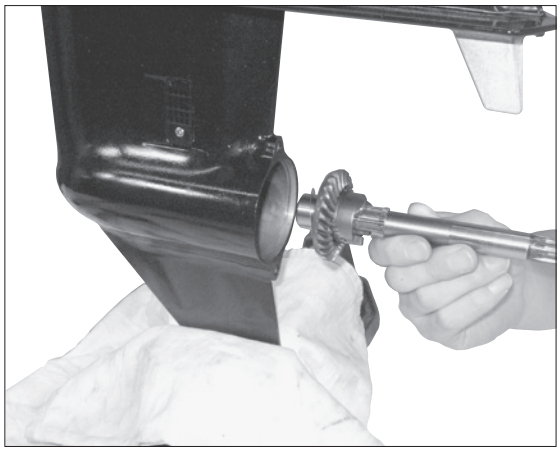
6. Use press to press fit ball bearing fully into housing.



6

27) Installation of Forward (A) Gear

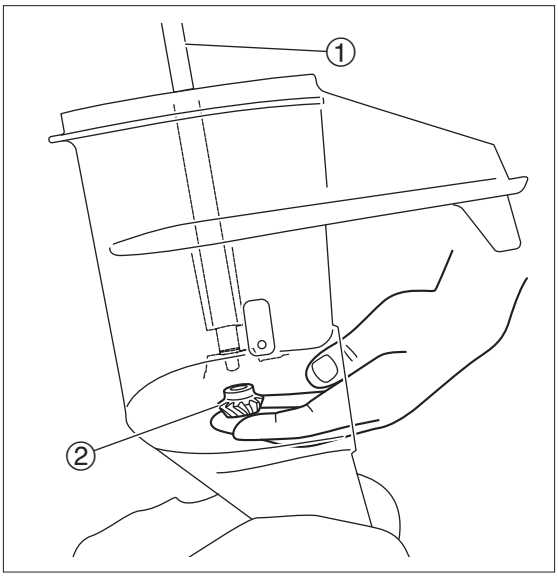
1. Put forward (A) gear and shims into gear case by using propeller shaft, and install them onto ball bearing.



28) Installation of Pinion (B) Gear

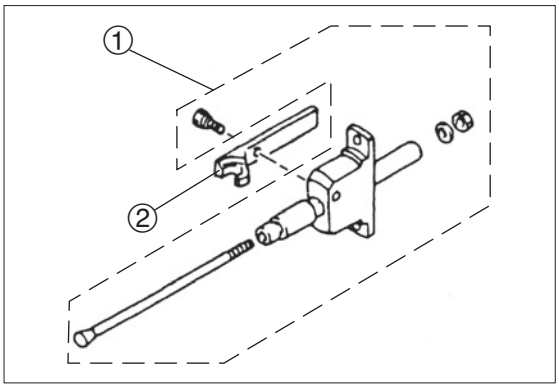
1. Install pinion (B) gear while lifting up drive shaft ass'y ① a little.

> Tilting gear case a little makes installation of pinion (B) gear easier.



29) Measurement of pinion (B) gear backlash and selection of shims

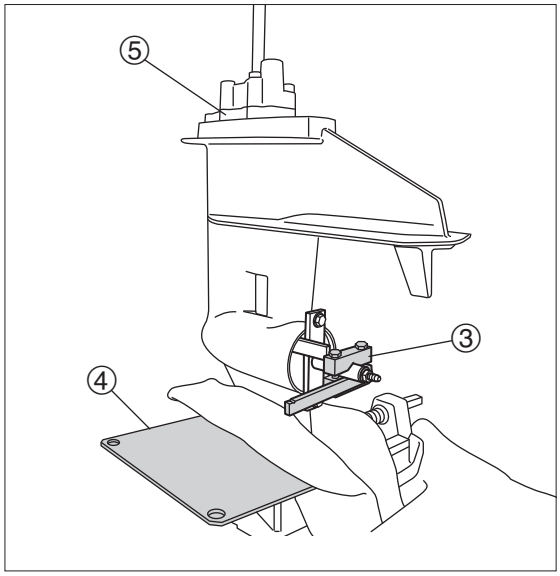
Backlash Measuring Tool Kit :
P/N. 369-72740-0
Backlash Measuring Tool Ass'y ① :
Measuring Tool Set Piece ② :
Backlash Measuring Tool
Clamp A ③ :
P/N. 3B7-72720-0
Dial Gauge Plate ④ :
P/N. 3B7-72729-0

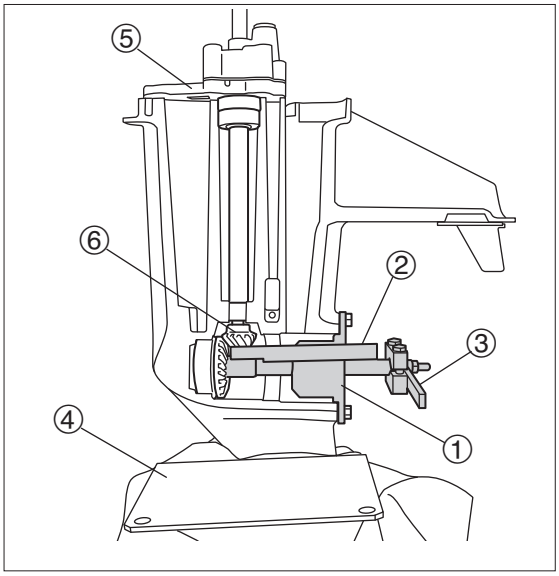


⑤ Pump Case (Lower)
⑥ Pinion (B) Gear

1. Install pump case to gear case, and assemble backlash measuring tool as illustrated.

- Fix gear case with vice.
- Clean drive shaft with new rag before assembling the tool.
- Assemble all parts of pump case except impeller and key, and tighten to specified torque.
- Perform measurement of backlash between forward (A) gear and pinion (B) gear with propeller shaft housing, propeller shaft and reverse (C) gear removed from gear case.

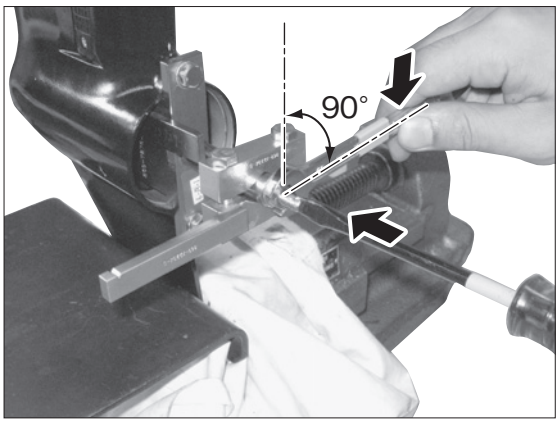




6

2. First, pull up drive shaft by using hand.
Fix shaft B with bladed screw driver, and tighten nut while pushing the shaft. At this time, be careful not to overtighten the nut, or shaft B is locked.

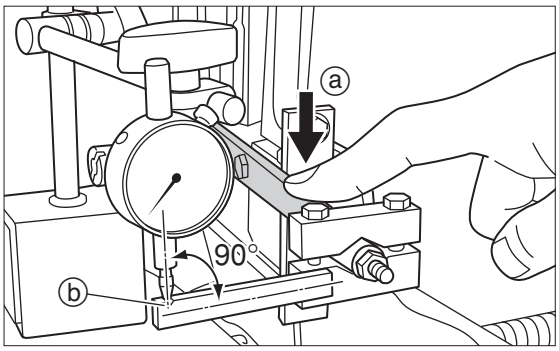
Tighten nut fully by using fingers, and then, additionally tighten approximately 90 degrees by using spanner wrench. During the work, fix shaft B by using bladed screw driver.



3. Secure clamp halves A and B to shaft B using bolts. Move clamp A while pushing arm in direction ⓐ, and read dial gauge at notch groove ⓑ position.

Proper Backlash Obtained from Gauge Reading :
0.14 - 0.42mm (0.0055 - 0.0165 in)

Sizes of Adjusting Shims :
For Pinion (B) Gear Side : 0.1, 0.15, 0.3mm

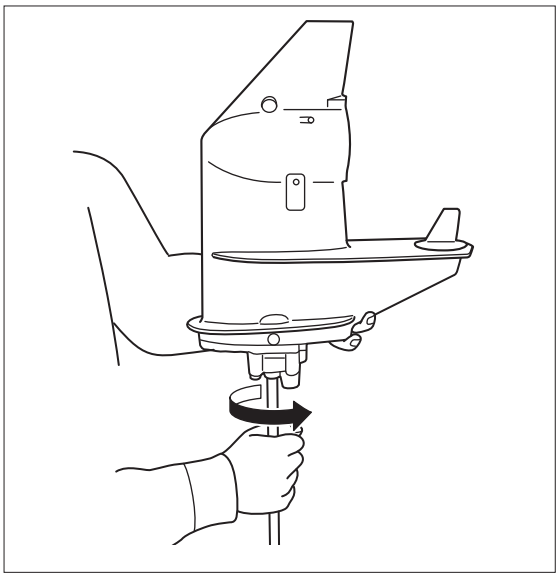


4. Perform shim adjustment at pinion (B) gear side as necessary based on the gauge value obtained. The table shows relation between dial gauge readings and shim adjustments.

1.Values in this table indicate dial gauge readings that are obtained when using special tool.
2.Change gear engagement position and measure backlash again for check.

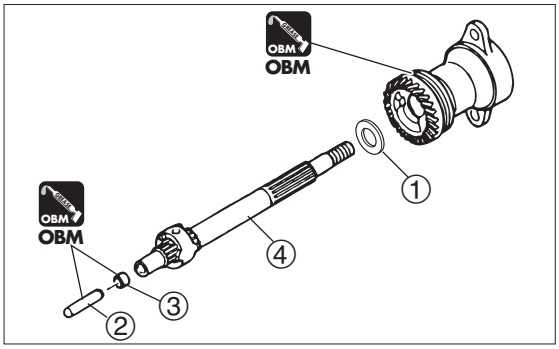
Gauge Reading mm	Shim Adjustment mm
0.00 ~ 0.02	-0.15
0.03 ~ 0.13	-0.10
0.14 ~ 0.42	0
0.43 ~ 0.47	+0.25
0.48 ~ 0.52	+0.30
0.53 ~ 0.58	+0.35
0.59 ~ 0.64	+0.40
0.65 ~ 0.69	+0.45
0.70 ~ 0.75	+0.50

5. After adjustment, remove backlash measuring tool, turn gear case upside down, and check that drive shaft can be turned by hand smoothly.
   If not, reduce shim thickness 0.05mm and adjust backlash again.

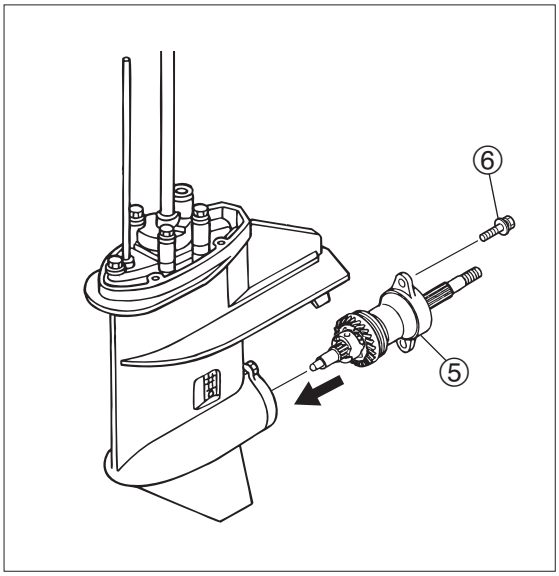


- When removing backlash measuring tool, loosen nut, and remove from forward (A) gear bearing while tapping shaft lightly with plastic hammer.
- If engagement of bevel (A) gear with pinion (B) gear is imperfect, they may produce abnormal noise when turning drive shaft. In such case, reduce shim thickness 0.05mm.

30) Assembly of Propeller Shaft Housing



1. Check that OBM grease is applied to housing ass'y oil seal.
2. Attach washer ① and propeller shaft ass'y to propeller shaft housing ass'y.
3. Apply grease to new O-ring.
   OBM
4. Apply grease to push rod ② and spring retainer ③, and install them to propeller shaft ④.
   OBM



5. Attach propeller shaft housing ass'y ⑤ to gear case, and tighten bolts ⑥ to specified torque.

Propeller Shaft Housing Bolt ⑥ :
13 N · m (9 lb · ft) [1.3 kgf · m]

- Use grease to prevent push rod from falling out.
- When installing housing ass'y to gear case, tighten upper and lower bolts in 2 or 3 steps evenly to specified torque.

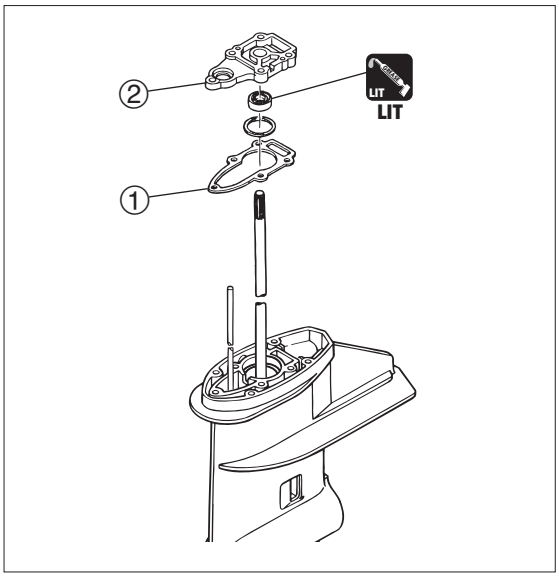
31) Reassembly of Pump Case (Lower)

1. Remove pump case (lower) and apply LITHIUM grease to oil seal.

   LIT

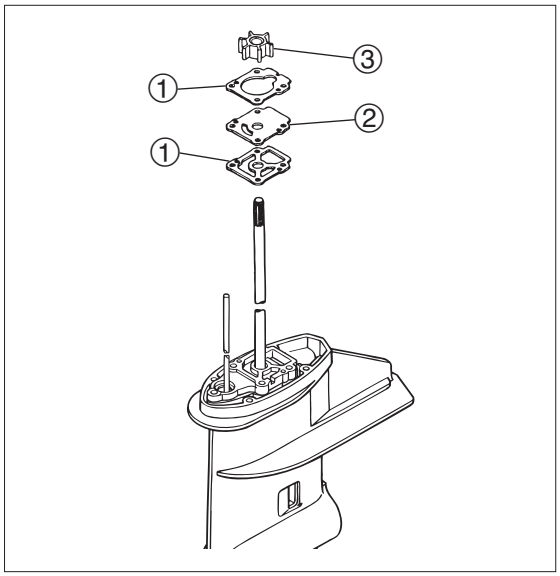
2. Attach new O-ring ① and pump case (lower) ②.

   Use new rag to clean drive shaft, before installation.



32) Assembly of Water Pump

1. Put new gasket ①, water pump guide plate ② and impeller ③.

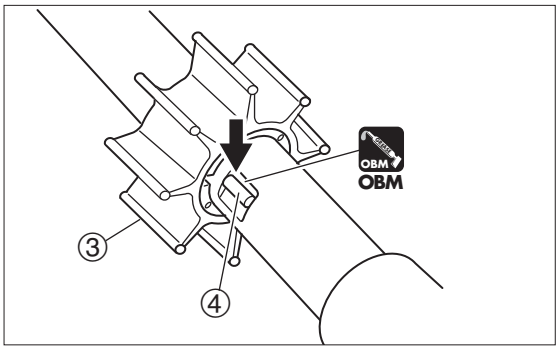


2. Apply small amount of OBM grease to recess of drive shaft, and put pin in it temporarily.

   OBM

3. Bring impeller ③ groove to pin ④ and install impeller to drive shaft.

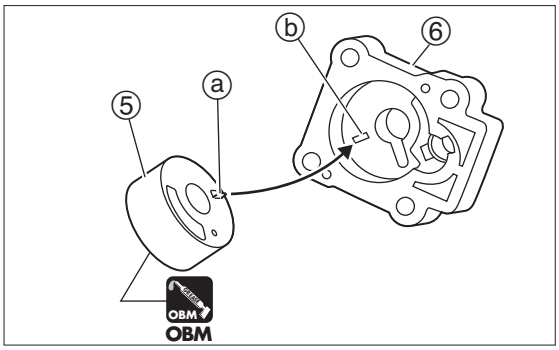
   When reusing impeller, install it so that it rotates in original direction.



4. Attach pump case liner ⑤ to pump case (upper) ⑥, and apply grease to interior of pump case liner ⑤.

Bring pump case liner projection ⓐ to pump case (upper) groove ⓑ.

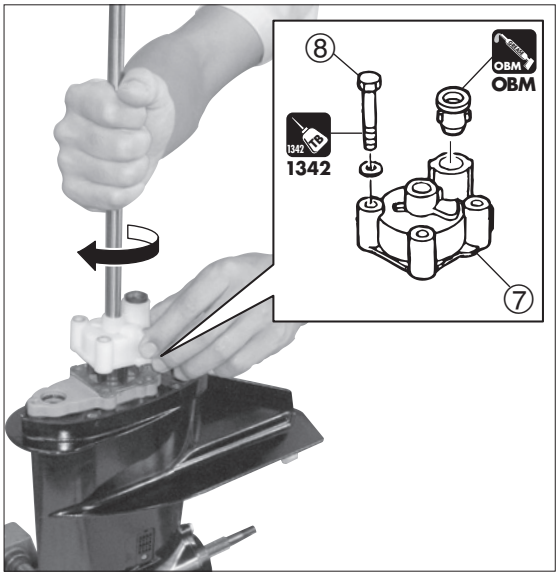
OBM



5. Install pump case (upper) ass'y ⑦ on the gear case, and tighten bolts ⑧ in two or three steps to specified torque.

Apply grease to interior of pump case liner, and install pump case (upper) by pushing it down with hand while turning drive shaft clockwise.

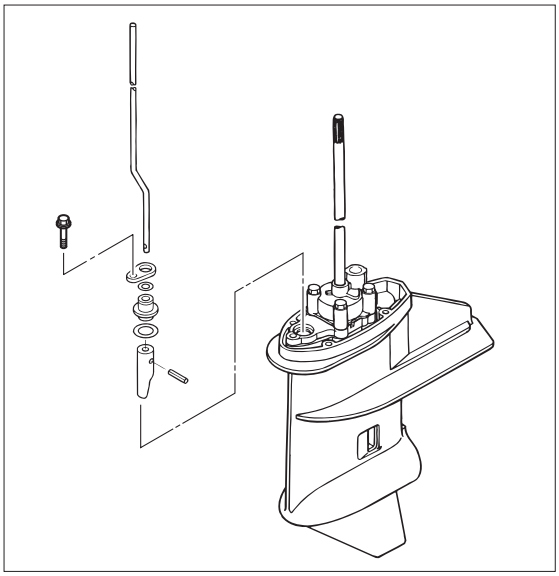
Pump Case (Upper) Bolt ⑧ :
6 N · m (4 lb · ft) [0.6 kgf · m]



6. Install cam rod ass'y ① as shown.

Cam Rod Bushing Bolt :
6 N · m (4 lb · ft) [0.6 kgf · m]

Be careful of direction of cam rod.

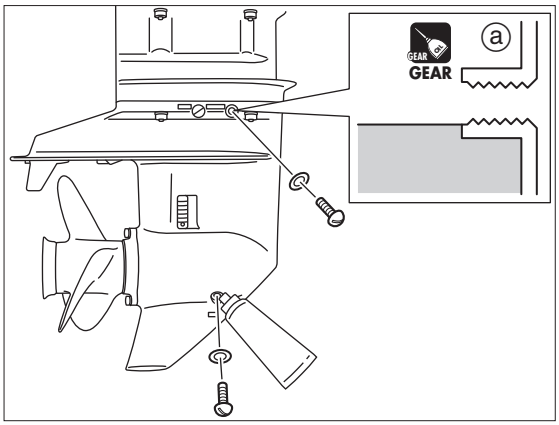


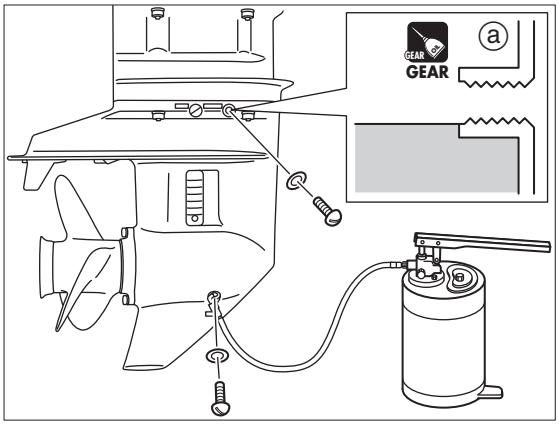
6

7. Feed gear oil to specified quantity ⓐ. "Refer to Chapter 3."

Perform "Inspection of Gear Case (Air Leakage)" in Chapter 3 if necessary.

Gear OIL



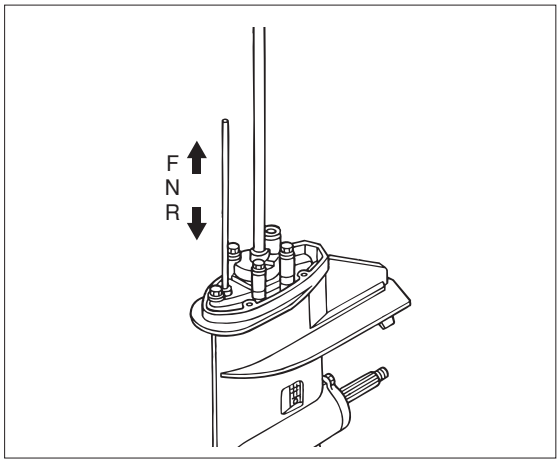


33) Installation of Lower Unit

⚠ WARNING

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

- Connect water pipe securely. Move flywheel a little or shift gear into forward (F), install propeller, and turn propeller shaft clockwise to engage spline.
- Align shift rod into connector.



1. Attach lower unit ass'y to drive shaft housing, and tighten lower unit installation bolts (nuts) ① to specified torque.

Gear Case Installation Bolt (Nut) ① :
11.5 N · m (8.5 lb · ft) [1.2 kgf · m]

TEF

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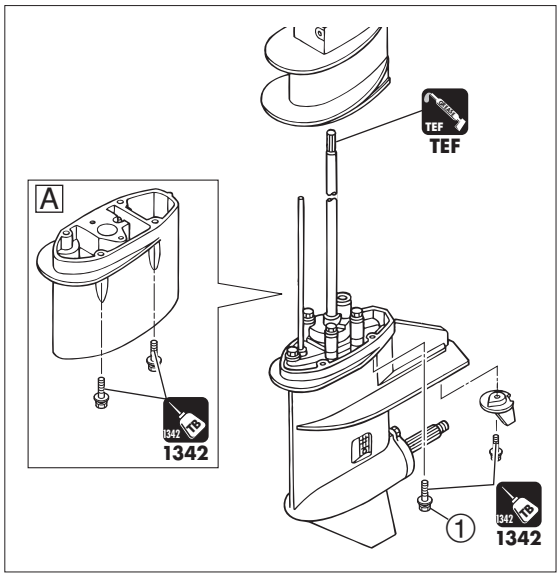
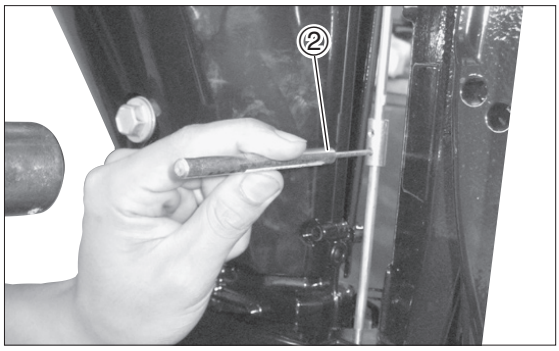


A "UL" Transom Model

2. Set both engine side and gear case side gear shifts to neutral (N).

3. Connect shift rod and cam rod with new spring pin.

Spring Pin Tool B (ø3.0) ② :
P/N. 345-72228-0

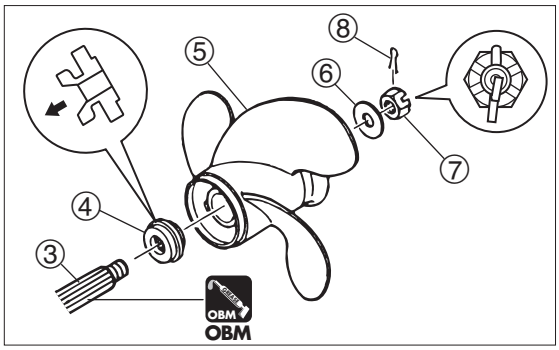


6

4. Apply OBM grease to propeller shaft ③.

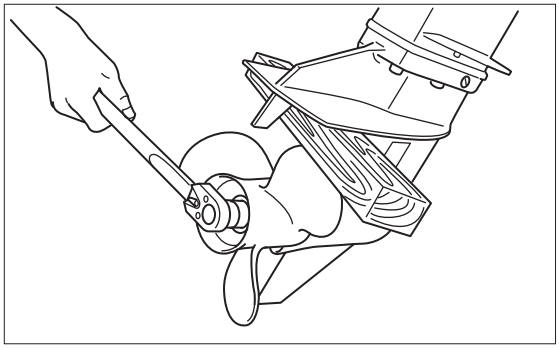
OBM

5. Attach thrust holder ④, propeller ⑤, washer ⑥ and propeller nut to propeller shaft ⑦. Put a piece of wooden block between anti-cavitation plate and propeller to prevent rotation of propeller, and tighten propeller nut to specified torque.



⚠ 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.**



6. Turn propeller nut to tightening direction to align one of grooves to propeller shaft hole, and attach split pin ⑧.

If propeller nut groove cannot be aligned with split pin hole, loosen nut and repeat steps 6 and 7.

Propeller Nut ⑦ :
12 N · m (9 lb · ft) [1.2 kgf · m]

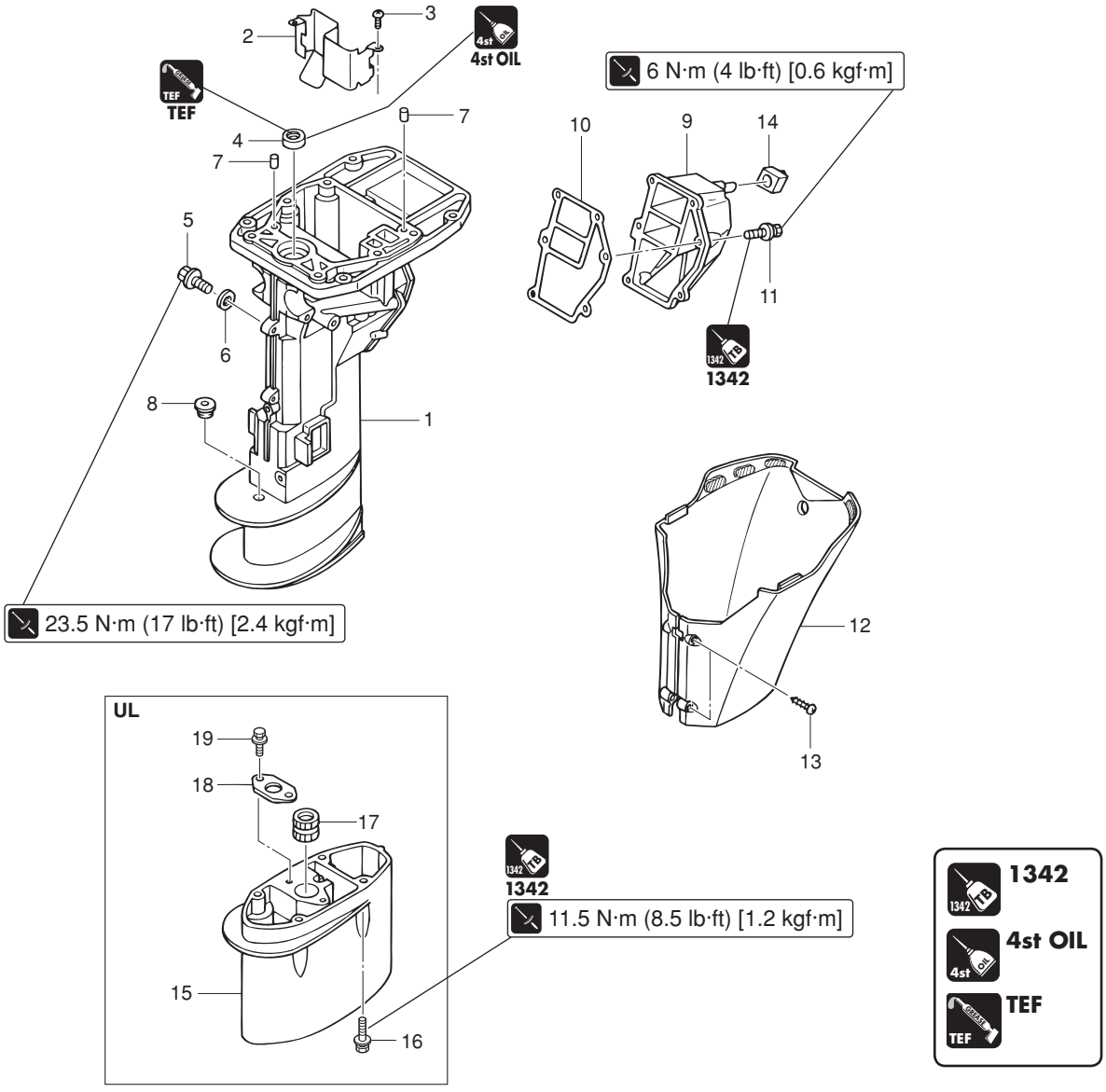
7. Check gear oil level. "Refer to Chapter 3."

Perform "Inspection of Lower Unit (Air Leakage)" in Chapter 3 if necessary.

7
Bracket

1.Parts Layout

Drive Shaft Housing



Ref. No.	Description	Q'ty	Remarks
1	Drive Shaft Housing Ass'y (S)	1	for Transom S
	Drive Shaft Housing Ass'y (L)	1	for Transom L&UL
2	Guide Plate	1	
3	Screw	2	
4	Oil Seal 12-28-5	1	Do not reuse.
5	Drain Bolt 14-14	1	
6	Washer 14.5-24-1	1	
7	Dowel Pin 6-12	2	
8	Grommet 10.7-3.5	1	
9	Idle Exhaust Port Cover	1	
10	Idle Exhaust Port Gasket	1	Do not reuse.
11	Bolt	6	
12	Apron Ass'y	1	
13	Tapping Screw 5-30	2	
14	Grommet 12.7-16.2	1	
15	Extension Housing	1	for Transom UL
16	Bolt 6-35	4	for Transom UL
17	Drive Shaft Bushing (UL)	1	for Transom UL
18	Stopper	1	for Transom UL
19	Bolt	2	for Transom UL

Clamp Bracket (For MF & EF Models)

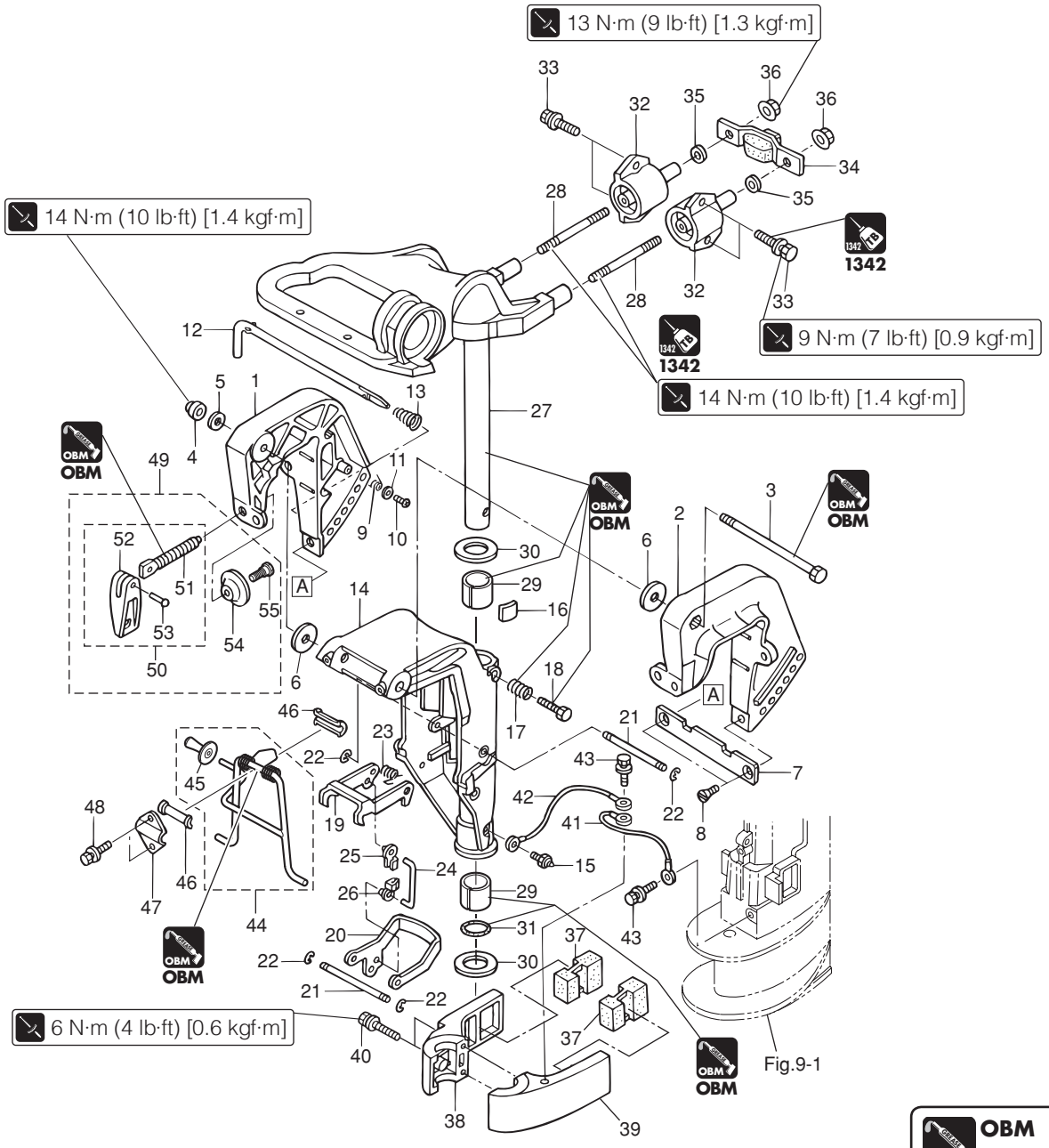


Fig.9-1

Ref. No.	Description	Q'ty	Remarks
1	Clamp Bracket (R)	1	Starboard Side
2	Clamp Bracket (L)	1	Port Side
3	Bolt 8-122	1	
4	Nylon Nut 8-P1.25	1	
5	Washer	1	
6	Washer 8.5-28-1	2	
7	Distance Plate	1	
8	Screw	2	
9	Stern Bracket Spring	1	
10	Screw	1	
11	Washer 4.3-16-1.5	1	
12	Thrust Rod	1	
13	Thrust Rod Spring	1	
14	Swivel Bracket	1	

Ref. No.	Description	Q'ty	Remarks
15	Grease Fitting	1	
16	Friction Piece	1	
17	Friction Spring	1	
18	Bolt	1	
19	Reverse Lock	1	
20	Reverse Lock Arm	1	
21	Reverse Lock Rod	2	
22	E-ring d=5	4	
23	Reverse Lock Spring	1	
24	Reverse Lock Link	1	
25	Rod Snap 5-3	1	
26	Rod Snap 4-2	1	
27	Steering Shaft Ass'y	1	
28	Stud	2	

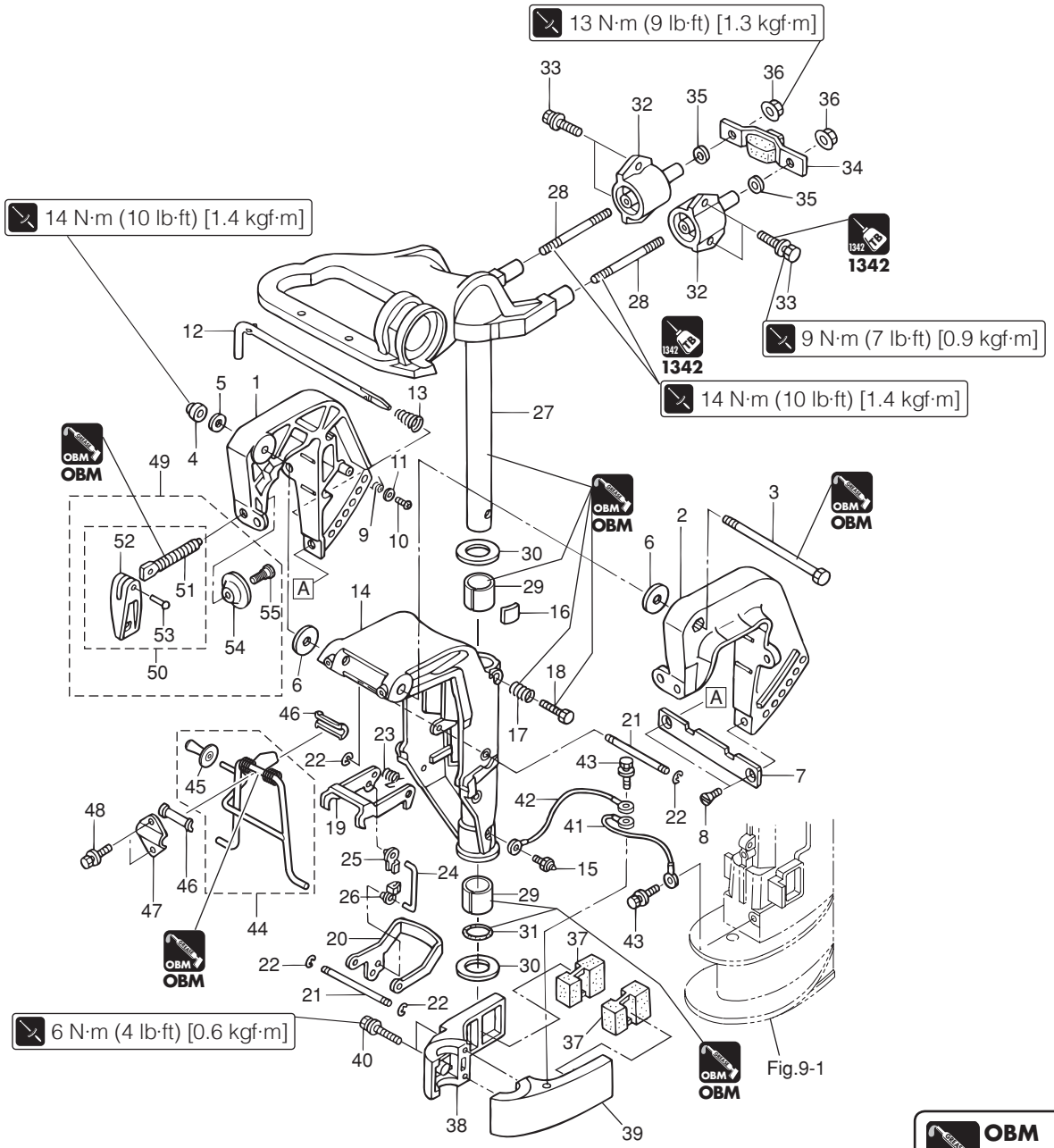
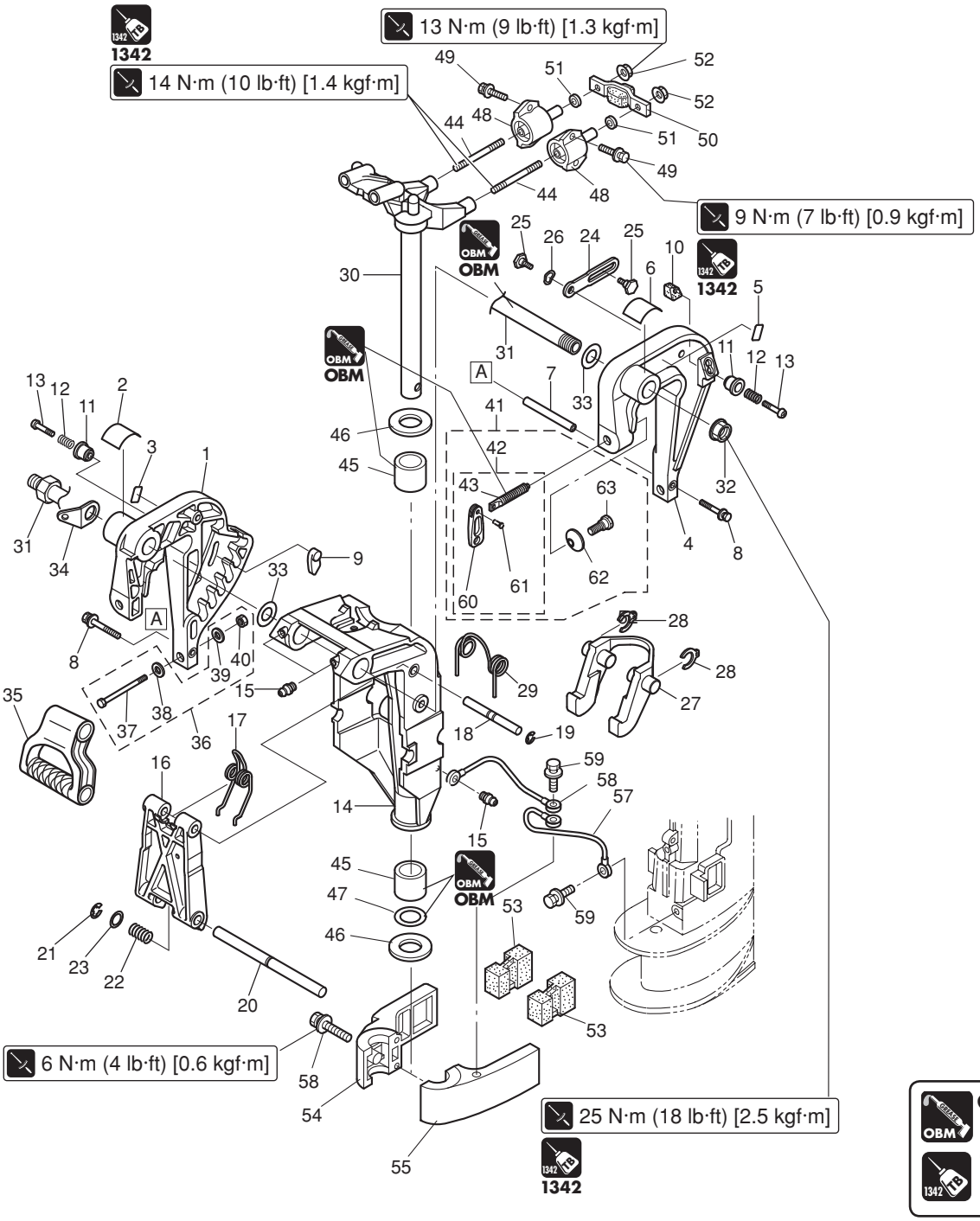


Fig.9-1

Ref. No.	Description	Q'ty	Remarks
29	Bushing 24-30-30	2	
30	Thrust Plate (Upper)	2	
31	O-ring 3.5-22	1	Do not reuse.
32	Rubber Mount (Upper)	2	
33	Bolt	4	
34	Damper (Upper)	1	
35	Washer	2	
36	Nut	2	
37	Rubber Mount (Lower)	2	
38	Mount Bracket (R)	1	Starboard Side
39	Mount Bracket (L)	1	Port Side
40	Bolt	2	
41	Ground L=110	1	Drive Shaft Housing-Mount Bracket (R)
42	Ground L=110	1	Swivel Bracket-Mount Bracket (R)

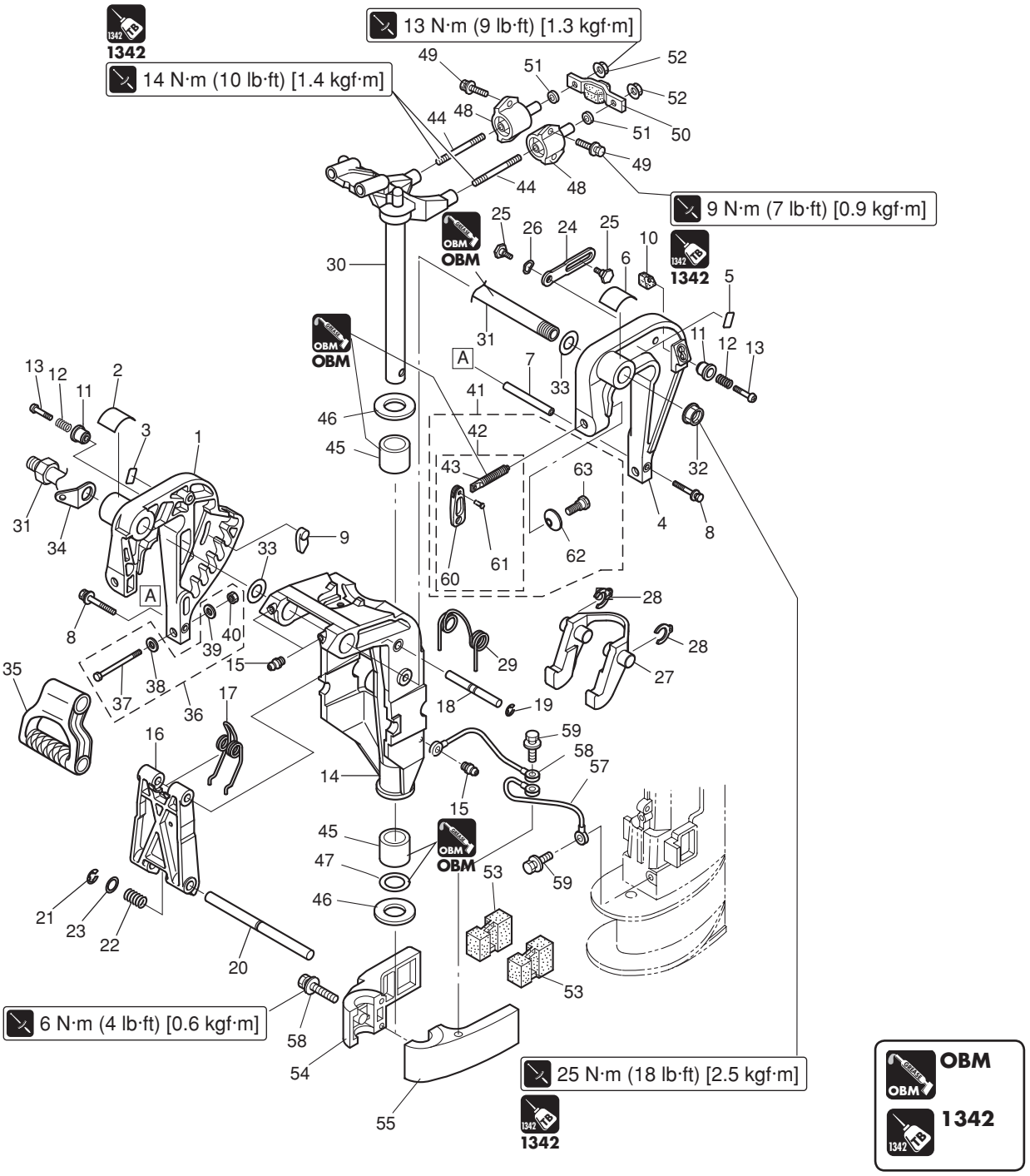
Ref. No.	Description	Q'ty	Remarks
43	Bolt	2	
44	Tilt Stopper Ass'y	1	
45	Tilt Stopper Grip	1	
46	Bushing	2	
47	Setting Plate	1	
48	Bolt	2	
49	Clamp Screw Kit	2	
50	Clamp Screw Ass'y	1	
51	Clamp Screw	1	
52	Clamp Screw Handle	1	
53	Rivet 3-22	1	
54	Clamp Screw Pad	1	
55	Shoulder Bolt	1	

Clamp Bracket (For EP Model)



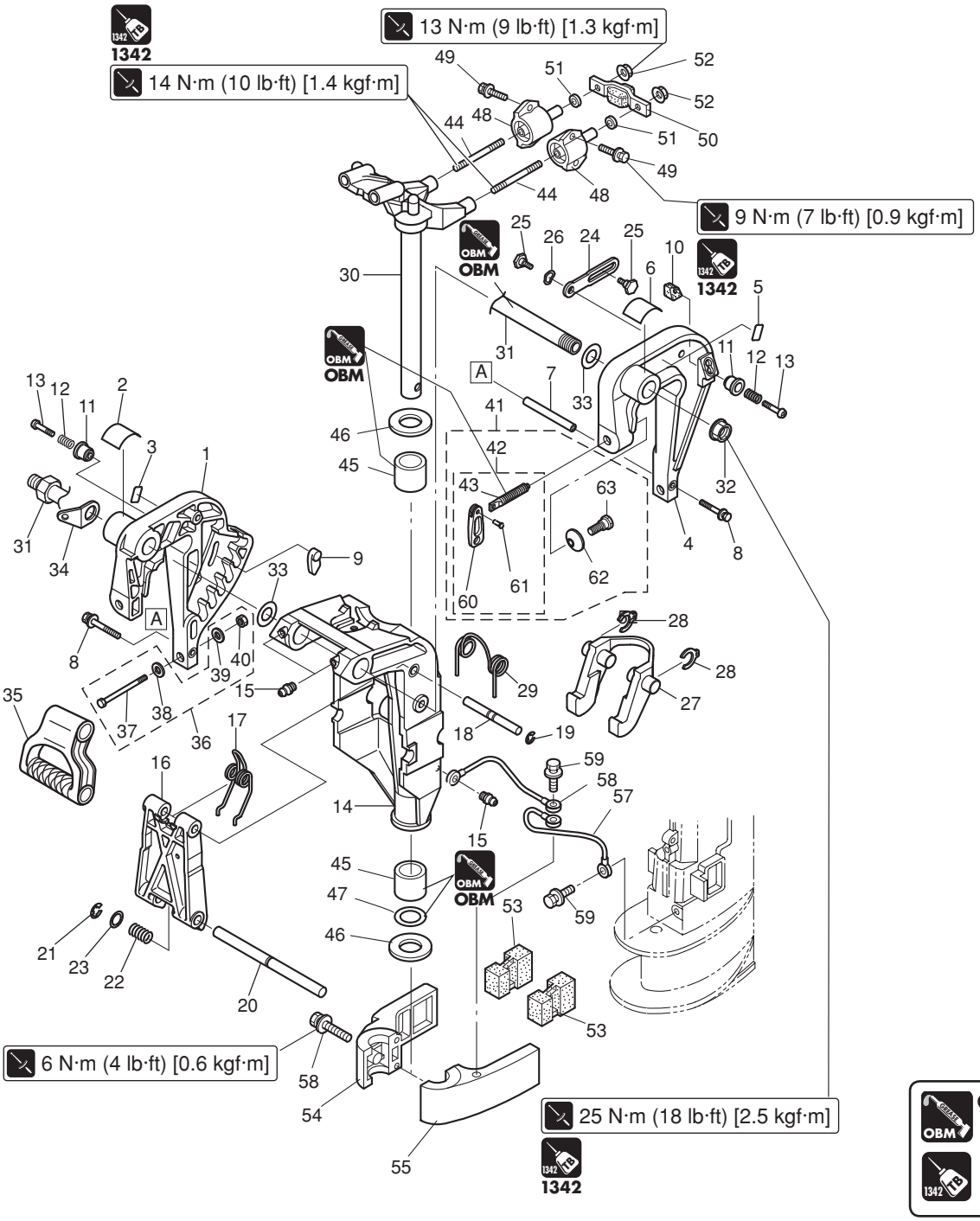
Ref. No.	Description	Q'ty	Remarks
1	Clamp Bracket (R)	1	Starboard Side
2	Trim Position Decal	1	
3	Lower Tilt Limit Decal	1	
4	Clamp Bracket (L)	1	Port Side
5	Tilt Lock Decal	1	
6	Co-pilot Decal	1	for EFT
7	Distance Piece	1	
8	Bolt	2	
9	Trim Setting Plate	1	
10	Tilt Lock Piece	1	
11	Knob	2	

Ref. No.	Description	Q'ty	Remarks
12	Spring	2	
13	Screw	2	
14	Swivel Bracket	1	
15	Grease Fitting	3	for EP & EFT/EPT
16	Tilt Stopper Body	1	
17	Spring	1	
18	Tilt Stopper Shaft (Upper)	1	
19	E-ring d=6	2	
20	Tilt Stopper Shaft (Lower)	1	
21	E-ring d=9	1	
22	Spring	1	



Ref. No.	Description	Q'ty	Remarks
23	Washer 10.5-18-1.5	1	
24	Tilt Stopper (L)	2	
25	Bolt 6-12.5-9.5-2.5	4	
26	Wave Washer d=10	2	
27	Reverse Lock	1	
28	Reverse Lock Clip	2	
29	Reverse Lock Spring	1	
30	Steering Shaft Ass'y	1	for EP & EFT/EPT
31	Swivel Bracket Shaft Ass'y	1	Bracket Bolt for EP & EFT/EPT
32	Nylon Nut 7/8-14	1	for EP & EFT/EPT
33	Washer 22-36-1	2	Nylon for EP & EFT/EPT

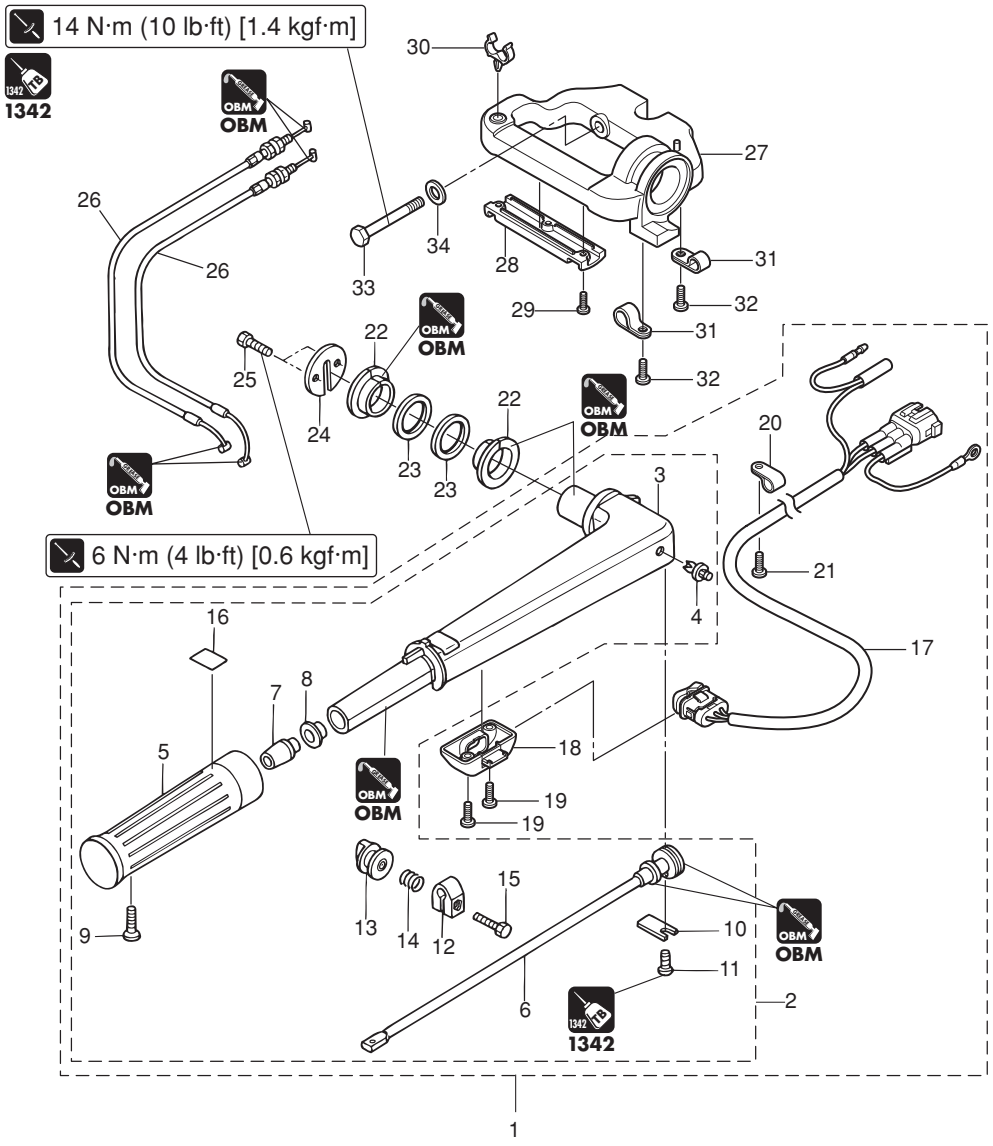
Ref. No.	Description	Q'ty	Remarks
34	Plate	1	for EP & EFT/EPT
35	Carrying Handle	1	for EP & EPT
36	Rigging Bolt Set	1	
37	Bolt	2	
38	Washer	2	
39	Washer 8.5-34-3	2	
40	Nylon Nut 8-P1.25	2	
41	Clamp Screw Kit	2	
42	Clamp Screw Ass'y	1	
43	Clamp Screw	1	
44	Stud	2	



Ref. No.	Description	Q'ty	Remarks
45	Bushing 24-30-30	2	
46	Thrust Plate (Upper)	2	
47	O-ring 3.5-22	1	Do not reuse.
48	Rubber Mount (Upper)	2	
49	Bolt	4	
50	Damper (Upper)	1	
51	Washer	2	
52	Nut	2	
53	Rubber Mount (Lower)	2	
54	Mount Bracket (R)	1	Starboard Side
55	Mount Bracket (L)	1	Port Side

Ref. No.	Description	Q'ty	Remarks
56	Bolt	2	
57	Ground L=110	1	Drive Shaft Housing-Mount Bracket (R)
58	Ground L=110	1	Swivel Bracket-Mount Bracket (R)
59	Bolt	2	
60	Clamp Screw Handle	1	
61	Rivet 3-22	1	
62	Clamp Screw Pad	1	
63	Shoulder Bolt	1	

Tiller Handle



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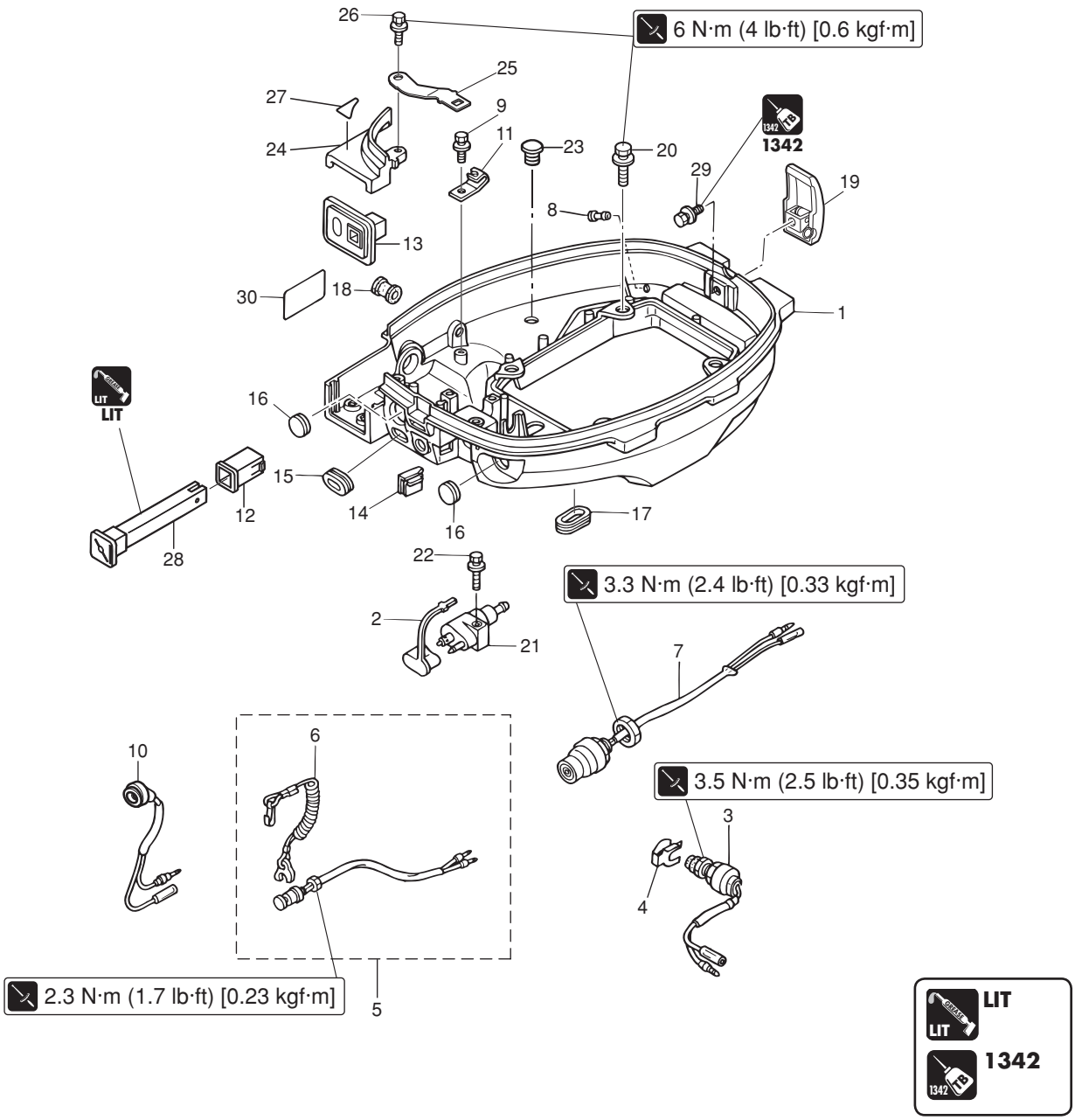
Ref. No.	Description	Q'ty	Remarks
1	Tiller Handle Ass'y	1	for EFT
2	Tiller Handle Ass'y	1	for MF/EF
3	Tiller Handle	1	
4	Plastic Rivet 6.5	1	
5	Grip	1	
6	Throttle Shaft	1	
7	Throttle Shaft Damper	1	
8	Bushing 14-15.8-7	1	
9	Screw	1	
10	Throttle Shaft Support	1	
11	Screw	1	
12	Friction Piece	1	
13	Adjusting Nut	1	
14	Spring	1	
15	Bolt	1	
16	Throttle Decal	1	
17	PTT Switch Ass'y	1	for EFT

Ref. No.	Description	Q'ty	Remarks
18	Switch Box	1	for EFT
19	Screw	2	for EFT
20	Clamp 6-9.5L	1	for EFT
21	Screw	1	for EFT
22	Bushing	2	
23	Washer 39-52-1	2	
24	Cover	1	
25	Bolt	2	
26	Throttle Wire	2	
27	Steering Bracket	1	for EFT
28	Cord Holder	1	for EFT
29	Screw	3	for EFT
30	Cord Holder	1	for EFT
31	Clamp 6-9.5L	2	for EFT
32	Screw	2	for EFT
33	Bolt 10-80	2	for EFT
34	Washer	2	for EFT

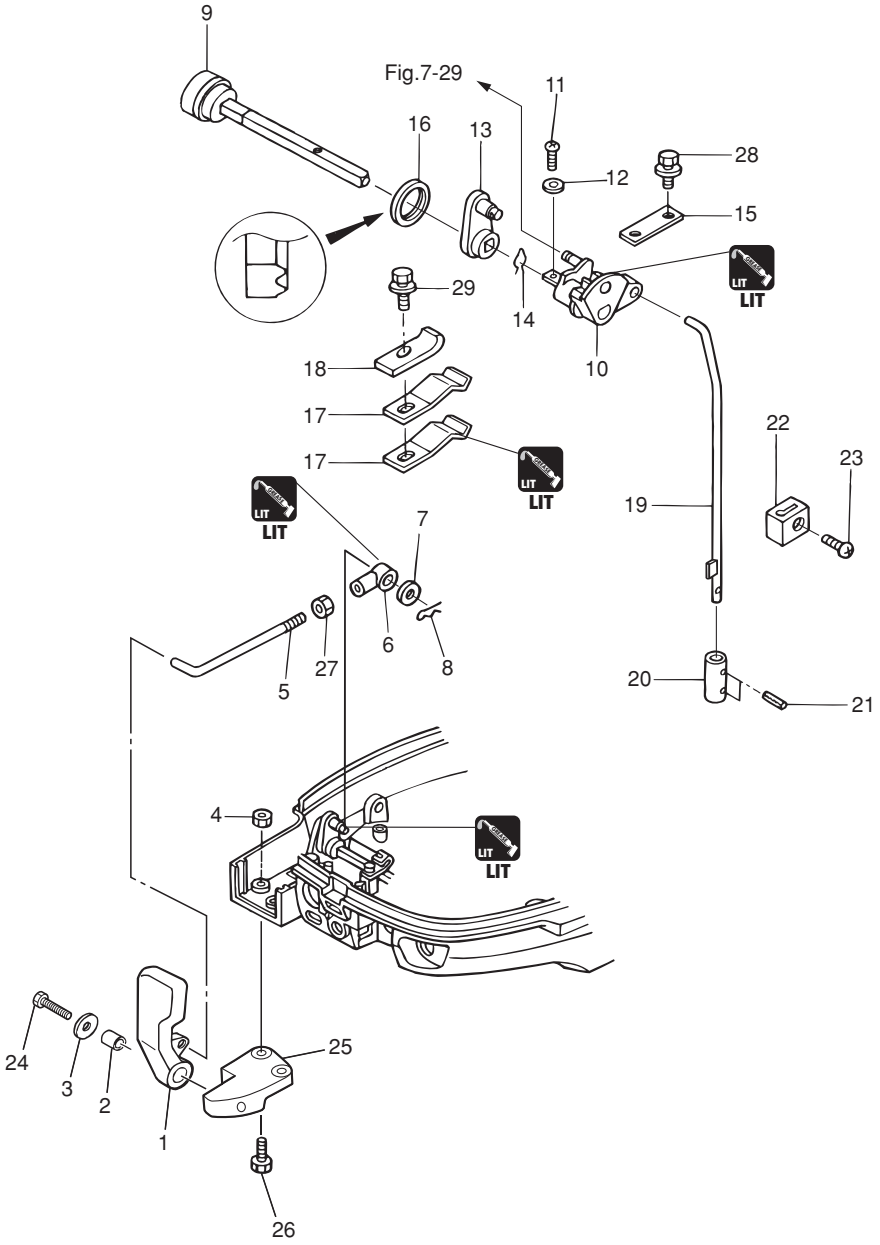
Bottom Cowl



Ref. No.	Description	Q'ty	Remarks
1	Bottom Cowl	1	
2	Fuel Connector Protector	1	
3	Neutral Switch	1	for EF/EFT
4	Neutral Switch Actuator	1	for EF/EFT
5	Stop Switch Ass'y	1	for MF & EF/EFT
6	Stop Switch Lanyard Ass'y	1	
7	Main Switch Ass'y	1	for EF/EFT
8	Nipple 6.8-3-10	1	
9	Bolt	2	for MF Clamp, Cable Bracket
	Bolt	1	for EF/EFT & EP/EPT Cable Bracket
10	Pilot Lamp Ass'y	1	
11	Starter Lock Cable Bracket	1	
12	Bushing	1	for MF & EF/EFT
13	Grommet	1	for MF & EF/EFT
14	Grommet	1	Throttle Cable
15	Grommet 25-15-3	1	Battery Cable
16-1	Grommet 17-2.7	1	Main Swich for MF

Ref. No.	Description	Q'ty	Remarks
16-2	Grommet 17-2.7	2	Main Swich, Stop Swich for EP/EPT
17	Grommet 40-18-3	2	Shift Rod PTT Cord
18	Grommet 16-17.5	1	for MF & EF/EFT Throttle Shaft
19	Cowl Latch Ass'y	1	
20	Bolt	4	
21	Fuel Connector (Male)	1	
22	Bolt	1	
23	Sub-water Inlet Hose Plug	1	
24	Shift Lever Bracket Cover	1	
25	Stay	1	for EFT/EPT
26	Bolt	1	
27	Shift Decal	1	for MF & EF/EFT
28	Choke Rod	1	for MF & EF/EFT
29	Bolt	1	
30	Storage Decal	1	

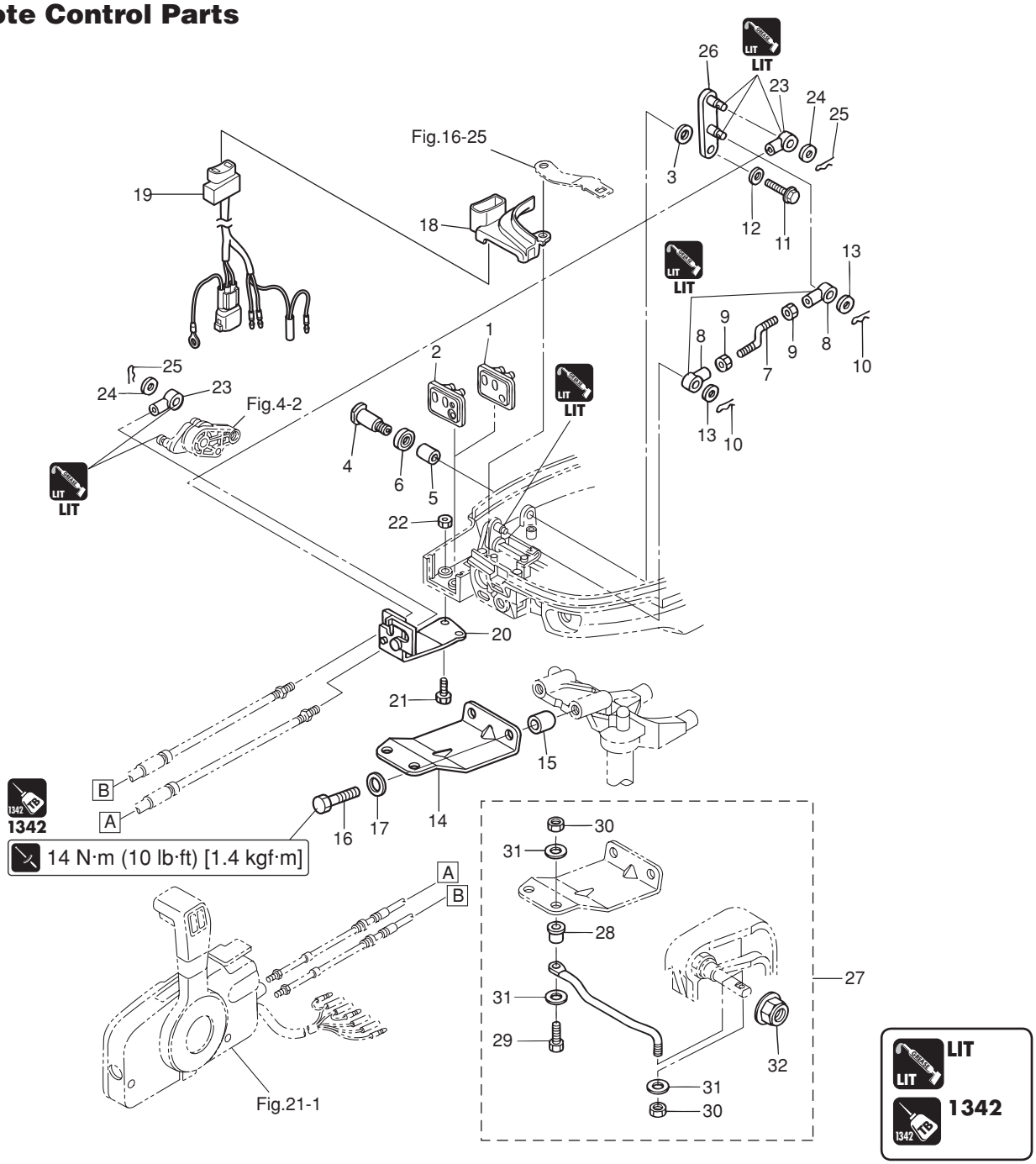
Shift



Ref. No.	Description	Q'ty	Remarks
1	Shift Lever	1	
2	Collar 6.5-10.5-10	1	
3	Washer 6.5-21-1	1	
4	Nut	2	
5	Shift Lever Rod	1	
6	Cable Joint 4.5-40.5	1	Rod End
7	Washer 8.5-18-1.6	1	
8	Snap Pin d=8	1	Rod End
9	Shift Lever Shaft	1	
10	Shift Rod Lever	1	
11	Screw	1	
12	Washer	1	
13	Shift Lever (Remote Control)	1	
14	Snap Retainer d=8	1	
15	Holder	1	

Ref. No.	Description	Q'ty	Remarks
16	Seal Ring 23-29-3.7	1	
17	Shift Lever Stopper t=0.5	2	
18	Shift Lever Stopper t=0.8	1	
19	Shift Rod	1	
20	Shift Rod Joint	1	
21	Spring Pin 3-10	2	Do not reuse.
22	Reverse Lock Link Joint	1	
23	Screw	1	
24	Bolt	1	
25	Shift Lever Bracket	1	
26	Bolt	2	
27	Nut	1	
28	Bolt	2	Holder
29	Bolt	1	Shift Lever Stopper

Remote Control Parts



Ref. No.	Description	Q'ty	Remarks
1	Grommet	1	for EP
2	Grommet	1	for EPT
3	Wave Washer d=14	1	
4	Pivot	1	
5	Hook Lever Bushing	1	
6	Seal Ring 13.8-22-3.7	1	
7	Shift Lever Rod	1	
8	Cable Joint 4.5-40.5	2	Rod End
9	Nut	2	
10	Snap Pin d=8	2	Rod End
11	Bolt	1	
12	Washer 6.5-21-1	1	
13	Washer 8.5-18-1.6	2	Rod End
14	Steering Hook Plate	1	
15	Collar 10.1-20-15	2	
16	Bolt	2	

Ref. No.	Description	Q'ty	Remarks
17	Washer	2	
18	Remote Cont Cable Stay Cover	1	
19	Ptt Switch Ass'y	1	
20	Cable Clip Ass'y	1	
21	Bolt	2	
22	Nut	2	
23	Cable Joint	2	Cable End
24	Washer 8.5-18-1.6	2	Cable End
25	Snap Pin d=8	2	Cable End
26	Shift Arm (Remote Control)	1	Mark 3V2
27	Drag Link Ass'y	1	for EP
28	Spacer 9.6-19-13	1	
29	Bolt 3/8-35	1	
30	Nylon Nut 3/8-24UNF	2	
31	Washer 9.6-18-2	3	
32	Seal Ring	1	

2. Inspection Items

1) Inspection of Throttle Cable

1. Check operation of throttle cable.

2. Check throttle cable inner wire and outer wire for bend and damage. Replace if necessary.

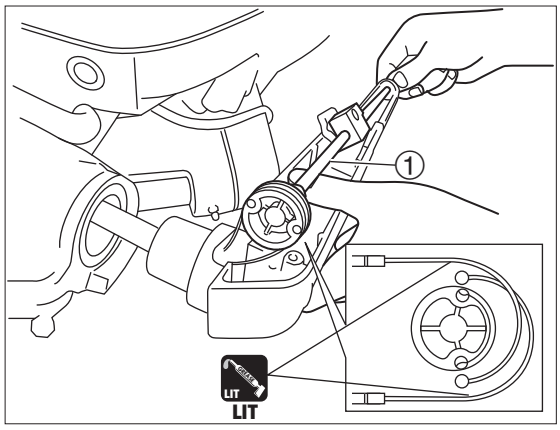
2) Installation of Tiller Handle

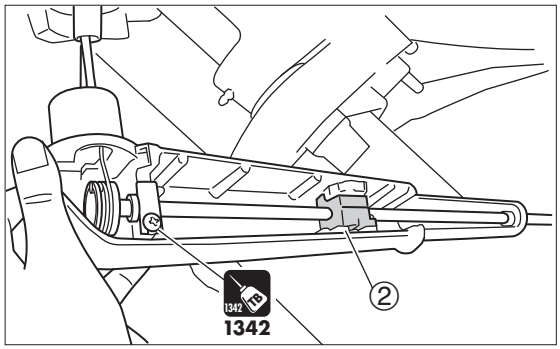
1. Attach cables to throttle shaft ① as shown.

   OBM

2. Install throttle shaft ① with cable to Tiller handle. Be careful of location of throttle friction ②.

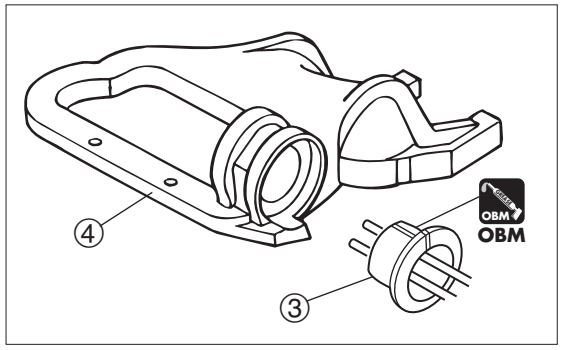
   1342





3. Install bushing ③ on the steering bracket ④.

   OBM

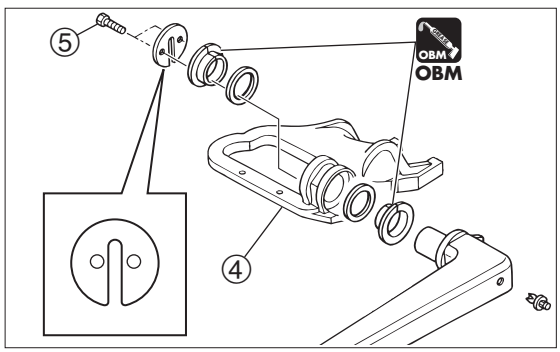


4. Attach Tiller handle ass'y to steering bracket ④, and tighten nut ⑤ to specified torque.

   Arrange throttle cable as shown.

   Tiller Handle Bolt ⑤ :
   6 N · m (4 lb · ft) [0.6 kgf · m]

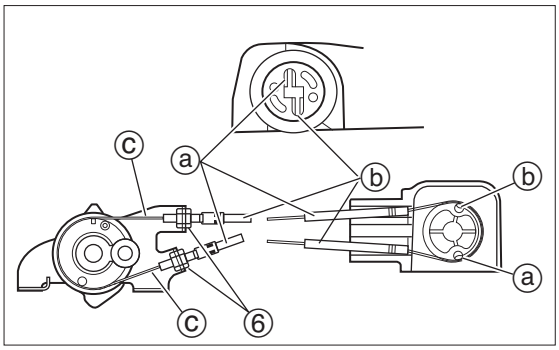
   OBM



5. Install cable ⓑ of which inner wire is stretched when acceleration grip is set to full close position.

6. Then, install another cable ⓐ (of which inner wire is stretched when acceleration grip is set to full open position.

7. Adjust position of lock nuts ⑥ of throttle cable so that throttle grip can reach full open and full close positions.



Adjust cable tension so that it moves approximately 1mm when pushed lightly with a finger.

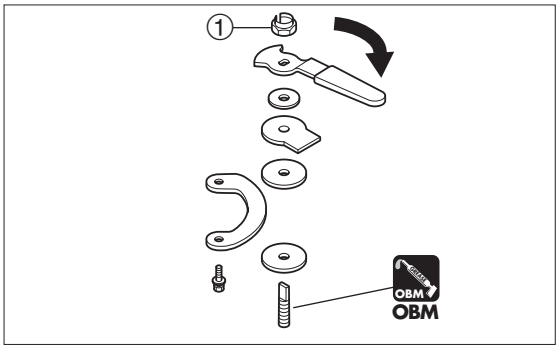
3) Adjustment of Co-pilot Plate

1. Install co-pilot plate.

OBM

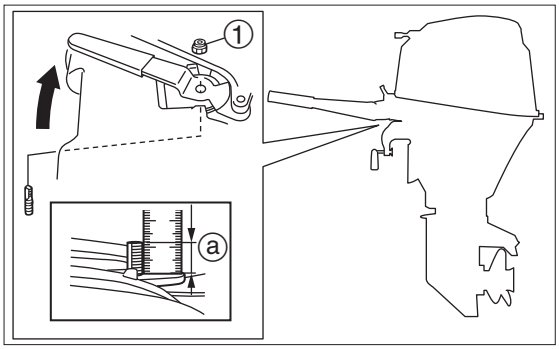
2. Move co-pilot handle to left to slide it to tightening position.

3. Tighten nylon nut ① until steering load becomes heavy.



Tighten nylon nut ① to approximately 6 N · m (4 lb · ft) [0.6 kgf · m] and check steering load.

4. Move co-pilot handle to the right to slide it to release position, and check that steering can be made lightly. If not, repeat steps 2. to 4. to finely adjust.



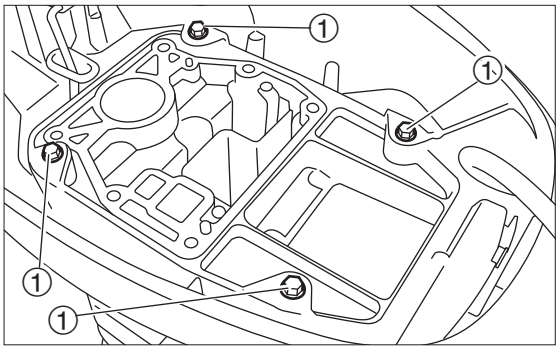
To prevent nylon nut from falling, tighten stud bolt until more than 13–14 mm ⓐ can be seen above top plate.

7

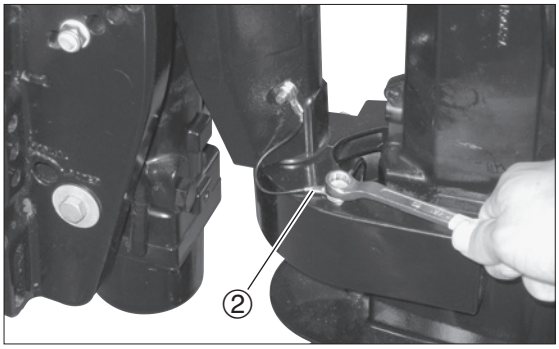
4) Removing Drive Shaft Housing

1. Drain engine oil by referring to “Removing Power Unit” in Chapter 5, and then, remove power unit.

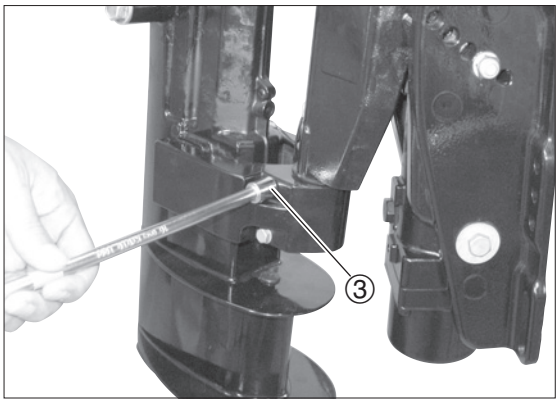
2. Loosen four bolts ① and remove bottom cowl from drive shaft housing.



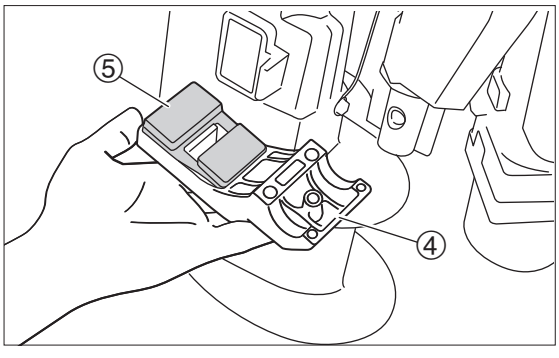
3. Remove ground wires ②.



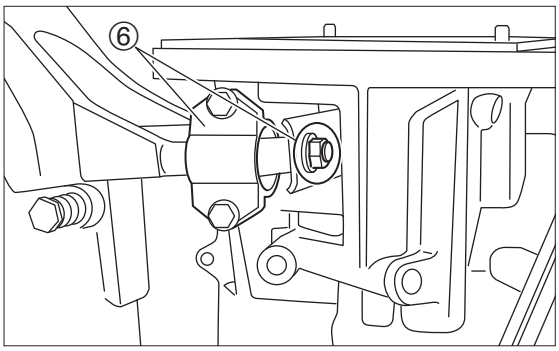
4. Remove bolts and nuts ③ lower mount bracket.



5. Check that damper ④ and rubber mount ⑤ are normal. Replace if abnormal.

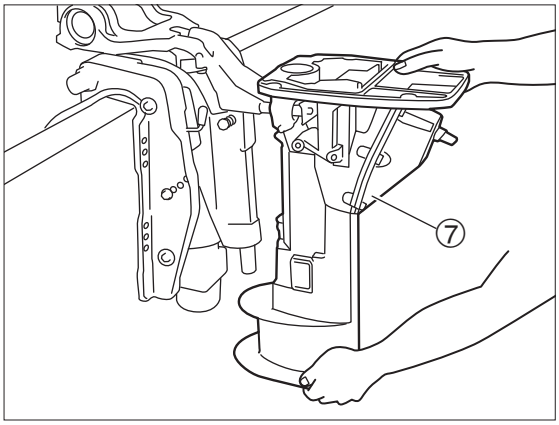


6. Remove nuts of upper rubber mount ⑥.



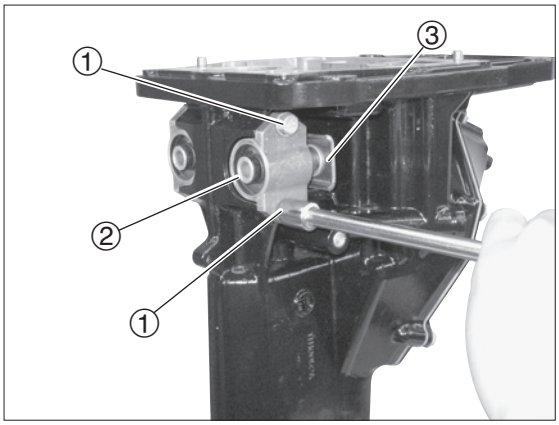
7. Remove drive shaft housing ⑦ from clamp bracket ass'y.

> Be careful not to drop drive shaft housing when removing the housing from clamp bracket.

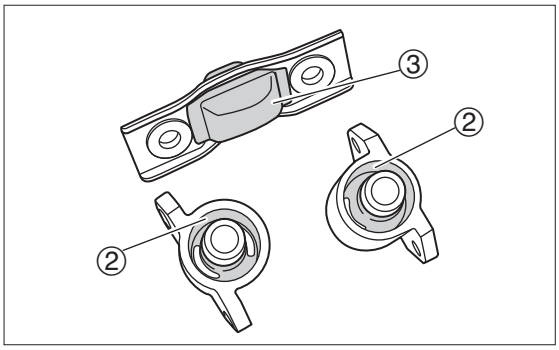


5) Disassembly of Drive Shaft Housing

1. Remove upper rubber mount installation bolts ① and then remove rubber mount ②, damper ③ from drive shaft housing.



2. Check rubber mount ② and damper ③ for abnormality such as crack. Replace if any abnormality is found.



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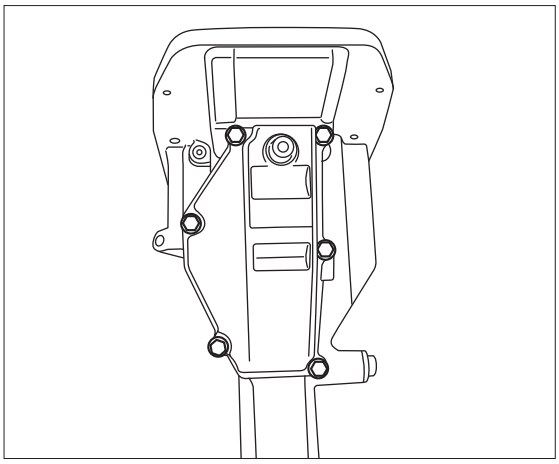
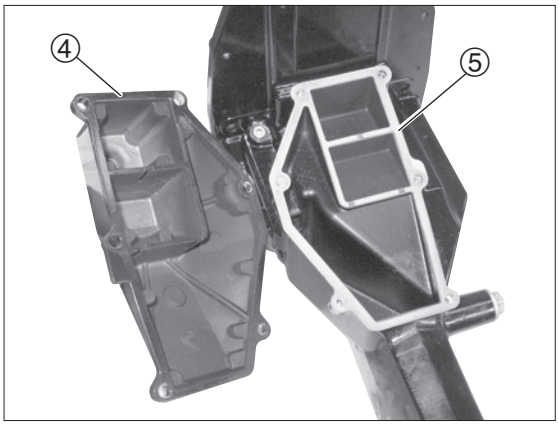
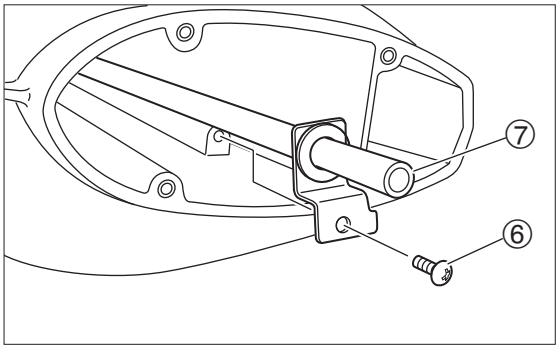
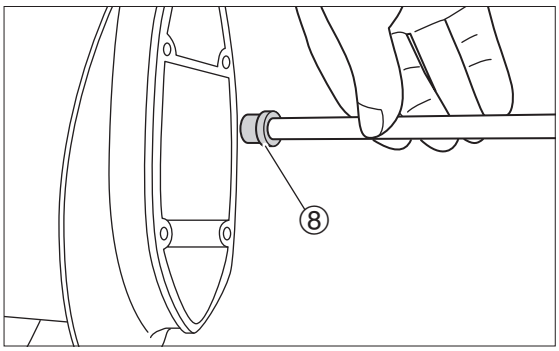
3. Remove idle exhaust cover ④ and gasket ⑤, and check idle exhaust cover for sludge in it, and abnormalities such as cracks.





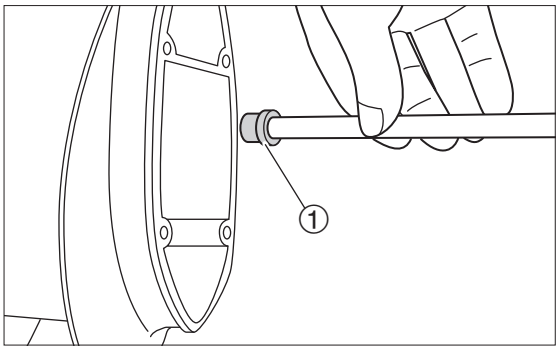
4. Remove screw ⑥, and remove water pipe ⑦ from drive shaft housing. Check water pipe auxiliary mount ⑧ for abnormality such as crack.

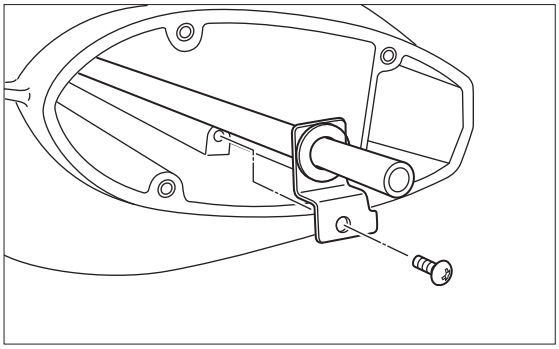




6) Assembly of Drive Shaft Housing

1. Install water pipe ① into drive shaft housing.





2. Put new gasket, and then, attach idle exhaust cover securing bolts and tighten them in the order of their numbers shown to specified torque.

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

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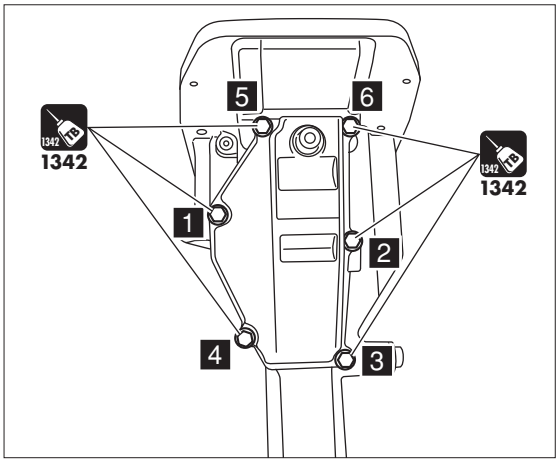
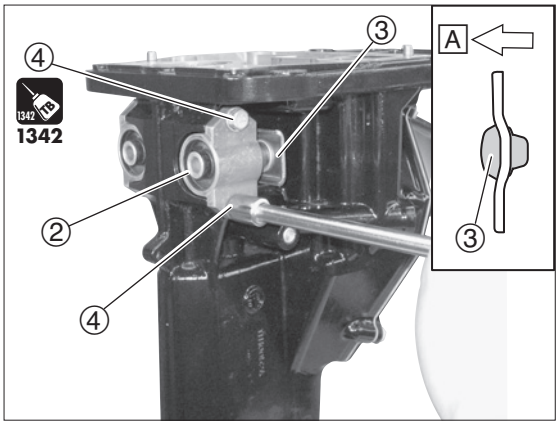


3. Put upper mount ② and damper ③ on drive shaft housing, and tighten bolts ④.

Install damper in direction as illustrated A.

Mount Rubber (upper) Installation Bolts:
9N · m (7 lb · ft) [0.9 kgf · m]

1342



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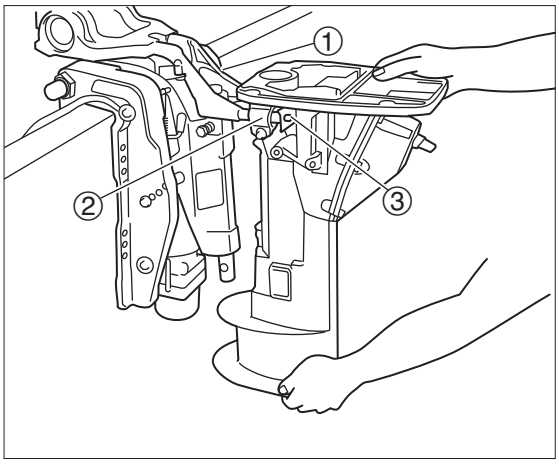
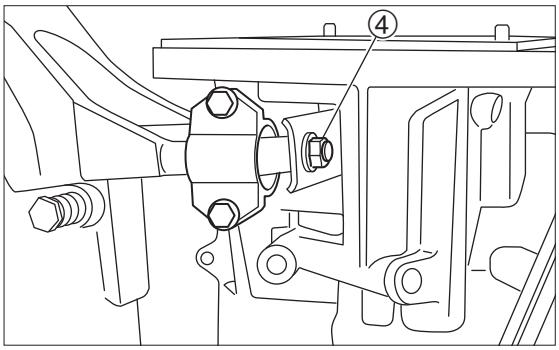
7) Installation of Drive Shaft Housing Ass'y

1. Insert drive shaft housing ass'y into stud bolt ③ of upper rubber mount ② of swivel bracket ①.



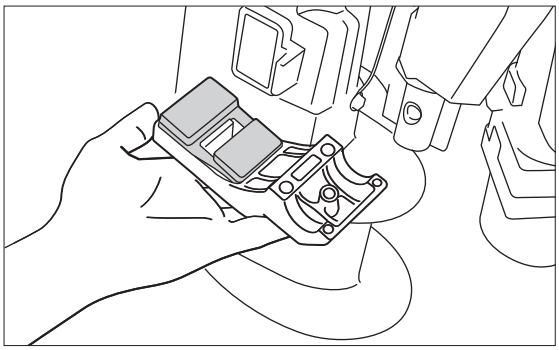
Align dumper bolt holes accurately.

2. Install rubber mount and lower damper and mount bracket to drive shaft housing. Tighten bolts ⑤ and nuts ④ to specified torque.

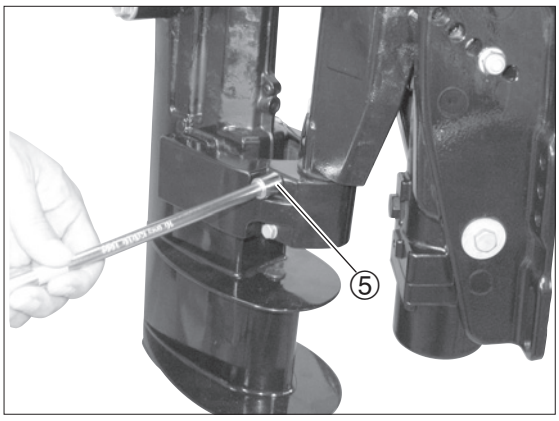


Steering Bracket Installing Nut ④ :
M8 13N · m (9 lb · ft) [1.3 kgf · m]

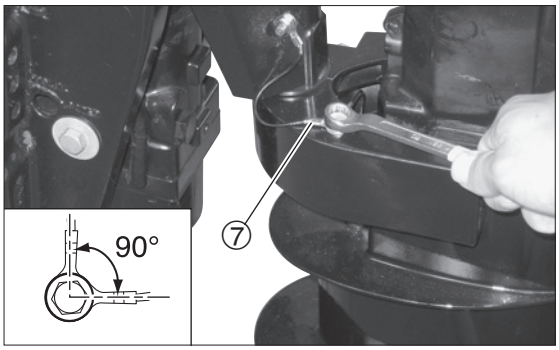
Lower Rubber Mount Bolt ⑤ :
M6 6N · m (4 lb · ft) [0.6 kgf · m]



- When installing lower rubber mount, be careful that ground lead is not caught by the part.
- When installing steering shaft, watch spigot joint for installation on the mount bracket.
- Tighten lower rubber mount bolts in several steps to 6N · m.



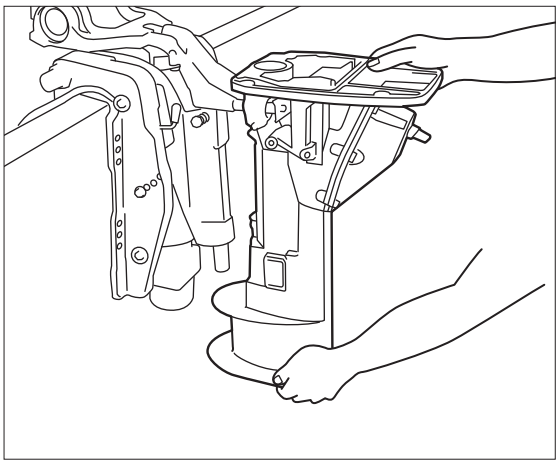
3. Attach ground wire ⑦.



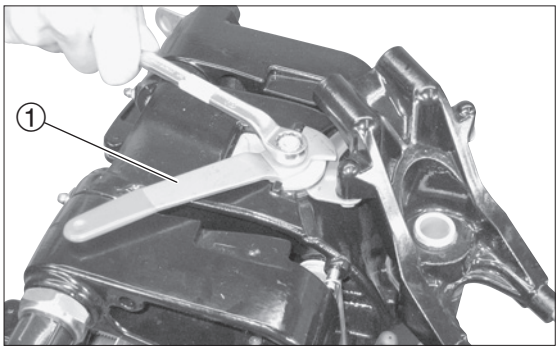
- Be careful not to paint earth wire attaching surface, or the anti-corrosion effect will be disabled.
- If there are two ground wires, split them 90 degrees as illustrated.

8) Removing Steering Shaft

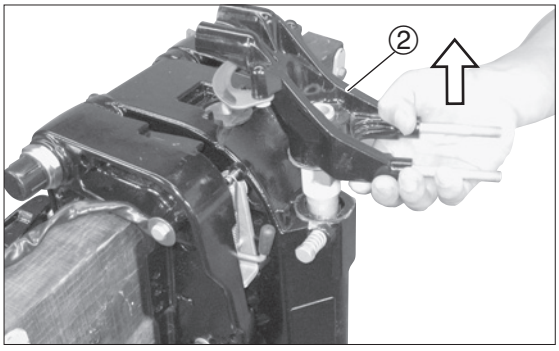
1. Remove drive shaft housing by referring to “Chapter 7 Removing Drive Shaft Housing”.



2. Loose co-pilot handle nut and remove handle ①.



3. Pull out steering shaft ② from swivel bracket ass'y to remove.

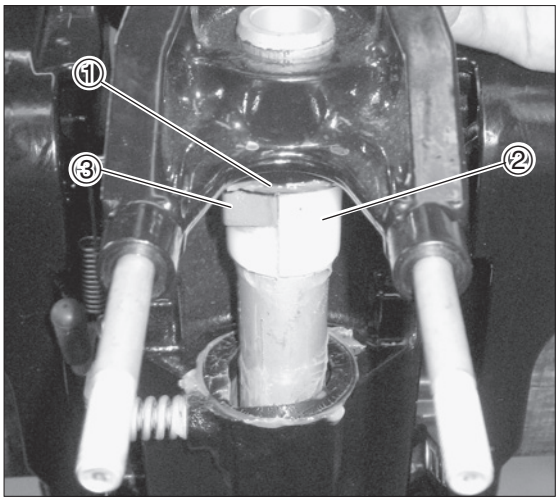


- Loosen friction bolt.
- Remove washer, and then, O ring and collar from steering bracket.
- When lifting steering shaft, be careful not to lose friction piece.

4. Check individual parts.

9) Installing Steering Shaft

1. Attach thrust plate ① and bushing ② friction piece ③ to steering shaft.

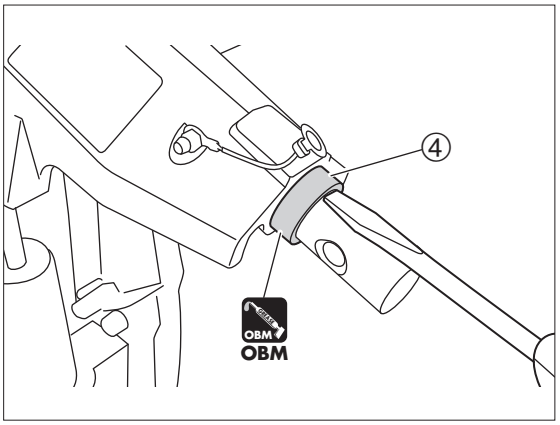


2. Stand swivel bracket ass'y vertically, and insert steering shaft into swivel bracket ass'y.

3. Attach bushing ④, new O ring ⑤, and thrust plate ⑥ to swivel bracket.

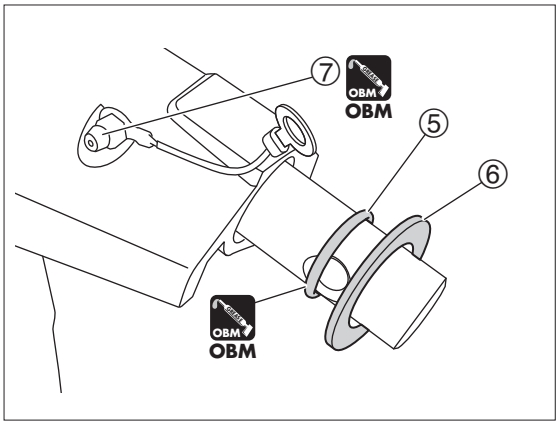
- Push bushing by using flat head screw driver until it stops.
- Put O ring until it contacts bushing.

OBM



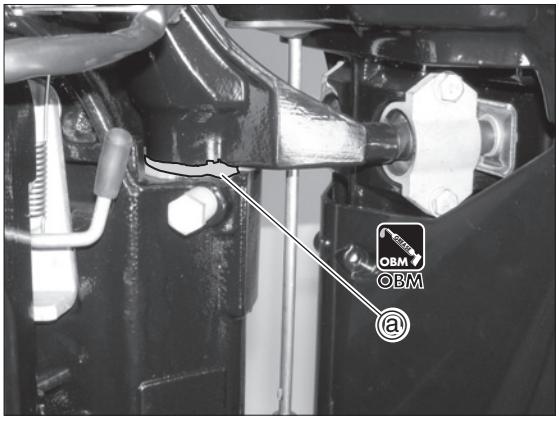
4. Put bushing and O ring into swivel bracket surely.

OBM

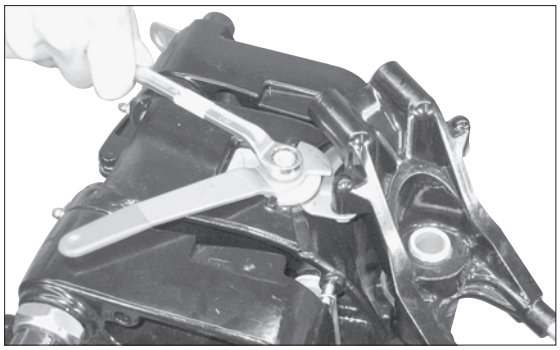


5. Put OBM grease into bushing ⓐ through grease nipple ⑦ until it overflows.

OBM



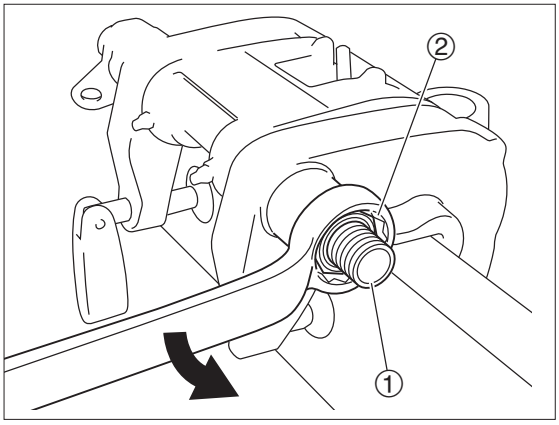
6. Install copilot handle, and adjust copilot.



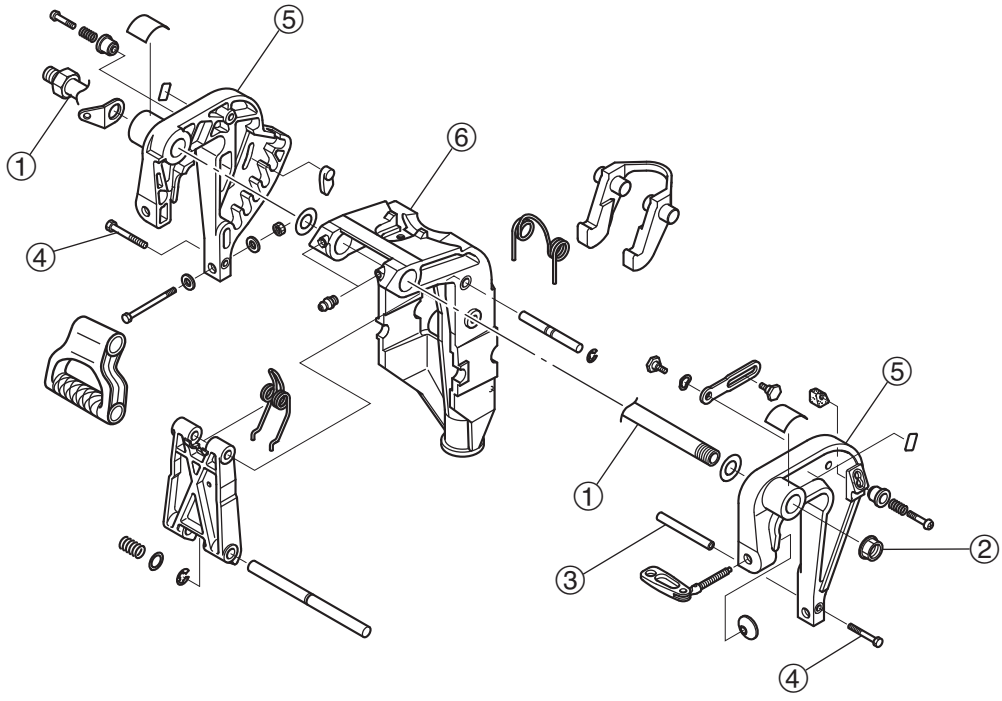
10) Disassembling Clamp Bracket (EP model)

1. Remove drive shaft housing, steering shaft and copilot before beginning this procedure.

2. Loosen nut ② of swivel bracket shaft ①. Loosen bolt ④ of distance piece ③ and remove bolt ④. Pull out swivel bracket shaft, and then, remove clamp bracket ⑤ from swivel bracket ⑥.



3. Check swivel bracket shaft and other parts for abnormality, and replace if necessary.



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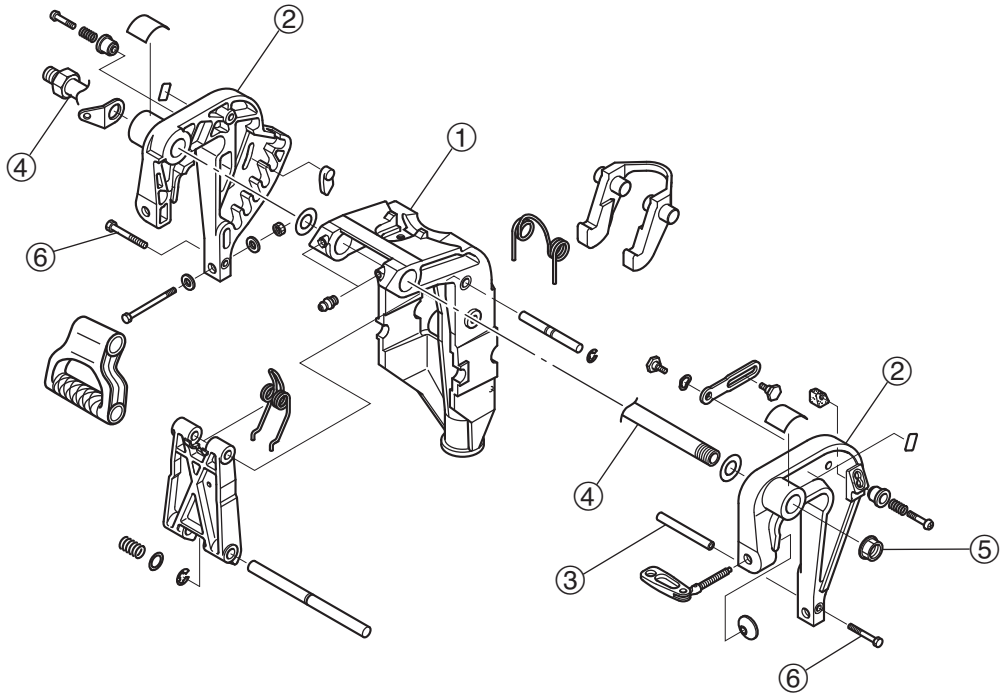
11) Assembling Clamp Bracket (EP model)

1. Reassemble components of swivel bracket ①, and then, insert distance piece ③ into clamp brackets ②.



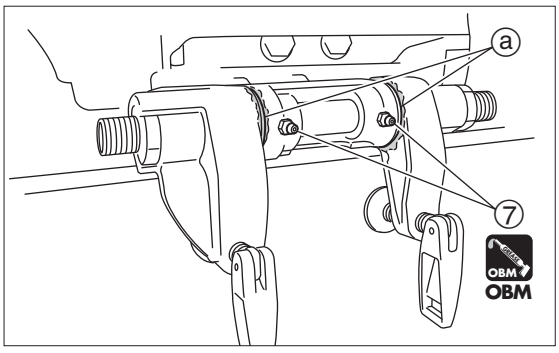
2. Install clamp bracket ① to swivel bracket ③, insert swivel bracket shaft ④, and then, tighten nylon nut ⑤ and nut to their specified torque respectively.

Nylon Nut ⑤ :
25 N · m (18 lb · ft) [2.5 kgf · m]

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

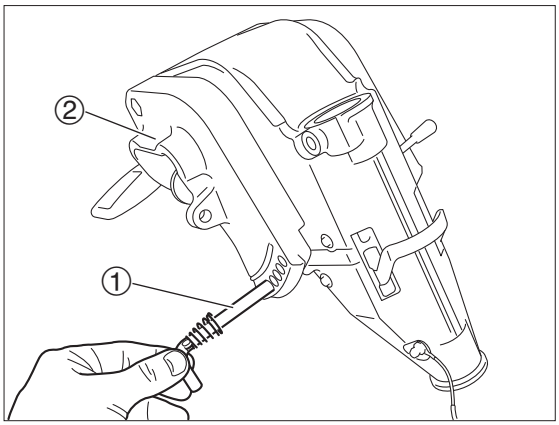
3. Put grease into bushing ⓐ through grease nipple ⑦ until it overflows.

OBM

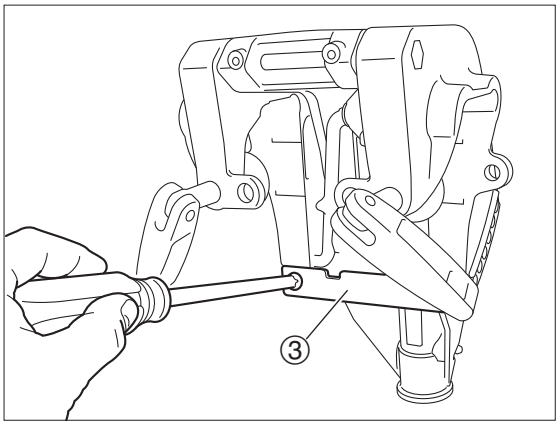


12) Disassembling Clamp Bracket (MF and EF models)

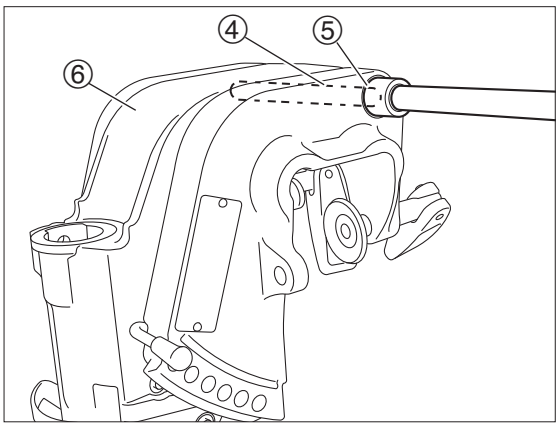
1. Remove thrust rod ① from clamp bracket ②.



2. Remove distance plate ③.

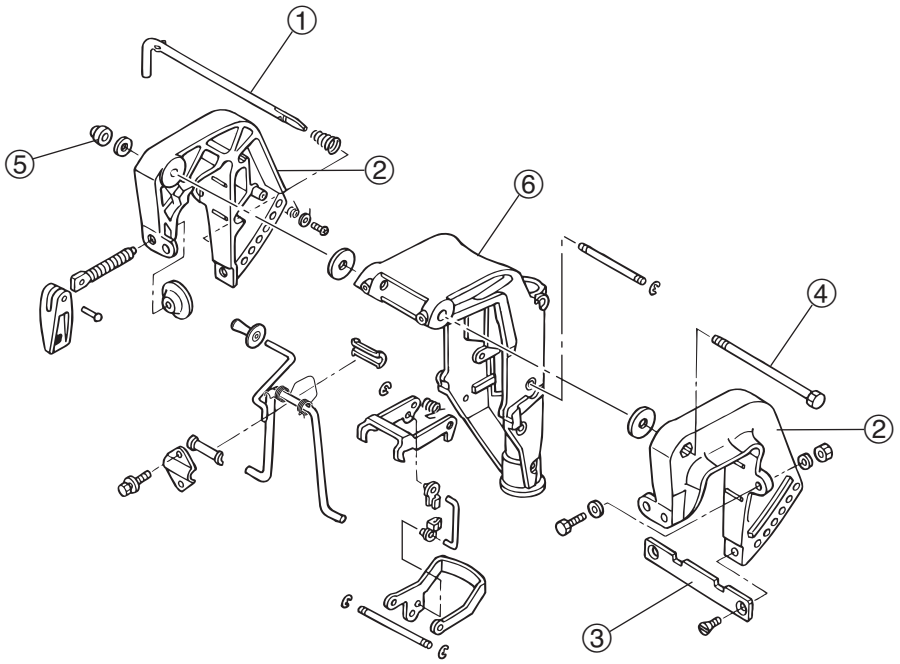


3. Loosen and remove nut ⑤ of swivel bracket shaft ④.
   Pull out swivel bracket shaft, and then, remove clamp bracket from swivel bracket ⑥.



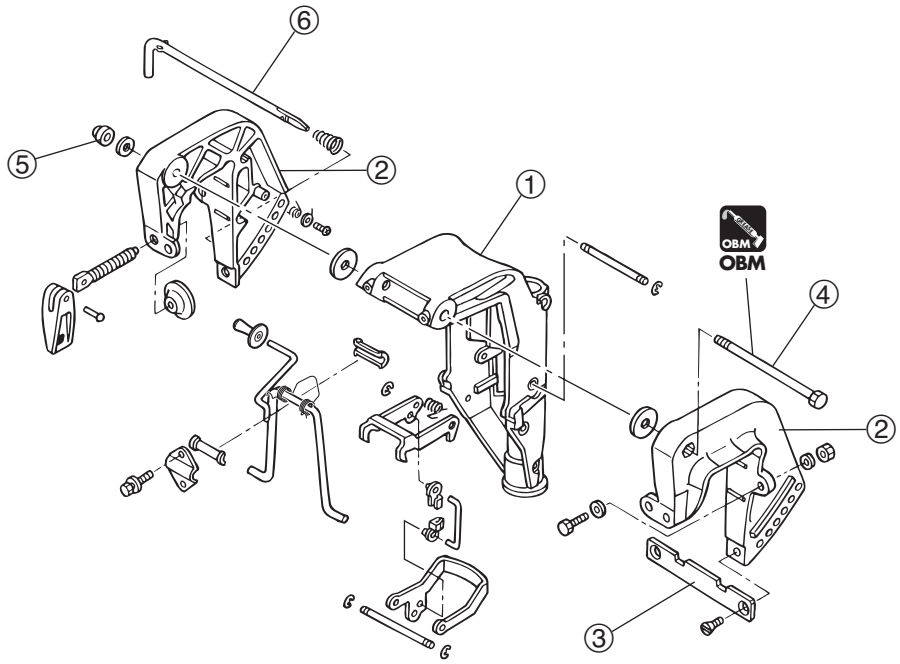
7

4. Check swivel bracket shaft and other parts for abnormality, and replace if necessary.



13) Assembling Clamp Bracket (MF & EF models)

1. Reassemble components of swivel bracket ①, and then, insert distance plate ③ into clamp brackets ②.

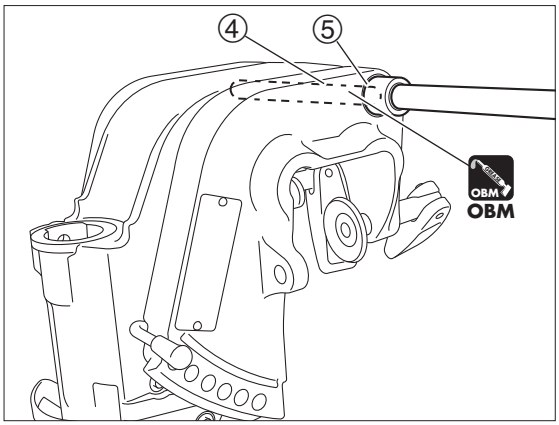


2. Install clamp bracket swivel bracket, insert swivel bracket shaft ④, and then, tighten nylon nut ⑤ to specified torque.

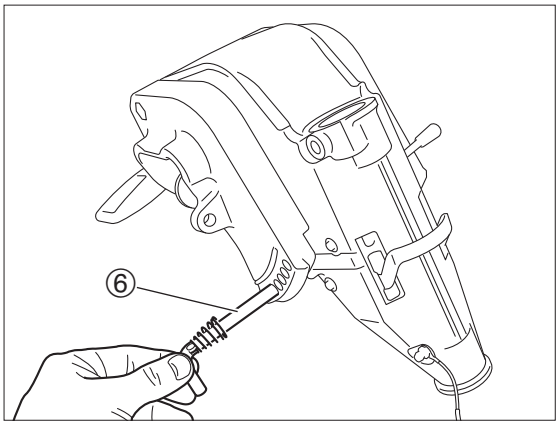
Nylon Nut ⑤ :
14 N · m (10 lb · ft) [1.4 kgf · m]

Apply OBM grease to swivel bracket shaft sufficiently.

OBM



3. Attach thrust rod ⑥.

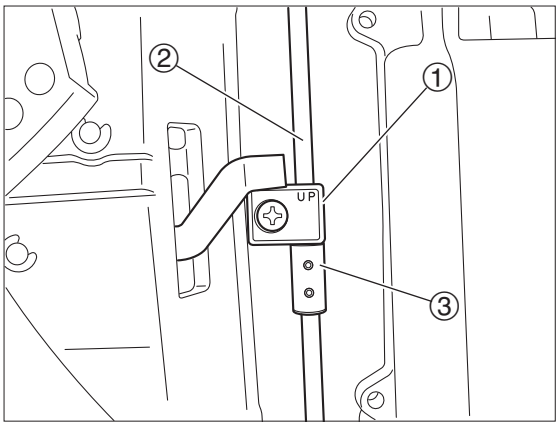


14) Inspection of Reverse Lock (MF, EF & EP models)

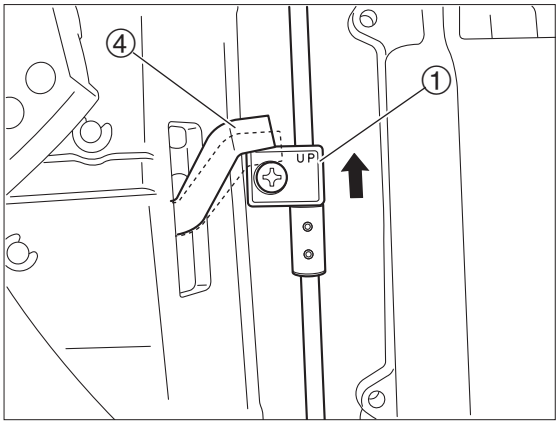
1. Check operation of reverse lock after disassembling and reassembling bracket.

2. Set reverse lock link joint ① on shift rod ② with "UP" mark directing upward.

Secure reverse lock joint at position contacting shift rod joint ③.

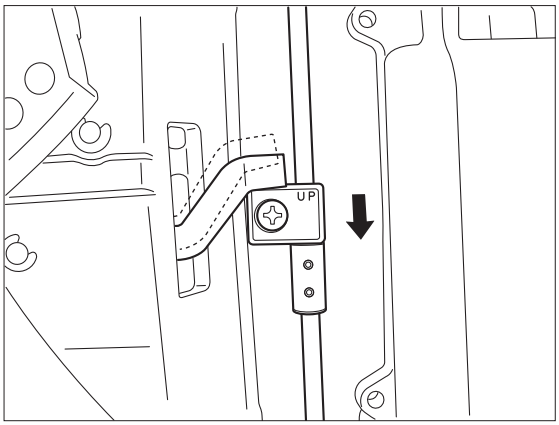


3. Check that shifting into forward (F) causes reverse link joint ① to push up reverse lock ④, allowing tilt up of outboard motor.



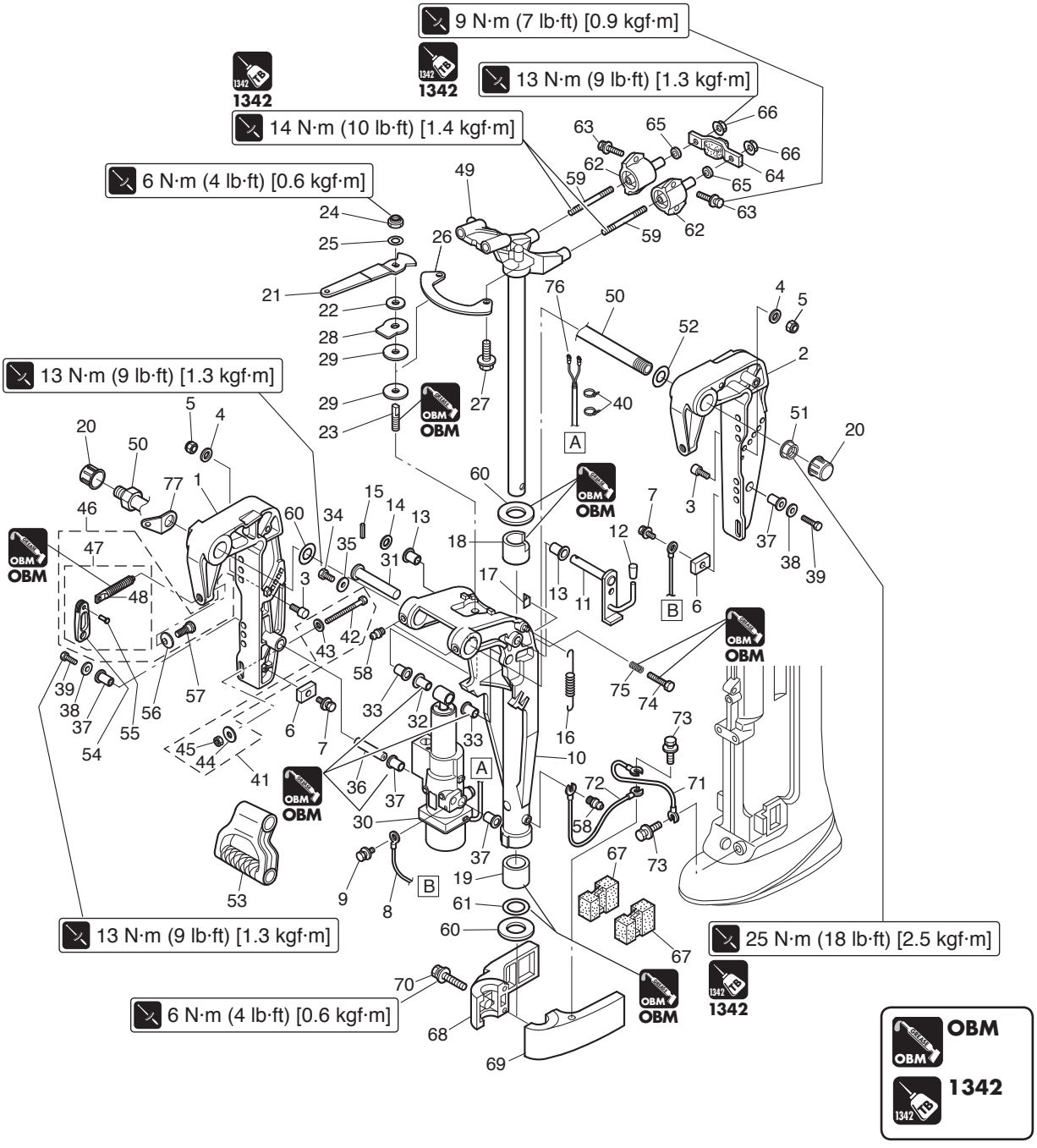
7

4. Check that outboard motor cannot be tilted up at neutral (N) or reverse (R) shift.



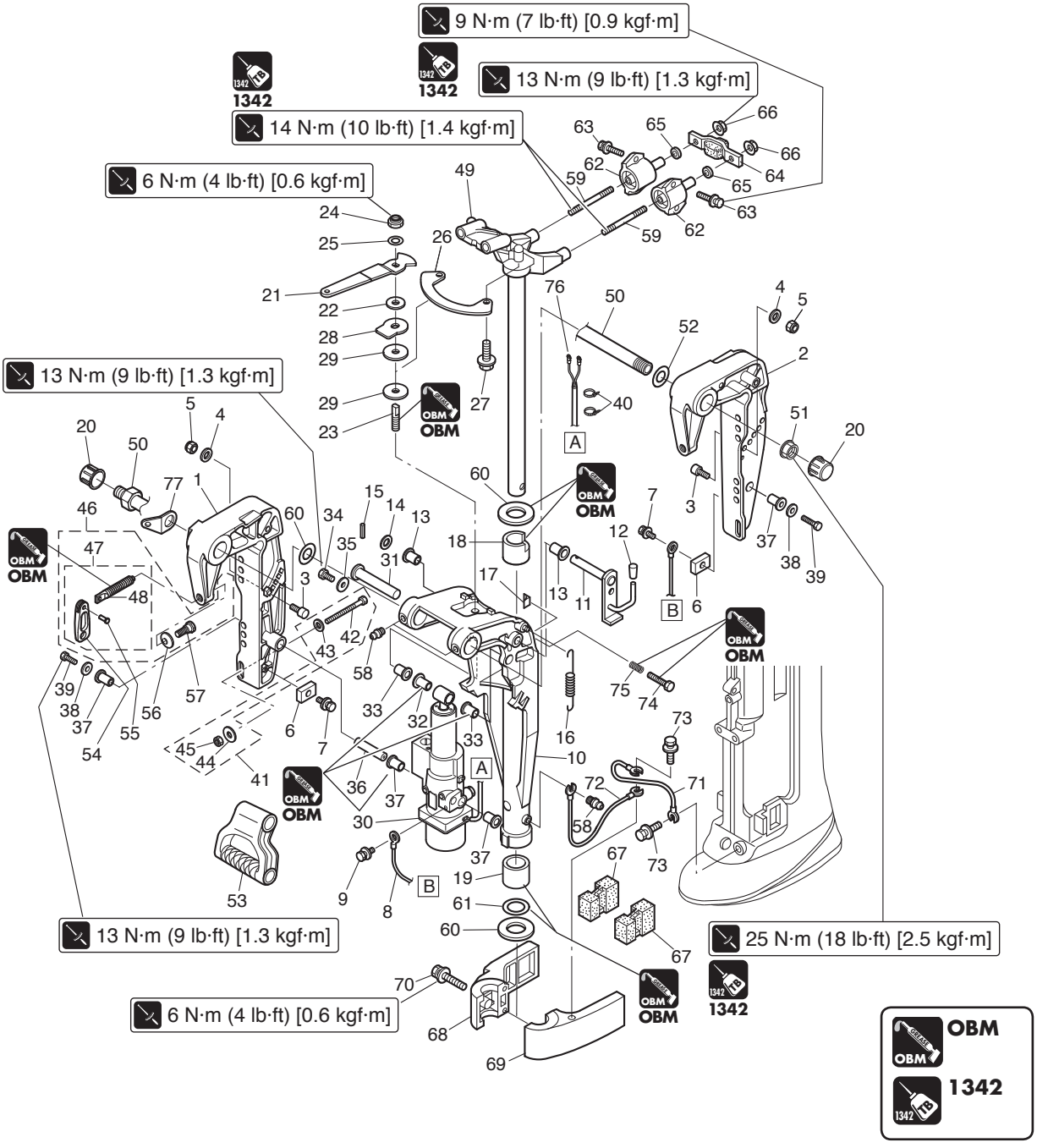
3.Parts Layout (PT Model)

Clamp Bracket (For EFT & EPT Models)



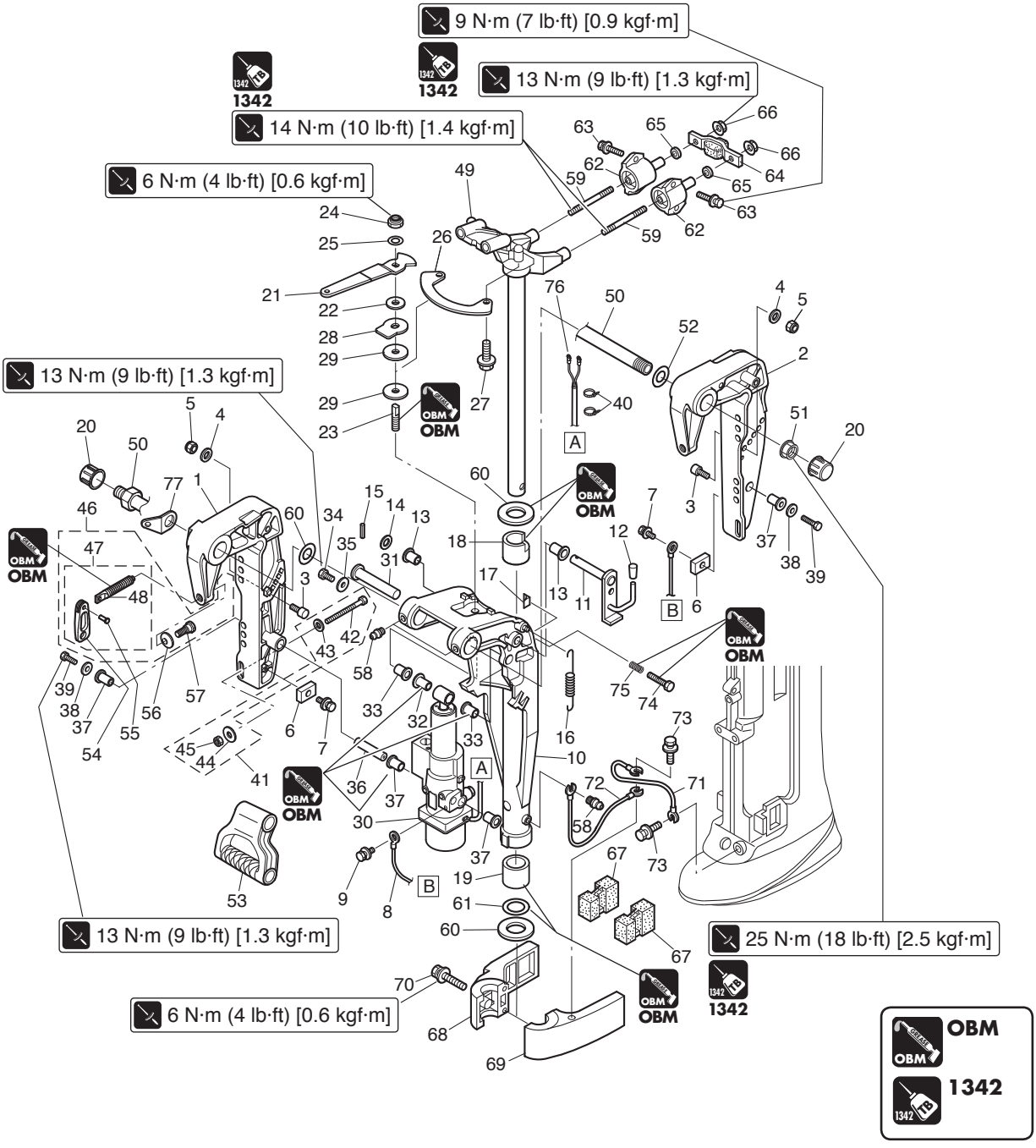
Ref. No.	Description	Q'ty	Remarks
1	Clamp Bracket (PTT-R)	1	Starboard Side
2	Clamp Bracket (PTT-L)	1	Port Side
3	Trim Lock Pin	2	
4	Washer 8.1-16-1.5	2	
5	Nylon Nut 8-p1.25	2	
6	Anode	2	
7	Bolt	2	
8	Ground L=130	1	PTT Ass'y-Cramp Bracket
9	Bolt	1	
10	Swivel Bracket Ass'y	1	
11	Tilt Stopper	1	
12	Tilt Stopper Grip	1	
13	Collar 10.2-12-12	2	
14	Washer	1	

Ref. No.	Description	Q'ty	Remarks
15	Spring Pin 3.5-16	1	
16	Tilt Stopper Spring	1	
17	Friction Piece	1	
18	Bushing 24-30-30	1	
19	Bushing 24-30-30	1	
20	Cap Nut	2	for EFT
21	Friction Lever	1	for EFT
22	Washer 8.1-20-0.8	1	for EFT
23	Bolt M8 P1.25	1	for EFT
24	Nylon Nut 8-p1.25	1	for EFT
25	Washer	1	for EFT
26	Plate	1	for EFT
27	Bolt	2	for EFT
28	Washer 8.5-38-3	1	for EFT



Ref. No.	Description	Q'ty	Remarks
29	Disc 8.5-38-2	2	for EFT
30	PT Ass'y	1	
31	Cylinder Pin (Upper)	1	
32	Bushing 13-16-31	1	
33	Bushing 13-17-19.5 13-17-19.5	2	
34	Bolt	1	
35	Washer 6.5-23-1.5	1	
36	Cylinder Pin (Lower)	1	
37	Bushing 13-16-31	4	
38	Washer 8.5-28-1	2	
39	Bolt	2	
40	Band 203	2	
41	Rigging Bolt Set	1	
42	Bolt	4	

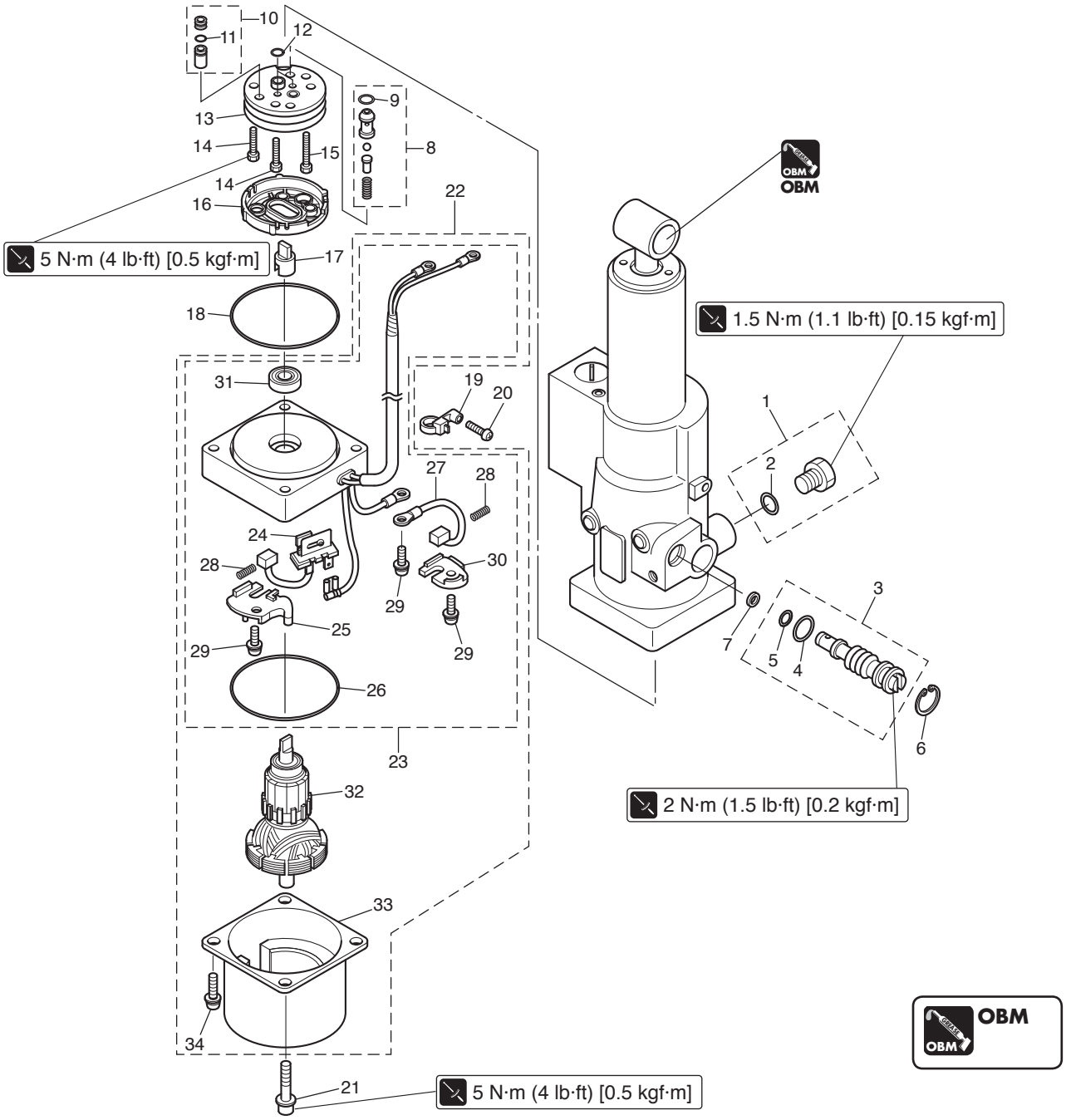
Ref. No.	Description	Q'ty	Remarks
43	Washer	4	
44	Washer 8.5-34-3	4	
45	Nylon Nut 8-P1.25	4	
46	Clamp Screw Kit	2	
47	Clamp Screw Ass'y	1	
48	Clamp Screw	1	
49	Steering Shaft Ass'y	1	for EP & EFT/EPT
50	Swivel Bracket Shaft Ass'y	1	Bracket Bolt for EP & EFT/EPT
51	Nylon Nut 7/8-14	1	for EP & EFT/EPT
52	Washer 22-36-1	2	Nylon for EP & EFT/EPT
53	Carrying Handle	1	for EP & EPT
54	Clamp Screw Handle	1	
55	Rivet 3-22	1	
56	Clamp Screw Pad	1	



Ref. No.	Description	Q'ty	Remarks
57	Shoulder Bolt	1	
58	Grease Fitting	3	for EP & EFT/EPT
59	Stud	2	
60	Thrust Plate (Upper)	2	
61	O-ring 3.5-22	1	Do not reuse.
62	Rubber Mount (Upper)	2	
63	Bolt	4	
64	Damper (Upper)	1	
65	Washer	2	
66	Nut	2	
67	Rubber Mount (Lower)	2	
68	Mount Bracket (R)	1	Starboard Side
69	Mount Bracket (L)	1	Port Side
70	Bolt	2	

Ref. No.	Description	Q'ty	Remarks
71	Ground L=110	1	Drive Shaft Housing-Mount Bracket (R)
72	Ground L=110	1	Swivel Bracket-Mount Bracket (R)
73	Bolt	2	
74	Bolt	1	
75	Spring	1	
76	Plate	1	for EP & EFT/EPT

Power Tilt Ass'y



Ref. No.	Description	Q'ty	Remarks
1	Cap Ass'y	1	
2	O-ring	1	Do not reuse.
3	Manual Valve Ass'y	1	
4	O-ring 2.4-9.8	1	Do not reuse.
5	O-ring	1	Do not reuse.
6	C-ring	1	
7	Seal Washer	1	
8	Relief Valve Ass'y	1	
9	O-ring	1	Do not reuse.
10	Valve Ass'y	1	
11	O-ring 1.5-3.5	1	Do not reuse.
12	O-ring	2	Do not reuse.
13	Pump	1	
14	Bolt	2	
15	Bolt	1	
16	Filter	1	
17	Coupling	1	

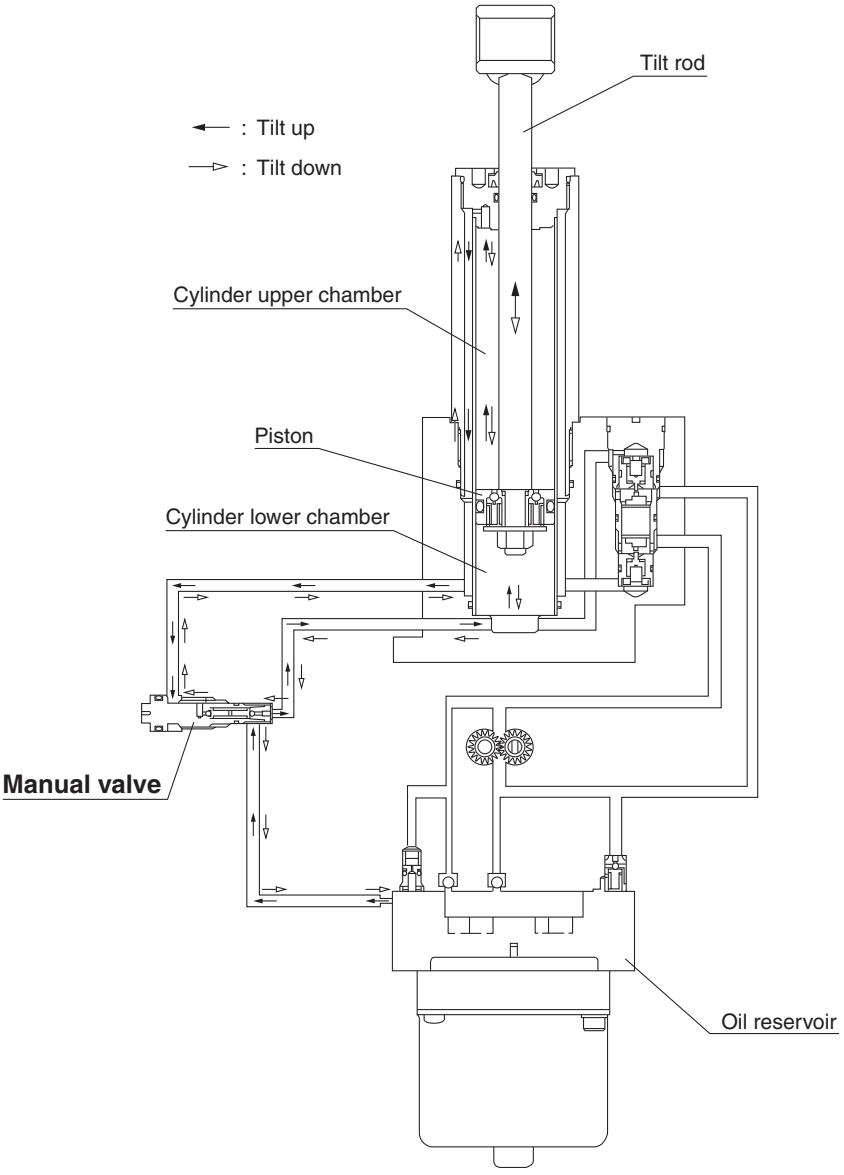
Ref. No.	Description	Q'ty	Remarks
18	O-ring 2-62.5	1	Do not reuse.
19	Band	1	
20	Pre-coated Screw 5-12	1	
21	Bolt	2	
22	Motor Ass'y	1	
23	Motor Bracket Ass'y	1	
24	Breaker	1	
25	Breaker Holder	1	
26	O-ring	1	Do not reuse.
27	Brush	1	
28	Brush Spring	2	
29	Screw	3	
30	Brush Holder	1	
31	Oil Seal	1	
32	Armature Ass'y	1	
33	Yoke Ass'y	1	
34	Screw	2	

4. Operation of Power Tilt

· The power tilt system has an electric motor built in the system that drives the hydraulic pump to feed pressurized oil into the tilt cylinder.

· The power tilt switch located on the tiller handle or remote control box is used to tilt-up or down the outboard motor.

5. Operations of Hydraulic Circuit

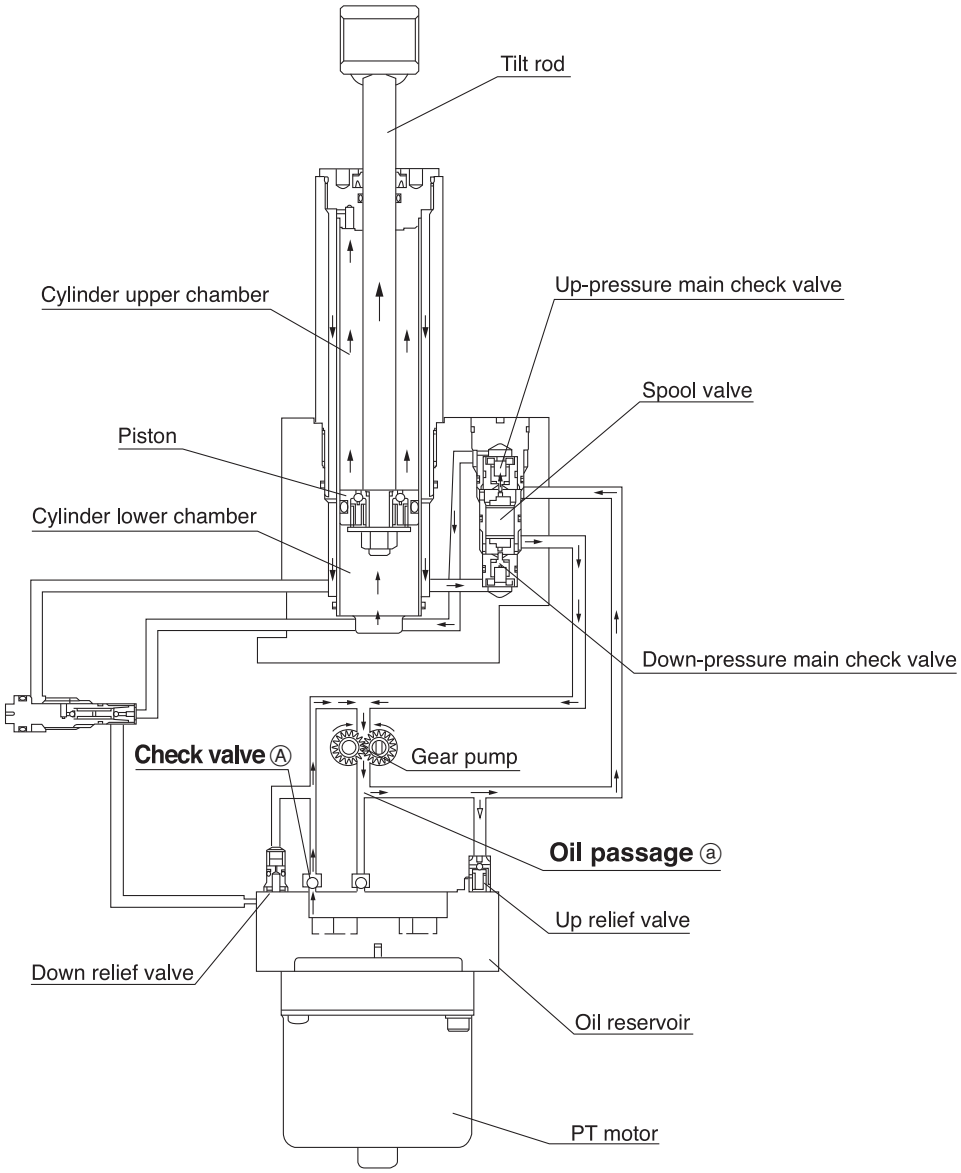


Manual Tilt Operation

Turning the manual operation valve counterclockwise 2 or 3 times opens the manual operation circuit.

The outboard motor can be tilted up or down easily by hand.

When the manual circuit is closed completely by turning the manual valve clockwise before the outboard motor reaches completely tilted up or down position, the outboard motor holds the position at the time.



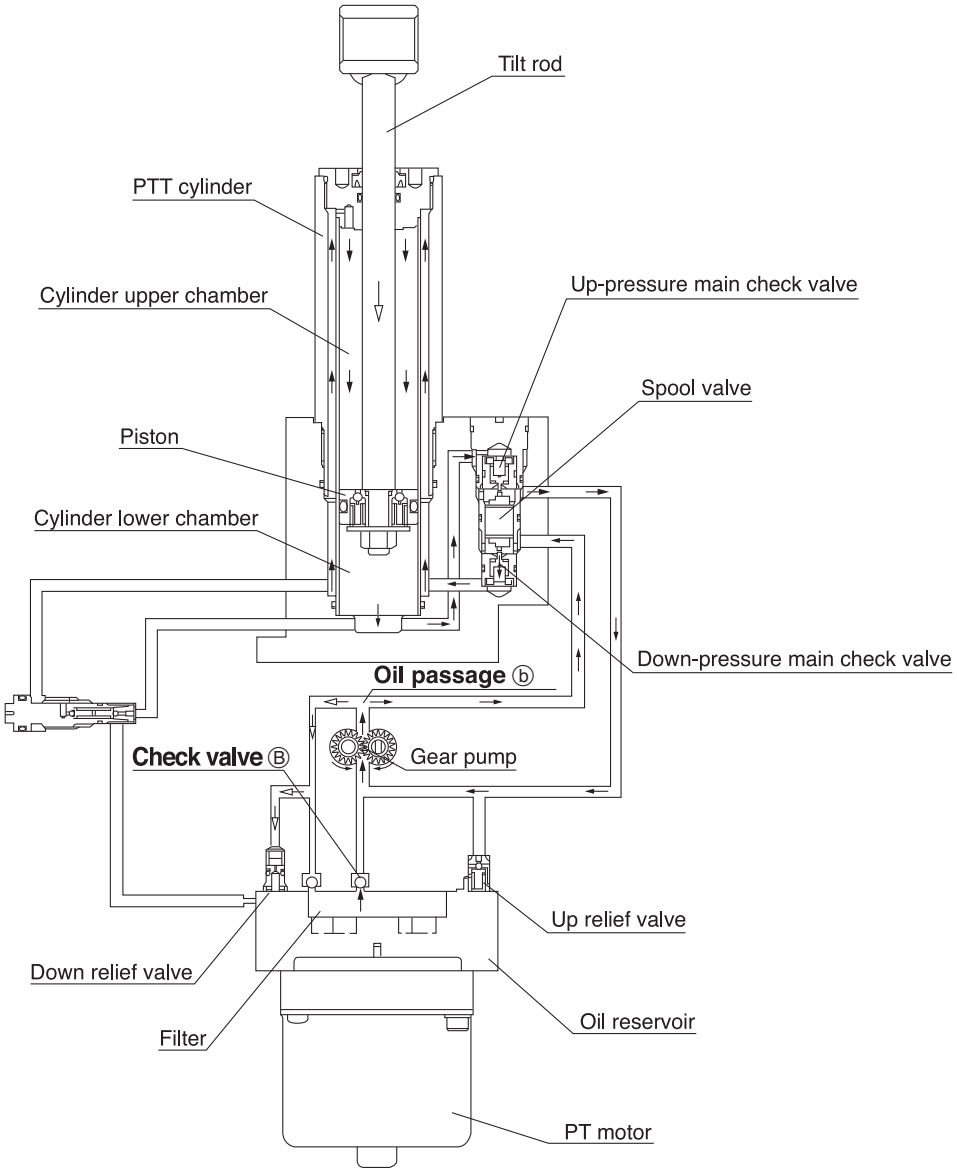
Tilt up Operation

Pressing "UP" side of PT switch causes the PT motor (gear of gear pump) to rotate clockwise.

Check valve Ⓐ opens to cause oil to flow from reservoir toward gear pump and spool valve. This oil flow shifts spool valve downward to open down-pressure main check valve. Oil in the cylinder upper chamber is returned to gear pump, hydraulic pressure of oil passage ⓐ is increased to open up-pressure main check valve, and the oil flows into cylinder lower chamber. As a result of the above operations, piston rod is pushed up to tilt up the outboard motor. The oil in the cylinder upper chamber returns to gear pump through down pressure main check valve.

Because of difference of capacity difference between cylinder upper chamber and lower chamber (piston rod at upper chamber side), oil flows into the pump through check valve Ⓐ to compensate for the lack of the oil. When the motor stops, down/up pressure main check valve closes, and spool valve moves to the center. As a result, piston rod is held at a position at the time.

When tilt rod fully extends, up relief valve opens to prevent increase of hydraulic pressure of cylinder lower chamber by relieving the pressure to protect PT unit.



Tilt down

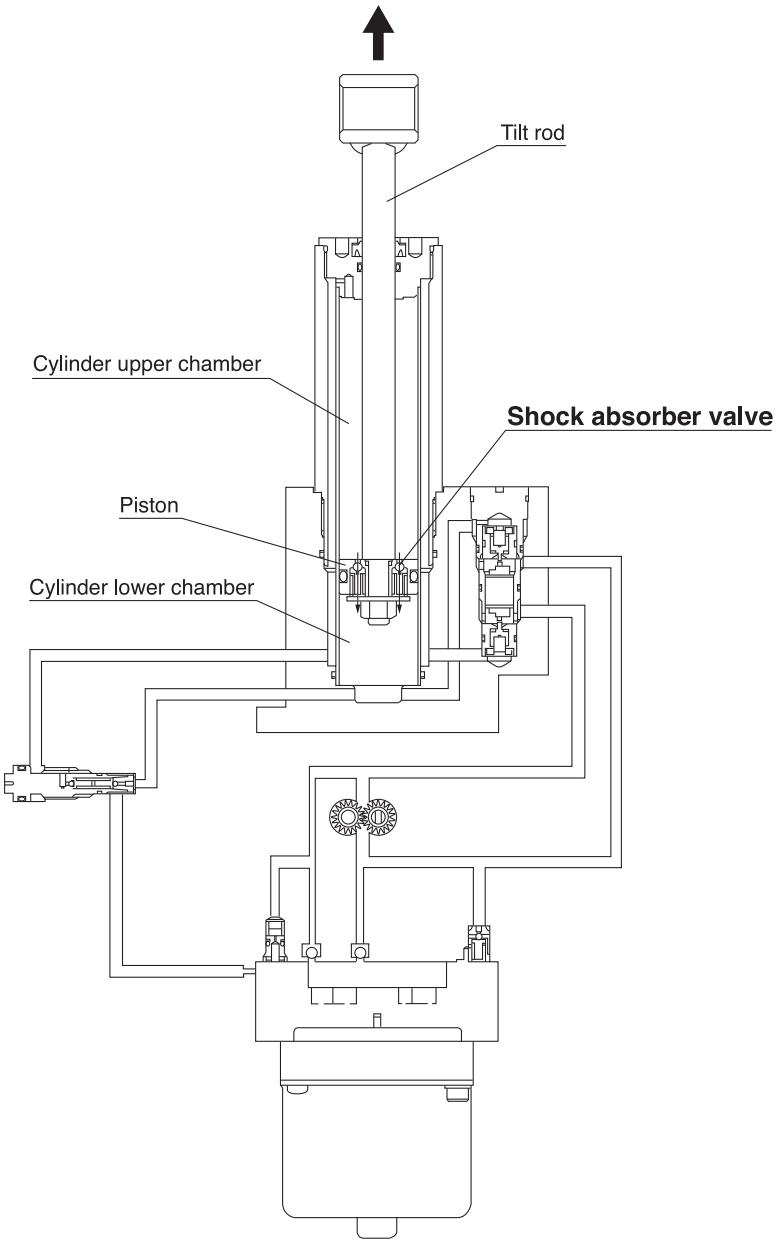
Pressing "DOWN" side of PT switch causes the PT motor (gear pump) to rotate counterclockwise.

Check valve Ⓑ opens to cause oil to flow from reservoir toward gear pump and spool valve. This oil flow shifts spool valve upward to open up-pressure main check valve. Oil in the cylinder lower chamber is returned to gear pump, hydraulic pressure of oil passage ⓑ is increased to open down-pressure main check valve, and the oil flows into cylinder upper chamber. As a result of the above operations, piston rod is pushed down to tilt down the outboard motor.

The oil in the cylinder lower chamber returns to gear pump through up-pressure main check valve.

Because of difference of capacity difference between cylinder upper chamber and lower chamber, oil of amount exceeding upper chamber requirement returns to gear pump.

When piston rod is drawn-in completely, all of oil discharged from the pump returns from down relief valve to the reservoir.

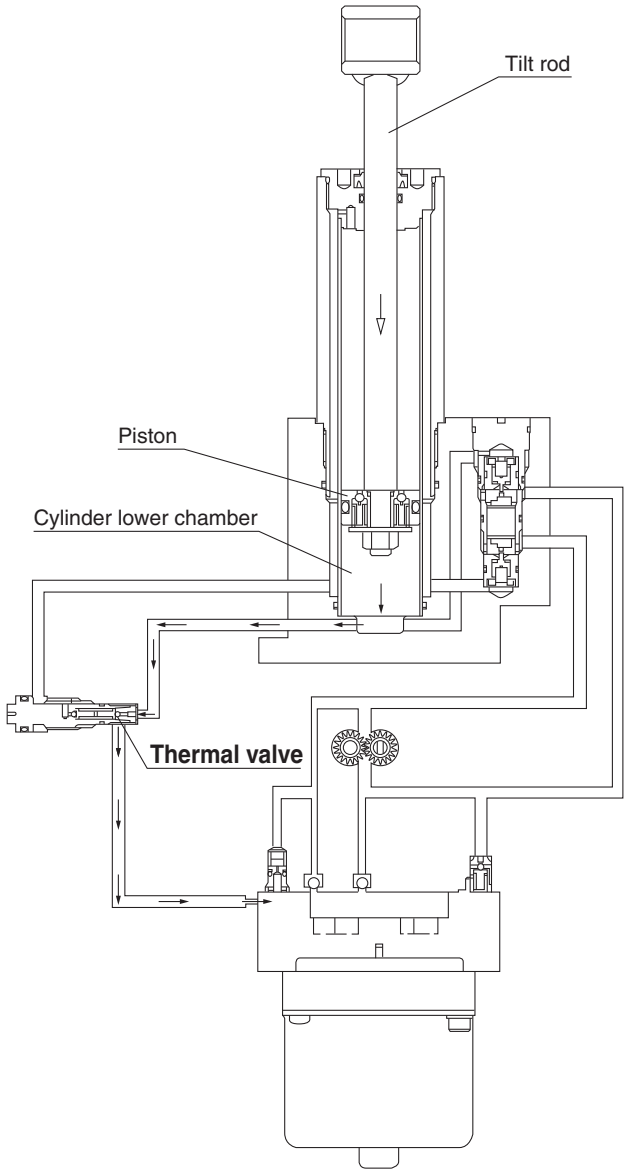


Shock Absorber Valve

The PT unit is provided with a shock absorber that protects the drive unit from an impact in case it hits underwater obstacle during cruising.

In case drive unit hits an underwater obstacle, the hydraulic pressure in the cylinder upper chamber is increased suddenly. The high pressure opens shock valve of piston.

When shock valve opens, oil in the cylinder upper chamber flows into the lower cylinder chamber to extend tilt rod upward to absorb the shock.



Thermal Valve

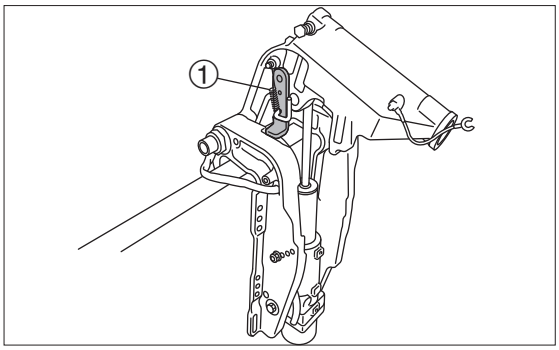
Thermal valve protects drive unit from excessive force that attempts to push down tilt rod when the outboard motor is at full tilt up position.

The piston rod to which excessive force is applied is pressed into the cylinder, resulting in increasing hydraulic pressure in the lower cylinder chamber over a rated value.

The increased hydraulic pressure reaches the thermal valve, resulting in opening the valve to dissipate itself.

6. Removing PT Unit

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

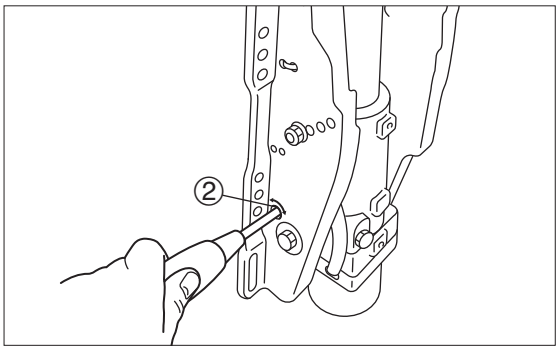


⚠ WARNING

- **Be sure to lock outboard motor with tilt stopper after tilting up. Leaving outboard motor up without locking may lead to accidental descent due to reduction of PT hydraulic pressure.**
- **When removing PT unit without removing power unit, hold outboard motor using hoist at tilt up position. Without such means, outboard motor can tilt down, causing danger.**

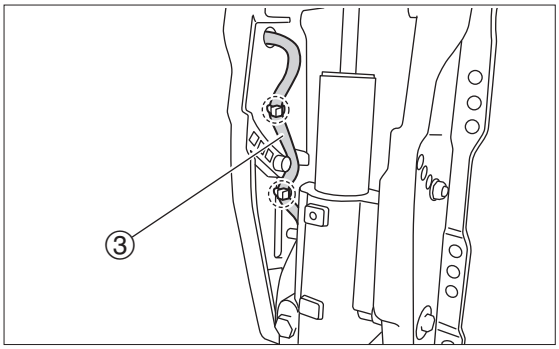
⚠ CAUTION

To prevent O-ring damage, open once fully for releasing oil pressure and then tighten, when closing manual valve.



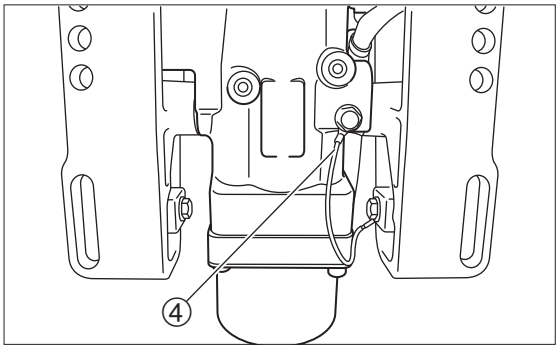
IF PT unit will not operate, open manual valve and lift up outboard motor with hands. When manual valve is opened, be sure to tighten it with specified torque after tilting up outboard motor.

Manual valve ② :
2 N · m (1.5 lb · ft) [0.2 kgf · m]

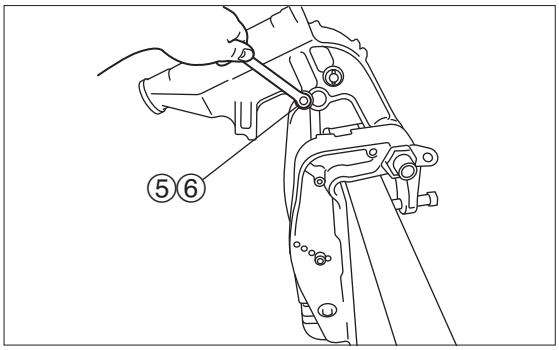


2. Disconnect PT cable ③ from PT solenoid, and ground strap ④ from power tilt unit.

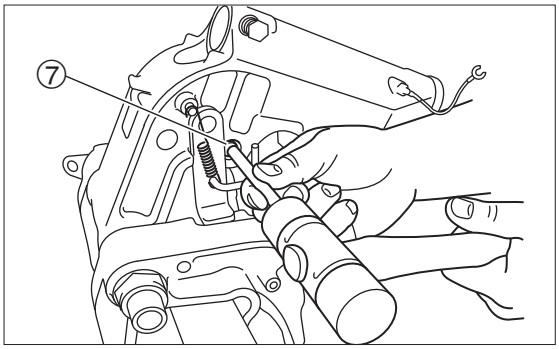
Disconnect negative battery cable first and then positive cable.



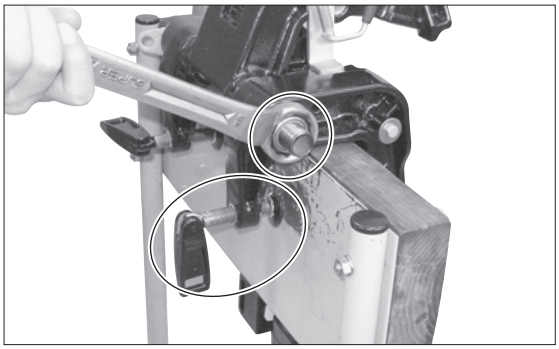
3. Remove bolt ⑤ and washer ⑥ located on the starboard side of the outboard motor, and then upper cylinder pin ⑦.



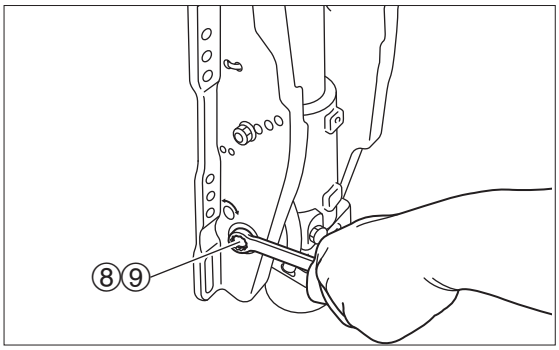
> Upper cylinder pin can be removed easily when tilt rod is retracted a little by performing tilt down operation.



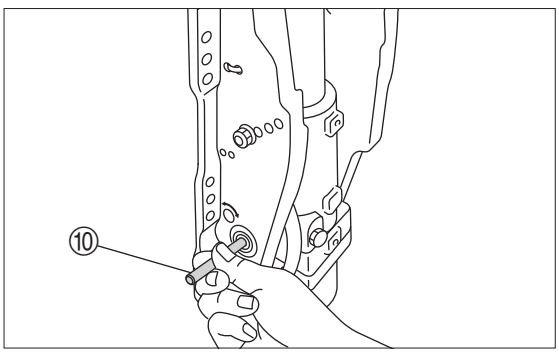
4. Remove cap, and loosen nylon nut of port side bracket and clamp screw.



5. Remove bolt ⑧ and washer ⑨, and use a proper punch ⑩ to remove lower cylinder pin.



> · Remove PT assembly taking care not to drop it.
> · Pry port side clamp with means such as handle of plastic hammer to make gap that makes removal of PT assembly easy.



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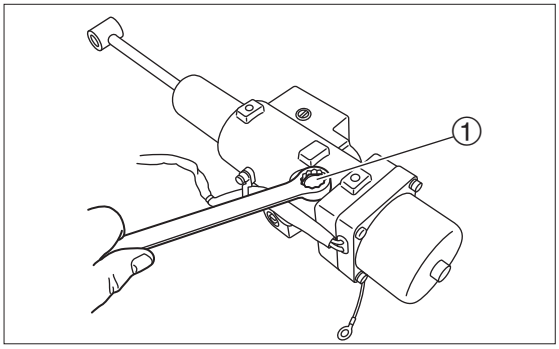
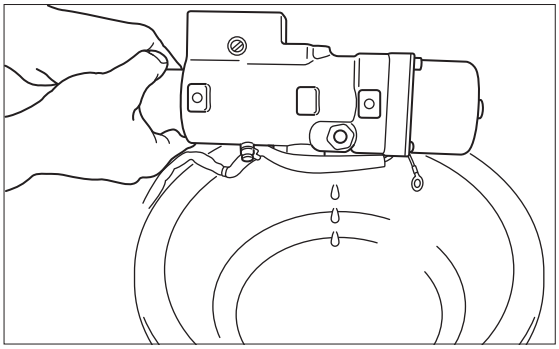
7. Removing and Repairing Manual Release Valve

1. Loosen fill cap ① of power tilt unit slowly, and then remove it.

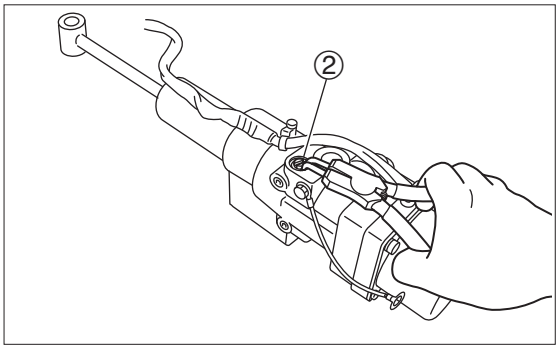


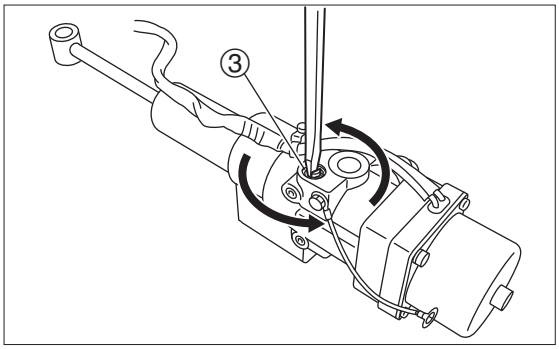
> Fully extend tilt rod when removing fill cap.

2. Drain power tilt fluid from filler cap outlet.



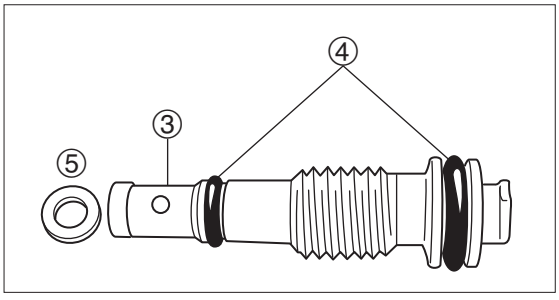
3. Remove manual valve C ring ② and turn manual valve ③ counterclockwise to remove.





4. Remove O ring (2 pcs) ④ from manual valve ③, check O ring for damages and deterioration, and replace with new part if necessary.

5. Remove seal washer ⑤, and replace with new part if necessary.

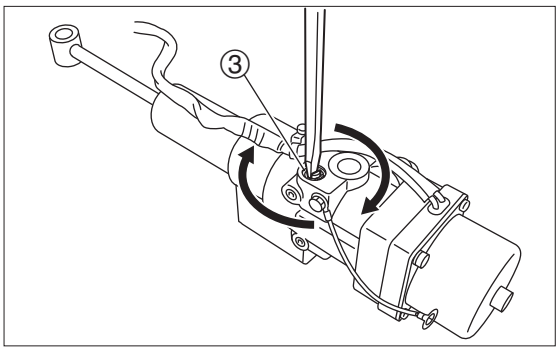


> Apply PT fluid to new O ring before attaching it to power tilt assembly.

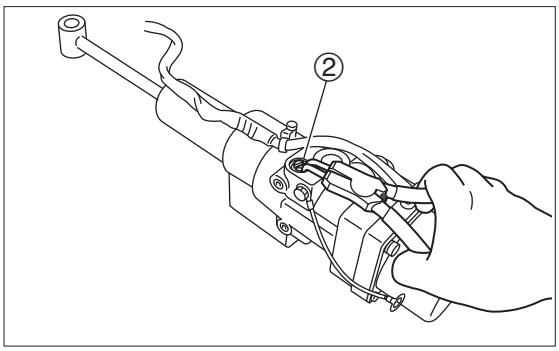
③ Manual valve
④ O ring
⑤ Seal washer

6. Attach O rings (2 pcs) ④ to manual valve.

7. Attach manual valve ③ to power tilt ass'y.



8. Attach C ring ②.

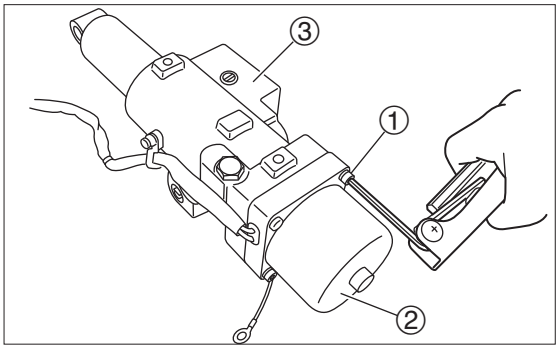


8.Power Tilt Motor

1）Removal, Check and Repair of Power Tilt Motor

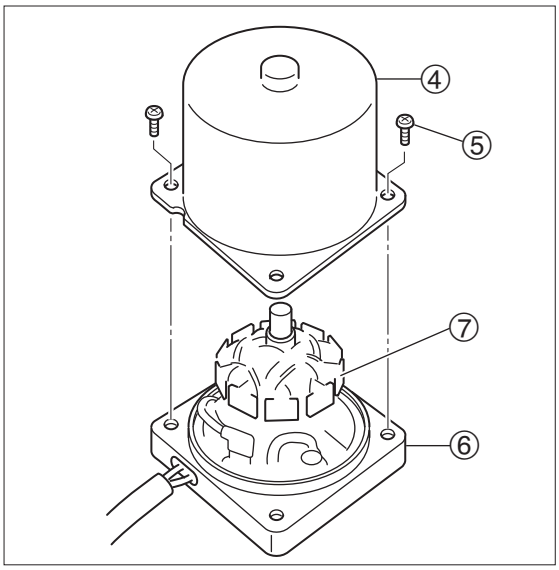
1. Remove 2 inner hex bolts ①, and then remove motor ass'y ② from power tilt pump and cylinder ass'y ③.

> Before disassembling power tilt motor, drain power tilt fluid. **<Refer to section 7.>**



2. Remove 2 screws ⑤, and then remove yoke ass'y ④ from motor bracket ass'y ⑥.

3. Remove armature ass'y ⑦ from yoke ass'y ④.

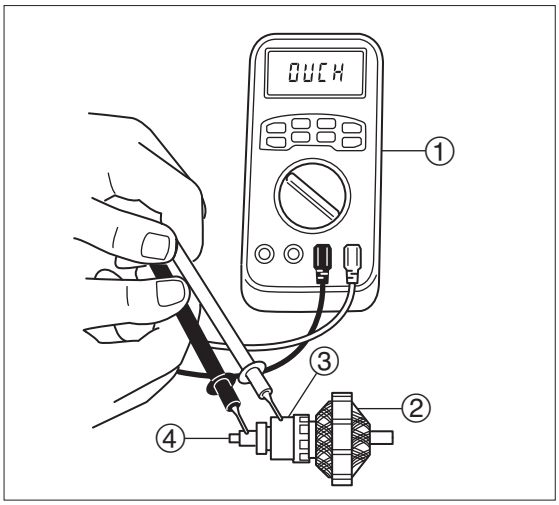


④Yoke ass'y
⑤Screw
⑥Motor bracket
⑦Armature ass'y

2) Continuity Test

1. Check electrical conductivity of armature ②. Replace armature ass'y if other than specification.

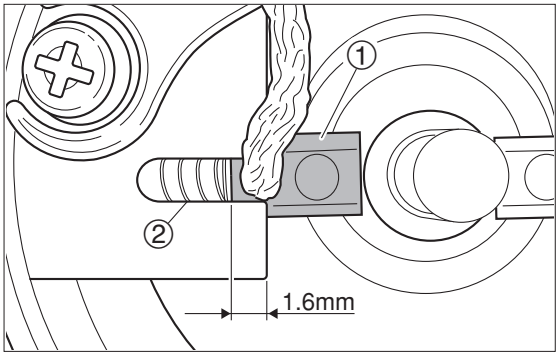
Armature Conductivity : ③Commutator ④Armature shaft	Non-conductive ∞



①Meter
②Armature
③Commutator
④Armature ass'y

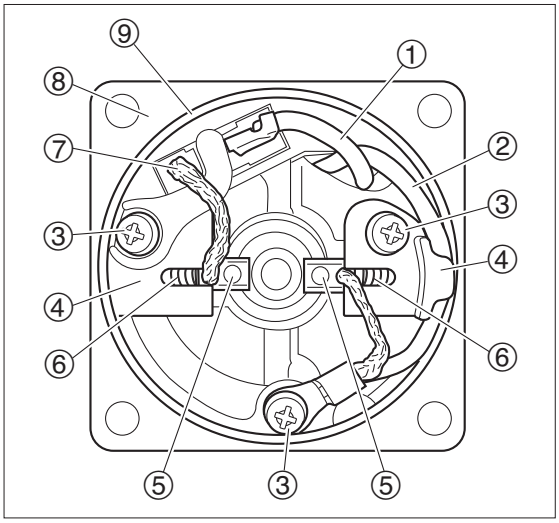
3) Inspection of Motor

1. Replace brush ① if it is damaged or if gap between brush end in the groove of brush holder ② and brush holder end is 1.6mm or less.



4) Replacement of Motor

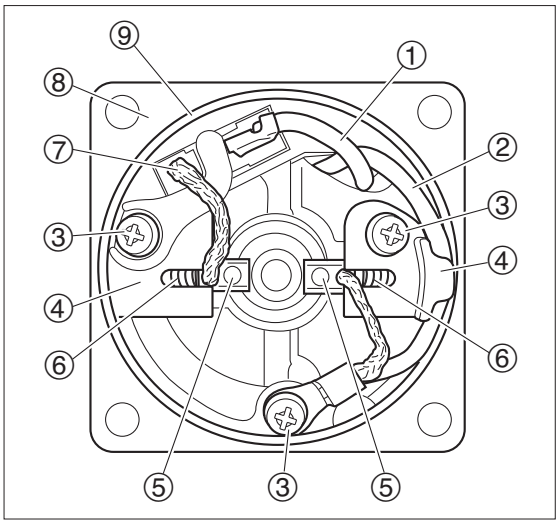
1. Remove 3 screws ③, and remove brush ⑤ and circuit breaker ⑦ from motor bracket ⑧.
2. Remove circuit breaker ⑦.
3. Remove brush holder ④ and brush ⑤.



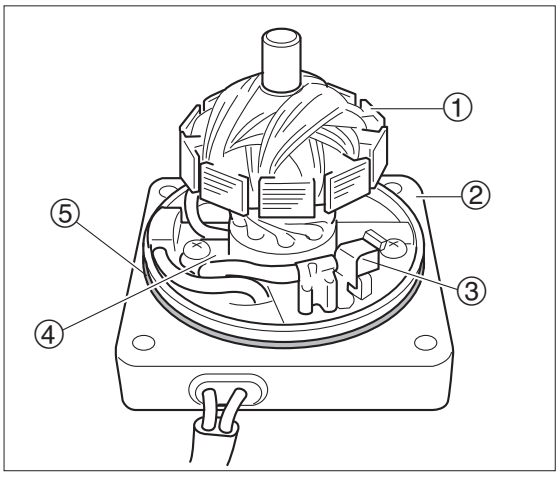
①Wire (blue)
②Wire (green)
③Screw
④Brush holder
⑤Brush
⑥Spring
⑦Circuit breaker
⑧Motor bracket
⑨O ring

5) Assembling Power Tilt Motor

1. Attach circuit breaker ⑦ to motor bracket ⑧.
2. Attach circuit breaker holder securely by using screws.
3. Attach blue wire ① to terminal post of circuit breaker ⑦.
4. Place green wire ② along bore of bracket.
5. Attach brush holder ④ by using screw ③.
6. Attach green wire ② and brush wire end to motor bracket ⑧ securely by using screw ③.
7. Attach 2 springs ⑥ in the brush.
8. Attach circuit breaker ⑦ and brush ⑤ in the groove.
9. Attach armature ① while holding brush ③ located in the groove during installation of armature ① to motor bracket ②.
10. Attach O ring ⑤ to motor bracket ②.



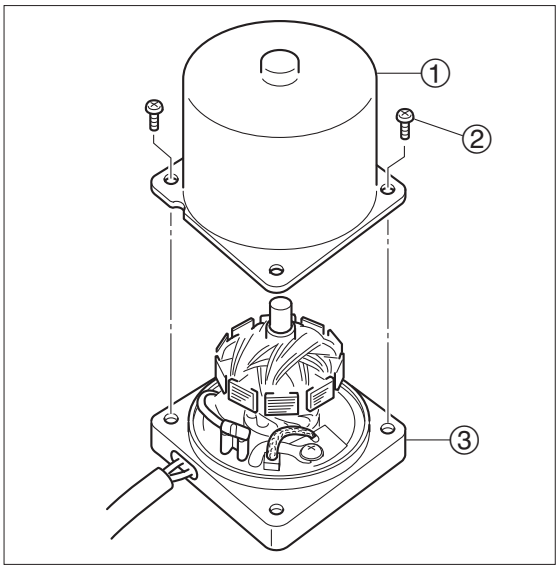
①Wire (blue)
②Wire (green)
③Screw
④Brush holder
⑤Brush
⑥Spring
⑦Circuit breaker
⑧ Motor bracket
⑨O ring



①Armature
②Motor bracket
③Brush
④Brush
⑤O ring

7

11. Attach yoke ass'y ① by using 2 screws ② with holding armature's shaft from the back side of motor bracket.



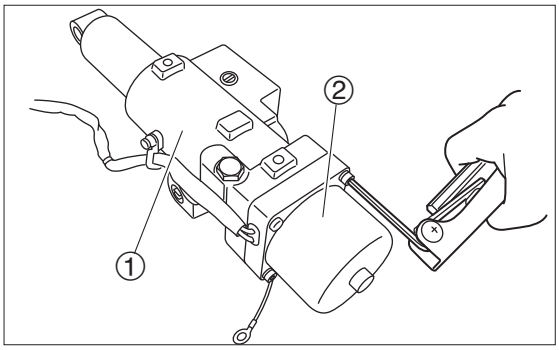
①Yoke ass'y
②Screw (2)
③Motor bracket

9.Power Tilt Pump

1) Disassembly of Power Tilt Pump

⚠ WARNING

Contamination of hydraulic system can give damage to the components and circuits, possibly resulting in serious damage to the product.
Before inspecting hydraulic circuit and parts, organize working space and tools.
Do not use cloth for inspection and servicing of parts.
Hydraulic circuit may be clogged.
Remove oil feed plug before beginning the work.
Keeps parts in the plastic bags during disassembly.

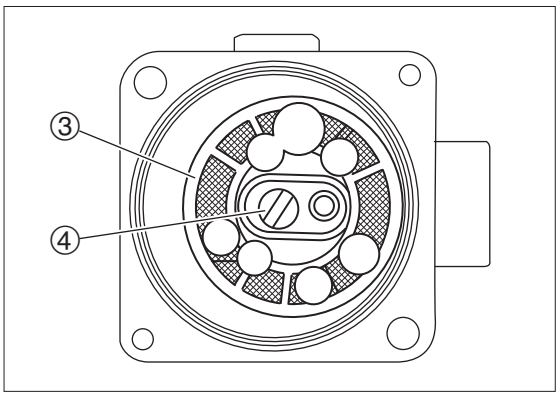


1. Remove power tilt ass'y from outboard motor.

2. Remove power tilt motor ass'y ② from power tilt ass'y ①.

3. Remove pump coupling ④.

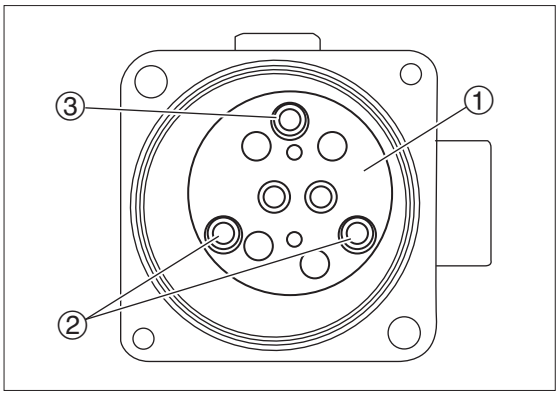
4. Remove filter ③ from power tilt ass'y.



③Filter
④Pump/motor coupling

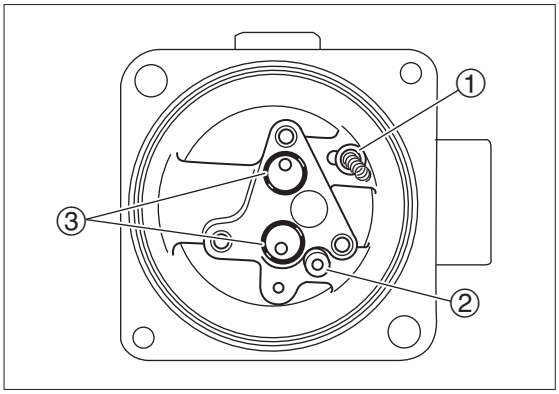
Relief valve ass'y is located in the power tilt pump.
When removing pump, be careful not to lose its parts.

5. Remove 3 screws ②, ③ that secure power tilt pump ① and assembly.



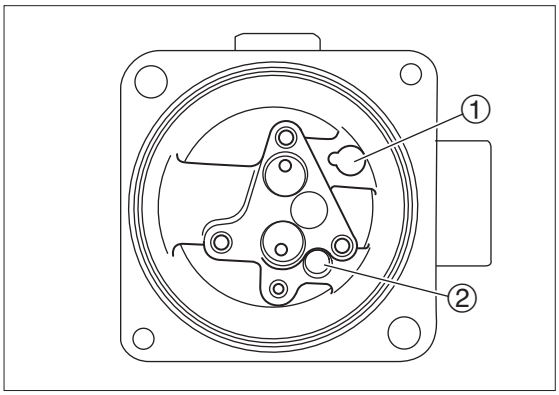
①Power tilt pump
②Internal hex screw (5mm×20)
③Internal hex screw (5mm×25)

6. Remove UP side relief valve ①, DOWN relief orifice ② and O ring ③ from power tilt housing.



①Up relief valve component
②Down relief orifice
③O ring

7. Check down side orifice screen ② and up side relief valve seat face ①. Replace parts if necessary.



①Up relief valve seat
②Down orifice screen

7

2) Assembling Power Tilt Pump

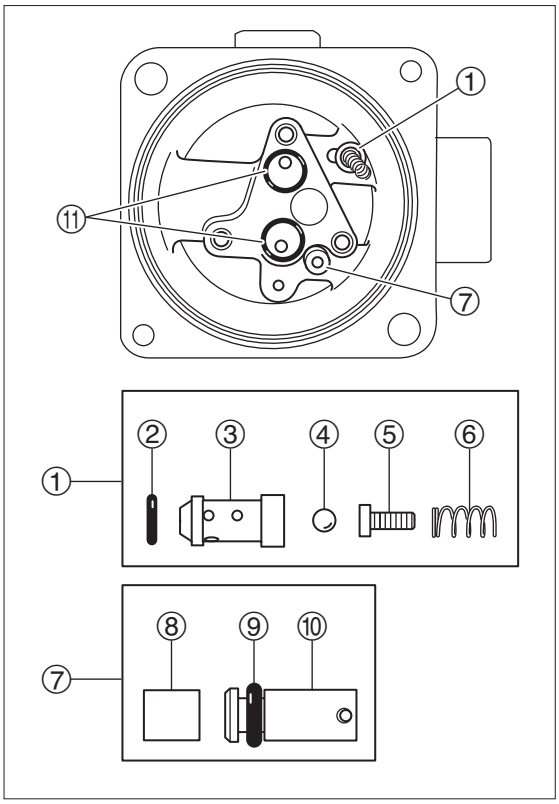
1. Coat new O rings (2) ⑪ with oil, and attach it to power tilt housing.

2. Coat new O ring ⑨ with oil, and attach it to orifice ⑩.

3. Attach filter ⑧ and orifice ⑩.

4. Attach up side relief valve ① to power tilt pump housing.

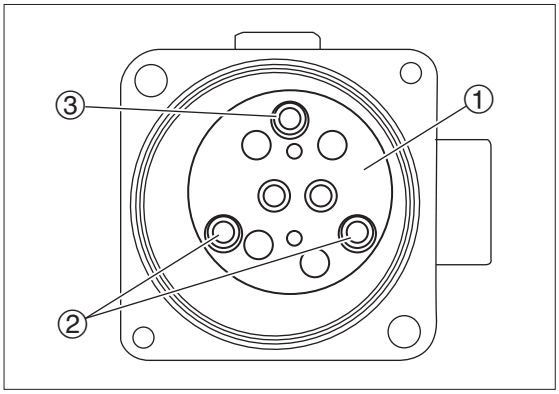
Recommended PT Fluid :
ATF DEXRON II



①Up relief valve ass'y
②O ring
③Valve seat
④Ball
⑤Spring guide
⑥Spring
⑦Down orifice ass'y
⑧Filter
⑨O ring
⑩orifice
⑪O ring

5. Secure pump with screws ②, ③.
Tighten screws to specified torque.

Pump mounting screw :
5N · m (4lb · ft) [0.5kgf · m]



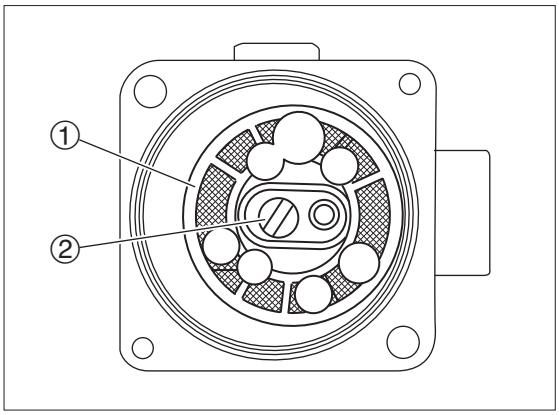
①Power tilt pump
②Internal hex screw (5mm×20)
③Internal hex screw (5mm×25)

6. Attach cleaned screen ①.

7. Attach pump coupling ② to pump.

8. Install motor ass'y to power tilt pump and cylinder ass'y.

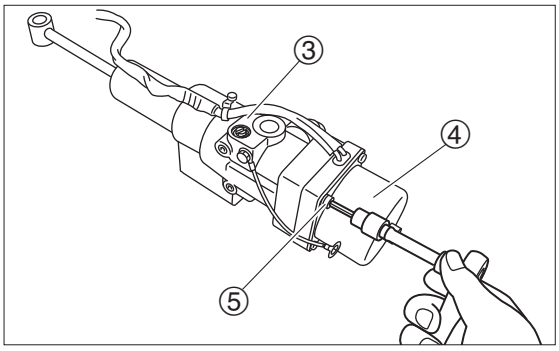
9. Attach wireharness mounting screws.



①Pump filter
②Pump/motor coupler

10. Install motor ass'y ④ to cylinder ass'y and power tilt pump ③ by using screws ⑤, and tighten screws to specified torque.

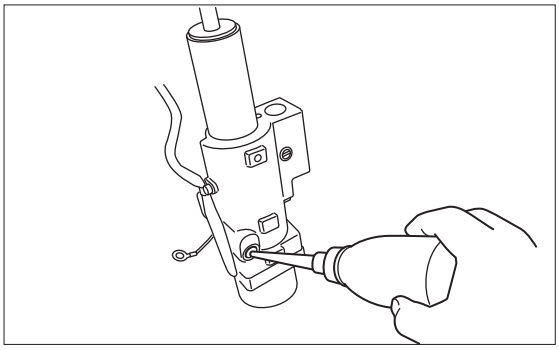
Motor ass'y installation screws:
5N · m (4lb · ft) [0.5kgf · m]



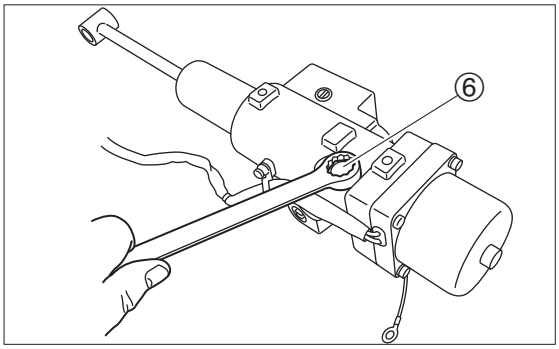
11. Fill power trim system with power trim fluid.

Recommended PT Fluid :
ATF DEXRON II

Extend trim rod and put PT unit vertically. Pour fluid until it overflows from inlet.

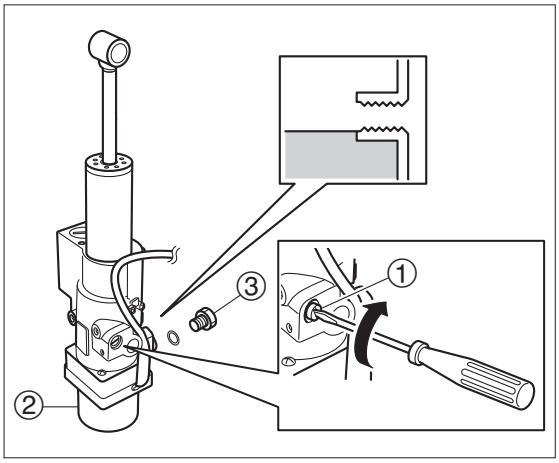


12. Attach the cap ⑥.



7

3) Air-Purging PT Unit (Separated from Outboard Motor)



1. Turn manual valve ① clockwise fully.

2. Put PT unit ② on the work bench vertically, remove cap ③ and check level of fluid in the reservoir.

⚠ WARNING

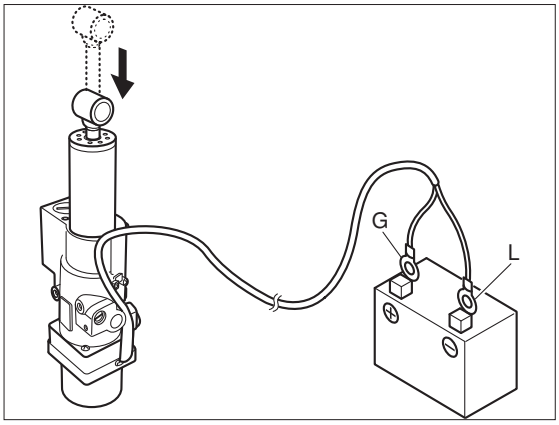
Check fluid level with tilt rod fully extended. Removing reserve tank cap with tilt rod at halfway position can cause blasting out of PT fluid, which is dangerous, and also result in inaccurate fluid level reading.

3. Add recommended PT fluid to specified level if it is lacking.

Recommended PT Fluid :
ATF DEXRON II

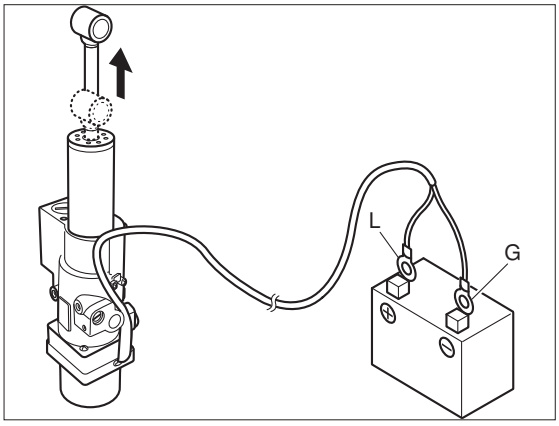
4. Put cap ③ and tighten to specified torque.

Reserve Tank Cap :
1.5N · m (1.1lb · ft) [1.5kgf · m]



5. Reconnect PT motor lead wires to battery terminals to fully retract tilt rod.

Tilt Rod	PT motor lead wires	Battery Terminals
DOWN	Green (G)	+ : Positive Terminal
	Blue (L)	– : Negative Terminal



6. Reconnect PT motor lead wires to battery terminals to fully extend tilt rod.

Tilt Rod	PT motor lead wires	Battery Terminals
UP	Blue (L)	+ : Positive Terminal
	Green (G)	– : Negative Terminal

Repeat above steps several times to move up and down tilt rod (When reversing motor lead wire connection, keep the connection open for two or three seconds.).

7. Check fluid level with tilt rod fully stretched.
Add recommended PT fluid to specified level if it is lacking.

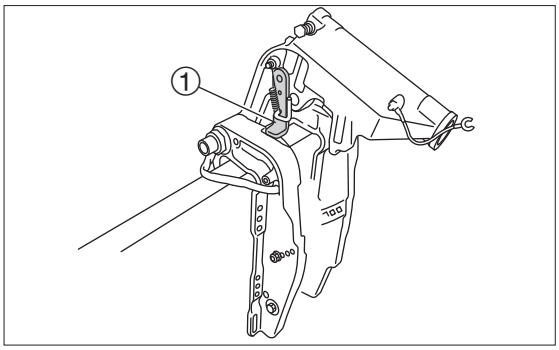
Recommended PT Fluid :
ATF DEXRON II

8. Repeat steps 2. to 7. until fluid reaches specified level.

9. Reattach cap.

4) Installation of Power Tilt Ass'y

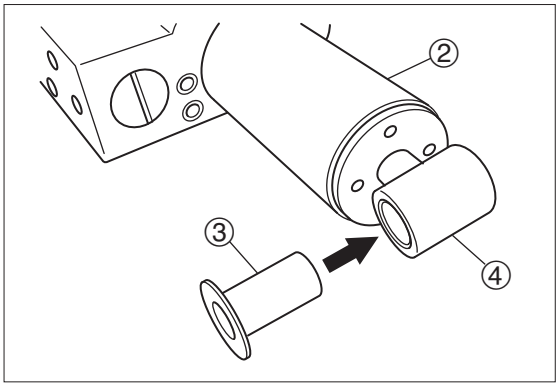
1. Fully tilt up outboard motor and lock with tilt stopper ①.



⚠ WARNING

- **Be sure to lock outboard motor with tilt stopper after tilting up. Leaving outboard motor up without locking may lead to accidental descent due to reduction of PT hydraulic pressure.**
- **When removing PT unit without removing power unit, hold outboard motor using hoist at tilt up position. Without such means, outboard motor can tilt down, causing danger.**

2. Install bushing ③ on the tilt cylinder rod ④.



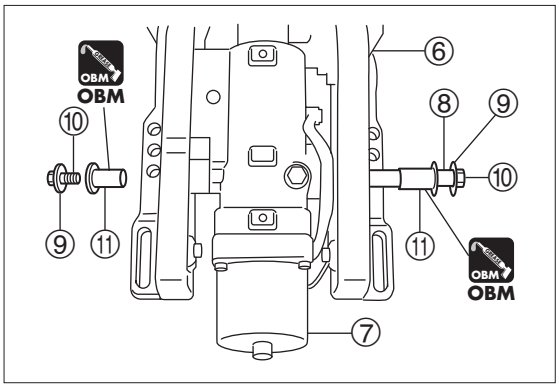
②Power tilt cylinder
③Bushing
④Cylinder rod eye

3. Attach pivot bushings ⑤ (2) to clamp bracket ⑥.

4. Place power tilt ass'y ⑦ between clamp brackets ⑥.

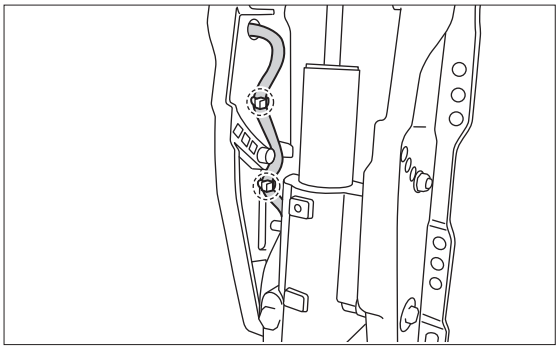
5. Put tilt cylinder pivot pin (lower) ⑧ in the hole of clamp bracket ⑥ to secure power tilt ass'y ⑦.

OBM



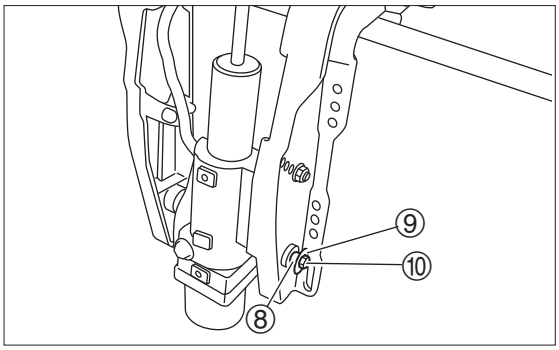
⑥Clamp bracket
⑦Power tilt ass'y
⑧Pivot pin
⑨Washer (2)
⑩Bolt (2)
⑪Pivot bushings (2)

6. Route PT cable as illustrated, and secure with lock ties.



7. Put washer ⑨ and bolt ⑩ on the pin (lower) ⑧ and tighten the bolt to specified torque.

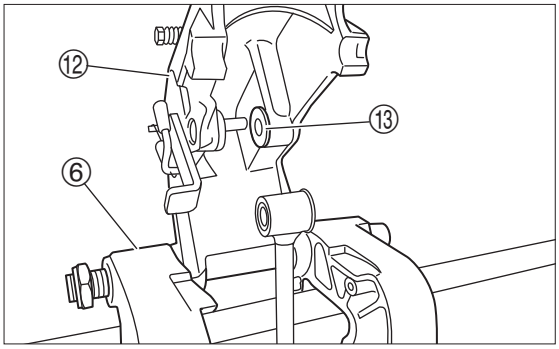
Retaining Bolt ⑩ :
13N · m (9.4lb · ft) [1.3kgf · m]



8. Attach bushings (2) ⑫ to swivel bracket ⑬.

9. Extend power tilt cylinder rod to align tilt cylinder rod and swivel bracket.

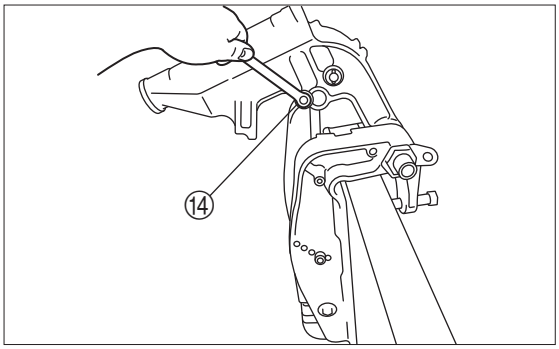
10. Fit tilt cylinder rod by using cylinder pin (upper).



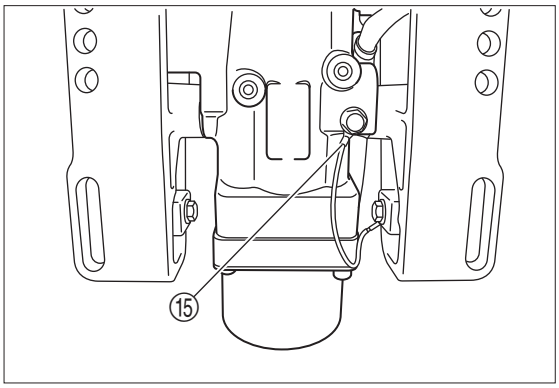
⑥Clamp bracket
⑫Swivel bracket
⑬Bushings (2)

11. Tighten tilt cylinder pin (upper) mounting bolt ⑭ to specified torque.

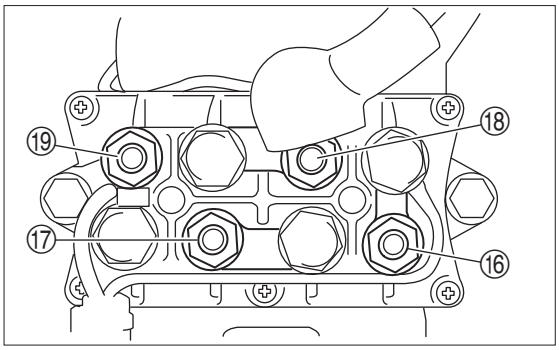
Tilt cylinder pin (upper) mounting bolt :
13N · m (9.4lb · ft) [1.2kgf · m]



12. Secure ground cord ⑮ by using bolt.



13. Attach electrical cord of power tilt unit to power tilt relay ⑯, ⑰.



⑯Up relay terminal (blue)
⑰Negative terminal (black)
⑱Positive terminal (red)
⑲Down relay terminal (green)

14. Unlock tilt stopper, and repeat tilting up and down outboard motor to bleed air from hydraulic circuit.
< Refer to 3) Air-Purging PT Unit >

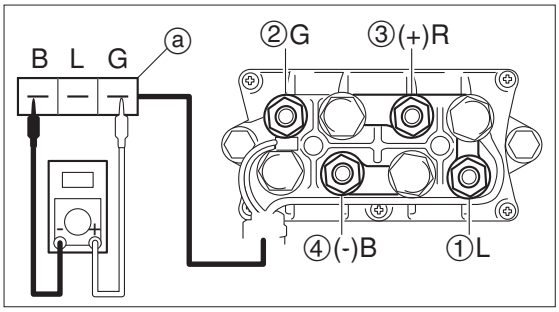
15. Check power tilt fluid level, and replenish if necessary.

5) Inspection of PT Relay

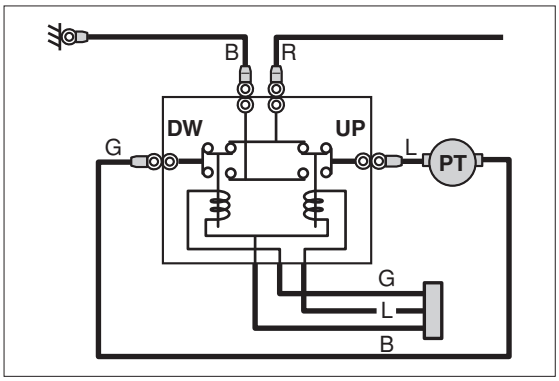
This test can be made without removing parts.

1. Disconnect positive ③ and negative ④ cables from battery.

2. Remove PT switch wire coupler from socket ⓐ, then disconnect lead wire from terminal ① and ②.



3. Check PT relay wires in accordance with the following table. Replace if out of specification.



Conductivity of PT relay

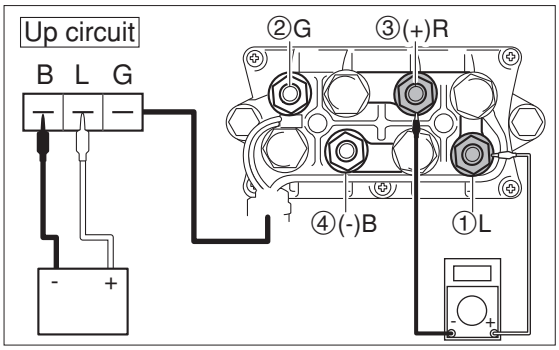
Coupler	Blue (L) - Black (B) Green (G) - Black (B)	Conductive
	Terminal ① - Terminal ④ (-) Terminal ② - Terminal ④ (-)	Conductive
	Terminal ① - Terminal ③ (+) Terminal ② - Terminal ③ (+)	Non-conductive

7

Inspection of UP side relay

4. As shown in the figure, connect blue terminal (L) in the coupler to battery positive terminal and black terminal (B) to negative terminal, and then, connect circuit tester leads to PT relay terminals ① and ③.

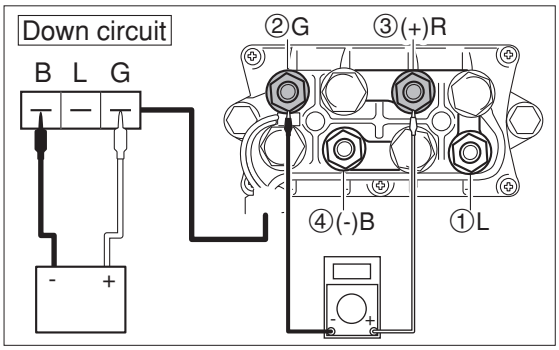
5. Check electrical conductivity between terminals ① and ③. Replace relay if non-conductive.



Inspection of DOWN side relay

6. As shown in the figure, connect green terminal (G) in the coupler to battery positive terminal and black terminal (B) to negative terminal, and then, connect circuit tester leads to PT relay terminals ② and ③.

7. Check electrical conductivity between terminals ② and ③. Replace relay if non-conductive.

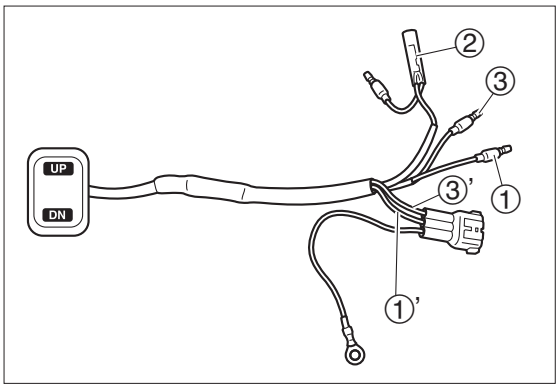


6) Inspection of PT Switch

1. Check electrical conductivity of PT switch. Replace if out of specification.

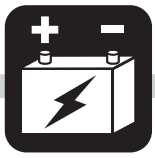
Lead Wires

Switch Position	Sky Blue (Sb) ① and ①'	Red (R) ②	Pink (P) ③ and ③'
UP (Tilt Up)	○	○	
Free			
DOWN (Tilt Down)		○	○

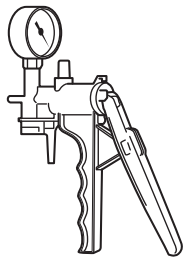
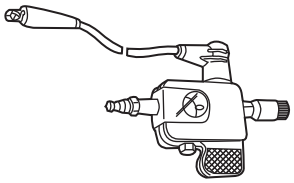


8

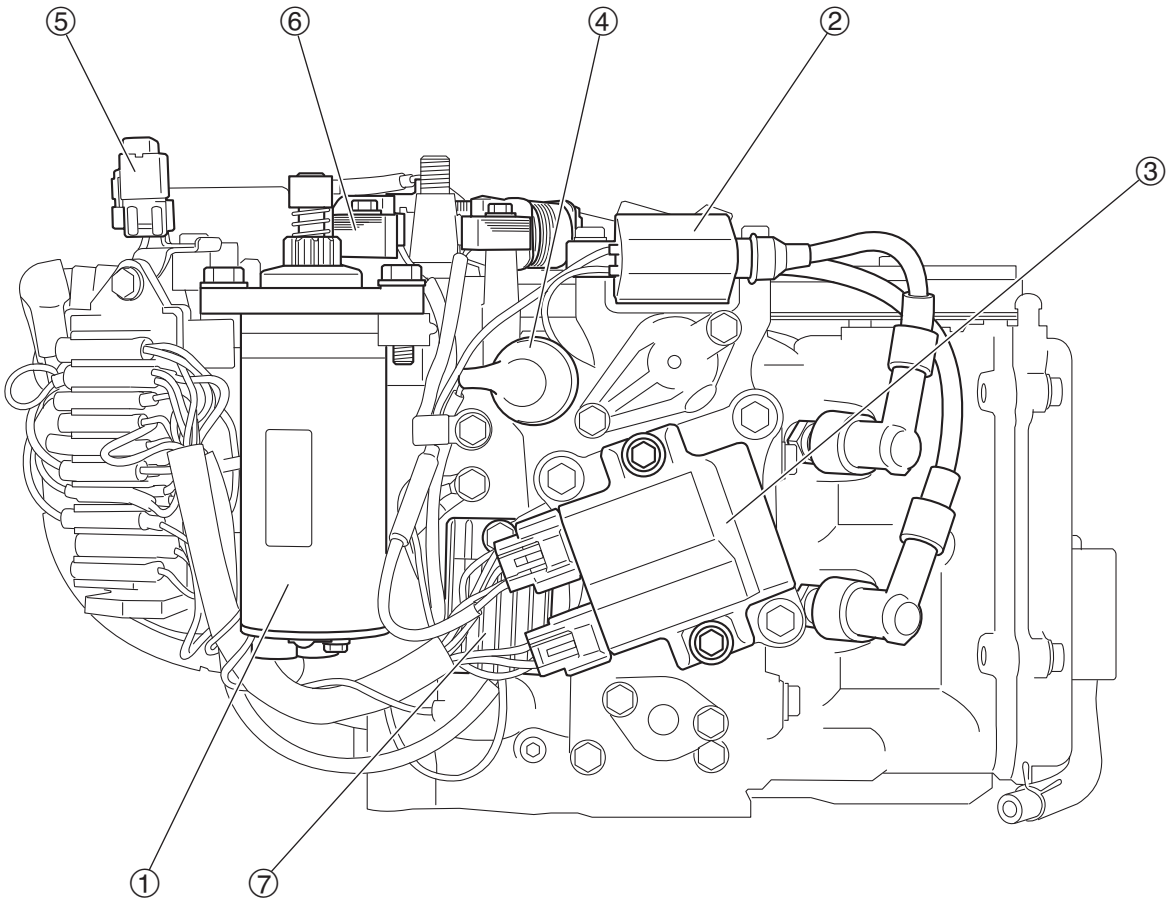
Electrical System



1.Special Tools

	
Vacuum/Pressure Gauge P/N. 3AC-99020-0	Spark Tester P/N. 3F3-72540-0
Inspecting pressure	Inspecting sparks

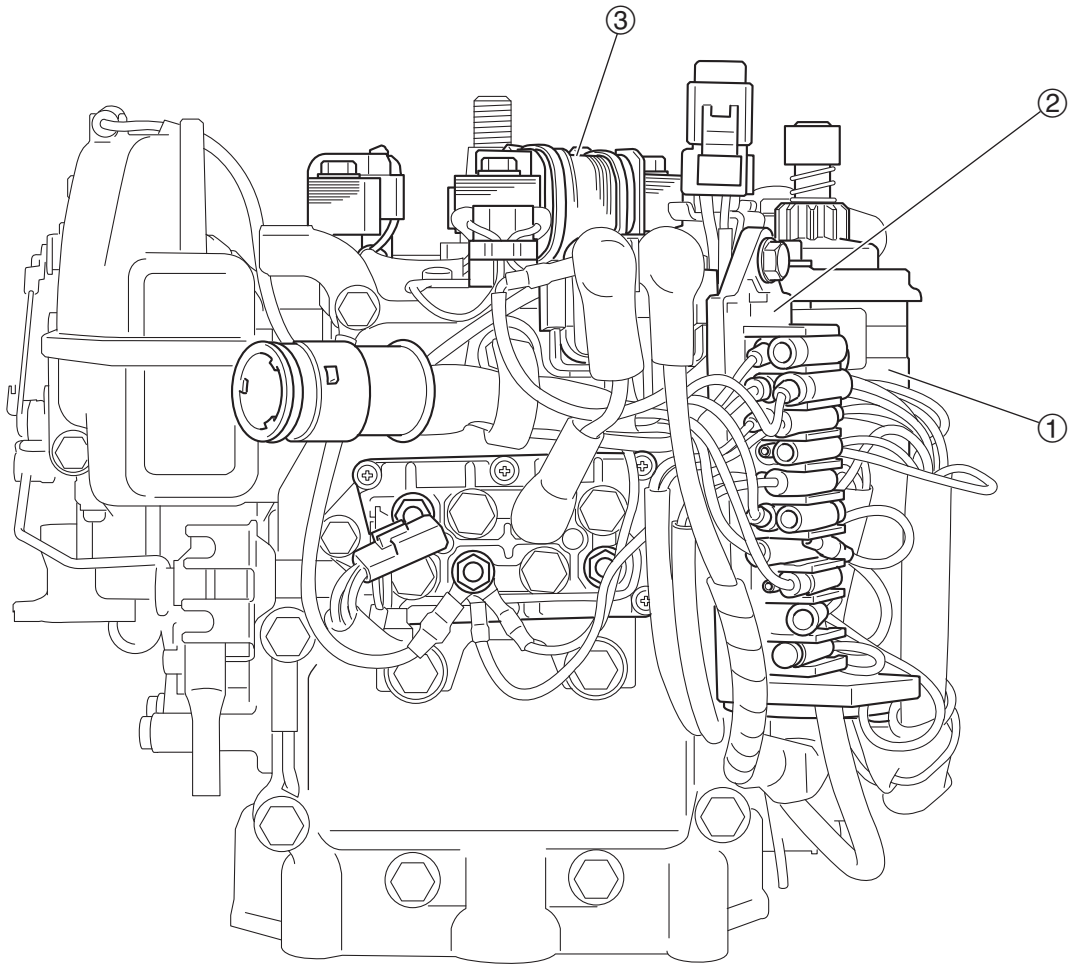
2. Electrical Component Layout
Port Side View



< EPT Model >

① Starter Motor
② Ignition Coil
③ C.D. Unit
④ Oil Pressure Switch
⑤ Fuse
⑥ Alternator
⑦ Rectifier

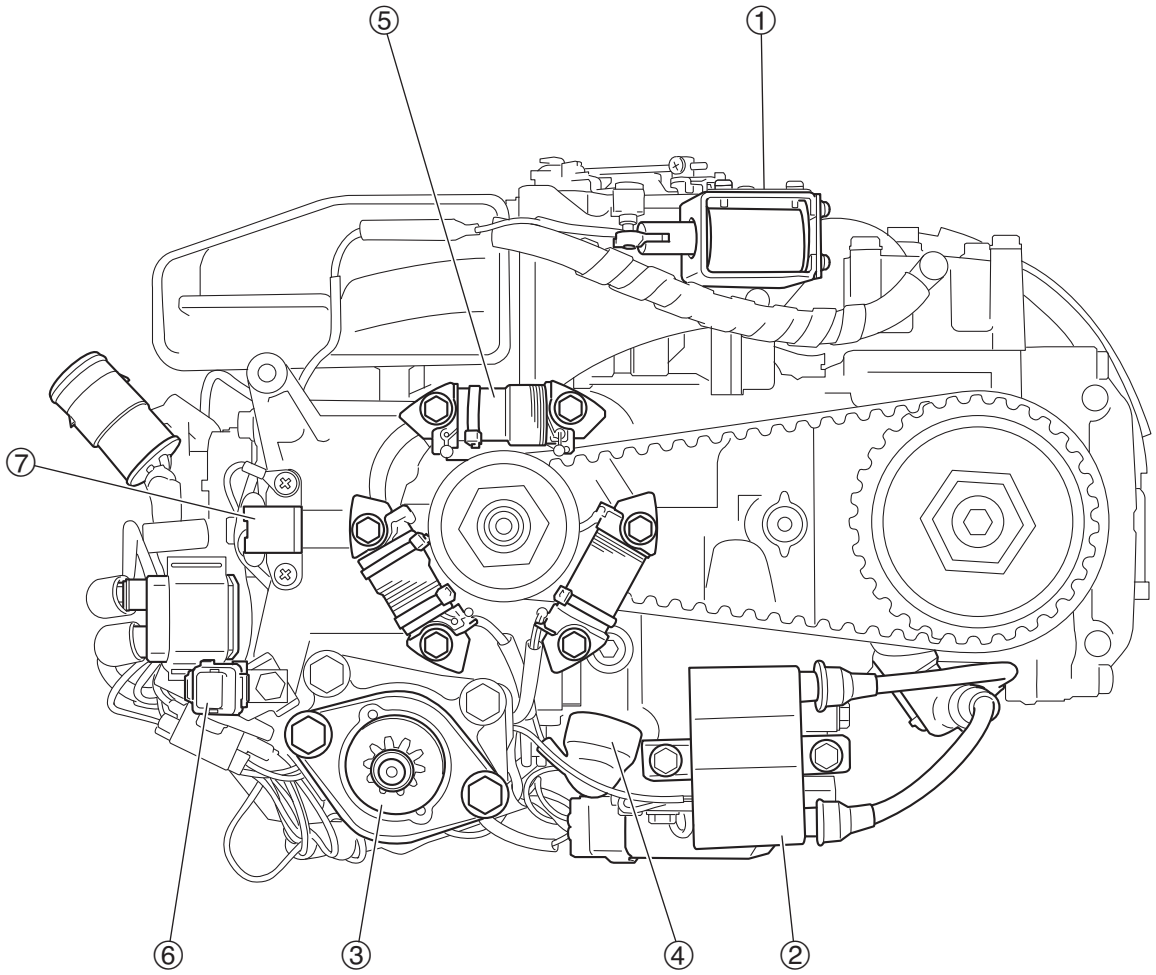
Bow Side View



< EPT Model >

① Starter Motor
② Cable Terminal Holder
③ Alternator

Top View

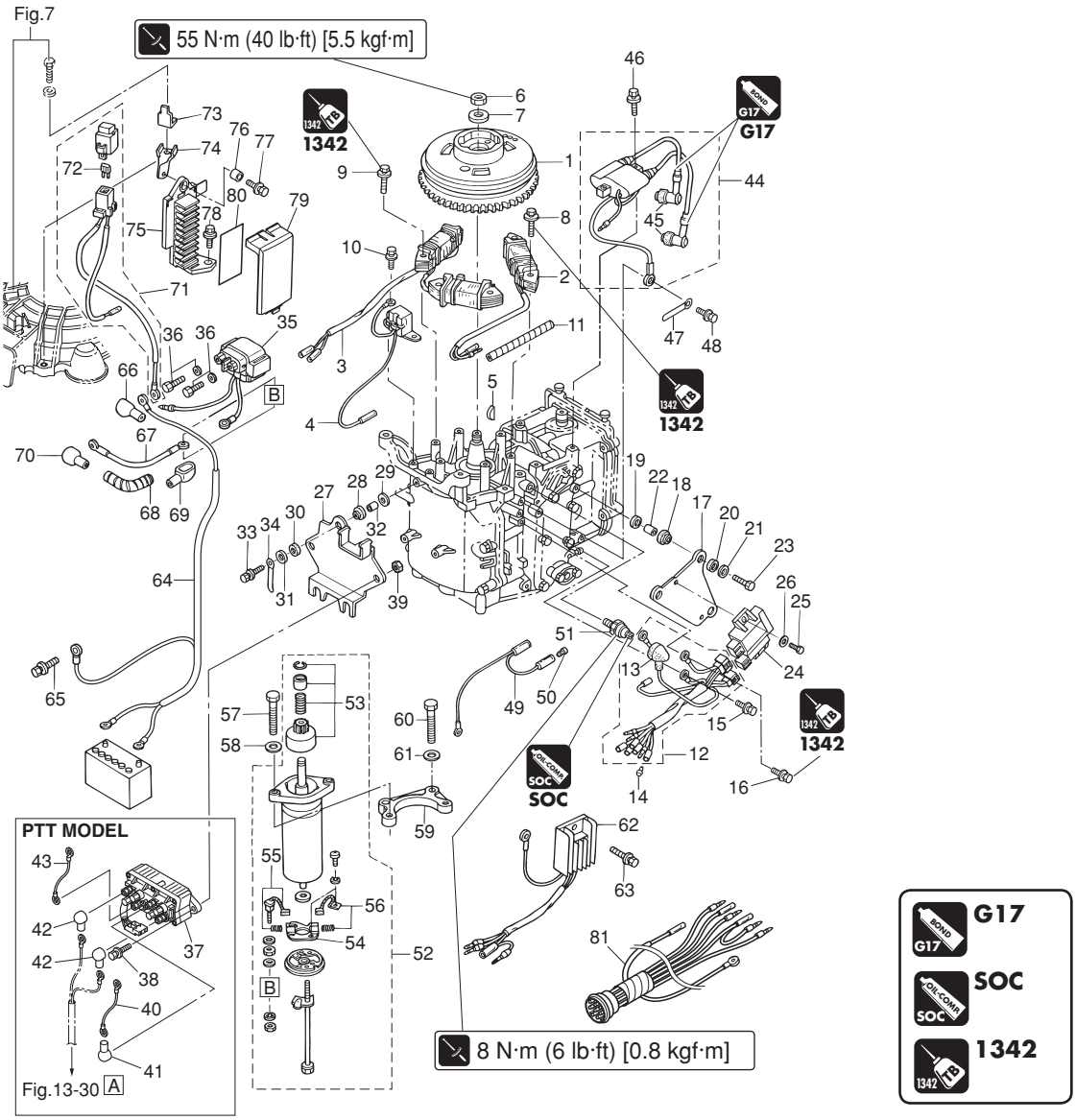


< EPT Model >

① Choke Solenoid
② Ignition Coil
③ Starter Motor
④ Oil Pressure Switch
⑤ Alternator
⑥ Fuse
⑦ Pulser Coil

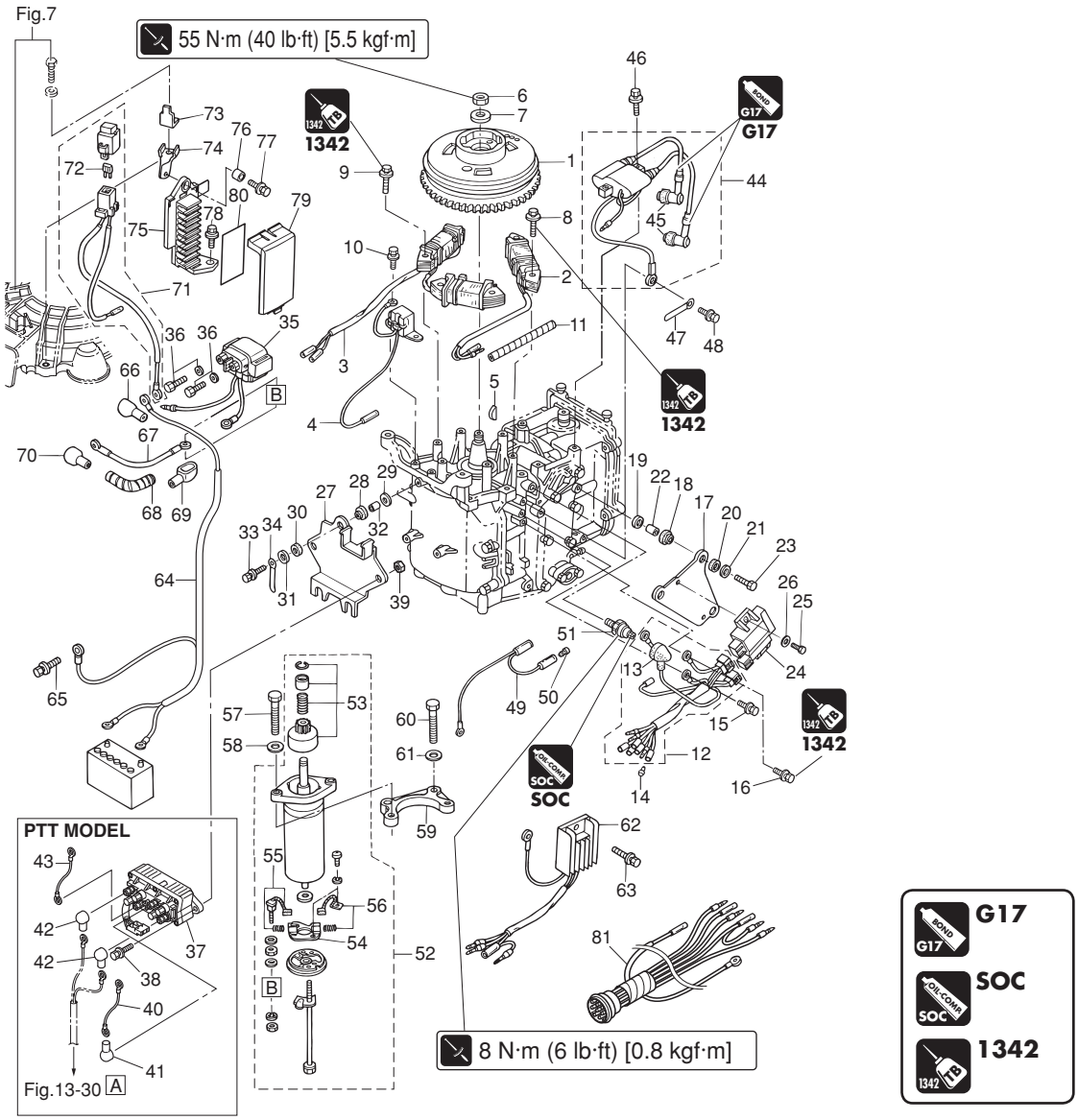
3.Parts Layout

Magneto • Electric Parts



Ref. No.	Description	Q'ty	Remarks
1	Flywheel W/Gear	1	FF-51
2	Exciter Coil	1	
3	Alternator Ass'y	1	for EF/EFT & EP/EPT
4	Pulsar Coil	1	
5	Key	1	Magneto
6	Nut 12-P1.25	1	
7	Washer	1	
8	Bolt	2	
9	Bolt	4	Alternator for EF/EFT & EP/EPT
10	Bolt	2	Pulsar Coil
11	Spiral Tube Protector ø10-100	1	Alternator & Exciter Cord for EF/EFT & EP/EPT
12	Cd Unit Cord Ass'y	1	
13	Grommet	1	
14-1	Cable Terminal Plug	2	Remote Control Light Green & White
14-2	Cable Terminal Plug	2	Stop Switch Brown & Black for EP/EPT
15	Bolt	1	Ground Cable
16	Bolt	1	for MF
17	Cd Unit Bracket	1	
18	Rubber Mount 8.5-18-7	3	
19	Washer 6-16-1.5	3	Cylinder Block Side
20	Rubber Mount 9-16-4.3	3	

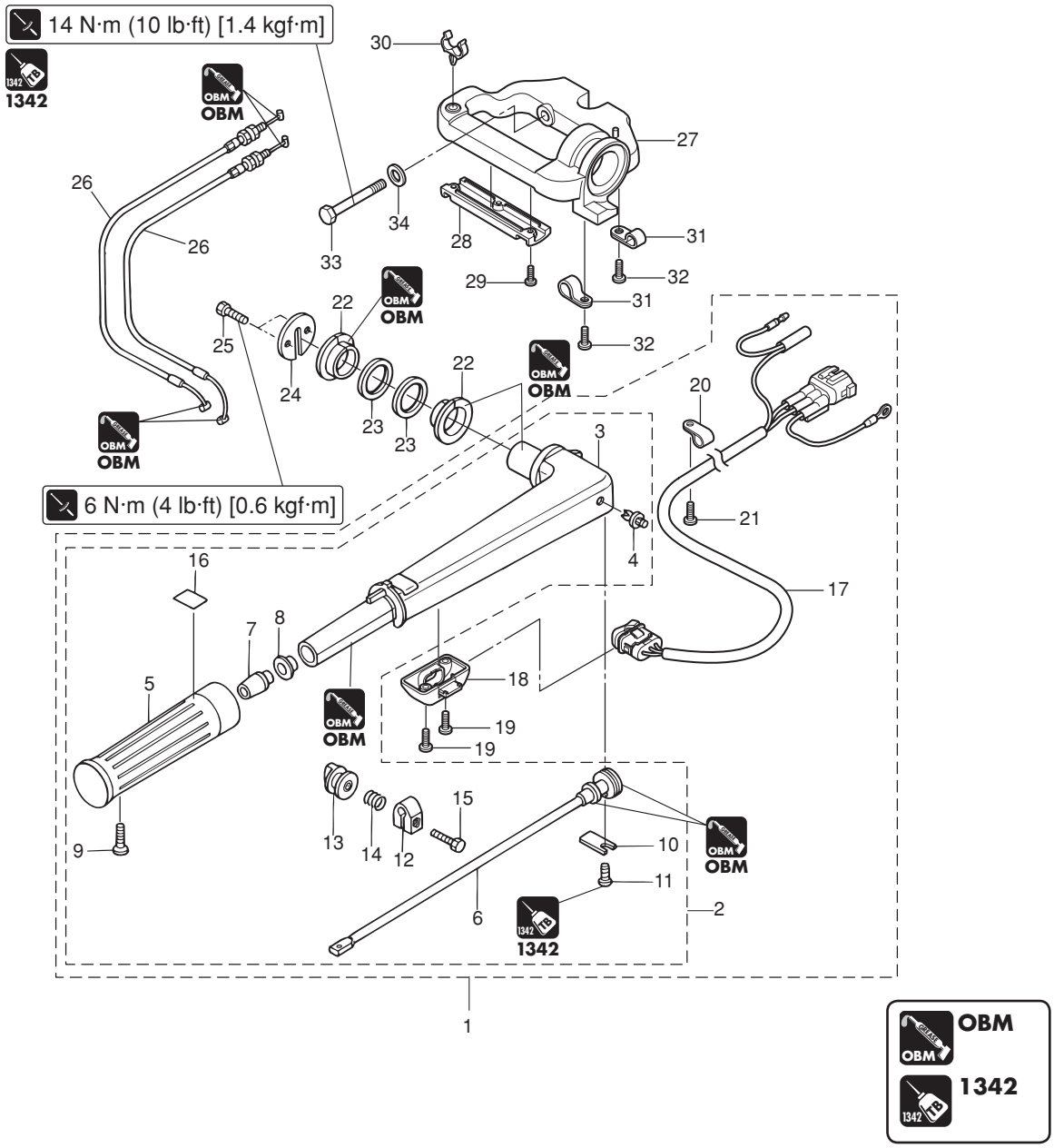
Ref. No.	Description	Q'ty	Remarks
21	Washer 6-16-1.5	3	for EF/EFT & EP/EPT
22	Collar 6.2-9-7.4	3	
23	Bolt	3	
24	CD Unit	1	
25	Pre-coated Bolt 6-16	2	
26	Washer 6-16-1.5	2	
27	Electric Bracket Ass'y	1	for EF/EFT & EP/EPT
28	Rubber Mount 8.5-18-7	3	for EF/EFT & EP/EPT
29	Washer 6-16-1.5	3	Cylinder Block Side
30	Rubber Mount 9-16-4.3	3	for EF/EFT & EP/EPT
31	Washer 6-16-1.5	3	for EF/EFT & EP/EPT Solenoid Switch Side
32	Collar 6.2-9-7.4	3	for EF/EFT & EP/EPT
33	Bolt	3	for EF/EFT & EP/EPT
34	Clamp 6.5-87P	1	for EP/EPT
35	Starter Solenoid	1	for EF/EFT & EP/EPT
36	Bolt	2	for EF/EFT & EP/EPT
37	Ptt Solenoid Switch (A)	1	for EFT & EPT
38	Bolt	2	for EPT
39	Nut	2	for EPT
40	Solenoid Switch Cord (A) L=80	1	Red for EFT & EPT
41	Terminal Cap 8-13-28	1	Red Cord for EFT & EPT



Ref. No.	Description	Q'ty	Remarks
42	Terminal Cap 8-13-28	2	PTT Cord for EFT & EPT
43	Solenoid Switch Cord (B) L=150	1	Black for EFT & EPT
44	Ignition Coil W/R-Cap	1	
45	Plug Cap W/Resistance	2	
46	Bolt	2	
47	Clamp 6.5-47.5P	1	Alternator & Exciter Cord
48	Bolt	1	
49	Separate Cord (Blk)	1	Yellow & Black
50	Cable Terminal Plug	1	Yellow Separate Cord
51	Oil Pressure Switch	1	
52	Starter Motor Ass'y	1	for EF/EFT & EP/EPT
53	Pinion Ass'y	1	
54	Brush Holder	1	
55	Positive Brush	1	Spring
56	Negative Brush	1	Spring
57	Bolt	2	Starter Motor
58	Washer	2	Starter Motor
59	Starter Motor Bracket	1	for EF/EFT & EP/EPT
60	Bolt	2	Bracket
61	Washer	2	Bracket
62	Rectifier Complete	1	for EF/EFT & EP/EPT

Ref. No.	Description	Q'ty	Remarks
63	Bolt	1	
64	Battery Cable L=2500	1	for EF/EFT & EP/EPT
65	Bolt	1	
66	Terminal Cap 13-13-28	1	
67	Starter Cable L=200	1	for EF/EFT & EP/EPT
68	Spiral Tube Protector ø10-100	1	Starter Cable
69	Terminal Cap 8-18-28	1	
70	Terminal Cap 8-13-28	1	
71	Fuse Wire Ass'y L=185	1	for EF/EFT & EP/EPT
72	Fuse 20A	2	for EF/EFT & EP/EPT
73	Fuse Holder Bracket	1	for EF/EFT & EP/EPT
74	Cable Terminal Holder Stay	1	for EF/EFT & EP/EPT
75	Cable Terminal Holder	1	for EF/EFT & EP/EPT
76	Collar 6-8-6	1	
77	Bolt	1	
78	Bolt	1	
79	Cover	1	for EF/EFT & EP/EPT
80	Wiring Diagram Decal	1	
81	Cord Ass'y	1	for EPT

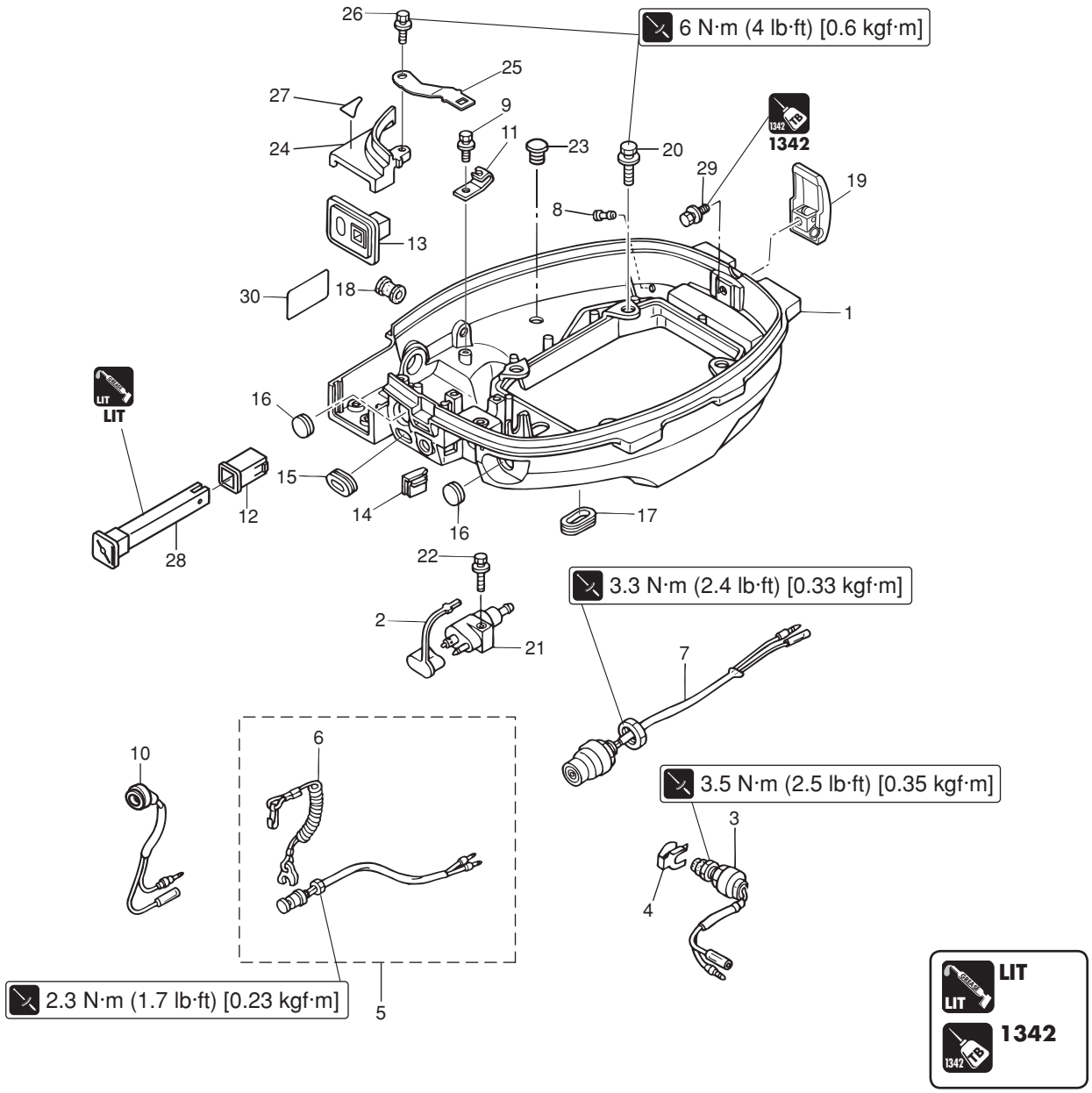
Tiller Handle



Ref. No.	Description	Q'ty	Remarks
1	Tiller Handle Ass'y	1	for EFT
2	Tiller Handle Ass'y	1	for MF/EF
3	Tiller Handle	1	
4	Plastic Rivet 6.5	1	
5	Grip	1	
6	Throttle Shaft	1	
7	Throttle Shaft Damper	1	
8	Bushing 14-15.8-7	1	
9	Screw	1	
10	Throttle Shaft Support	1	
11	Screw	1	
12	Friction Piece	1	
13	Adjusting Nut	1	
14	Spring	1	
15	Bolt	1	
16	Throttle Decal	1	
17	PTT Switch Ass'y	1	for EFT

Ref. No.	Description	Q'ty	Remarks
18	Switch Box	1	for EFT
19	Screw	2	for EFT
20	Clamp 6-9.5l	1	for EFT
21	Screw	1	for EFT
22	Bushing	2	
23	Washer 39-52-1	2	
24	Cover	1	
25	Bolt	2	
26	Throttle Wire	2	
27	Steering Bracket	1	for EFT
28	Cord Holder	1	for EFT
29	Screw	3	for EFT
30	Cord Holder	1	for EFT
31	Clamp 6-9.5l	2	for EFT
32	Screw	2	for EFT
33	Bolt 10-80	2	for EFT
34	Washer	2	for EFT

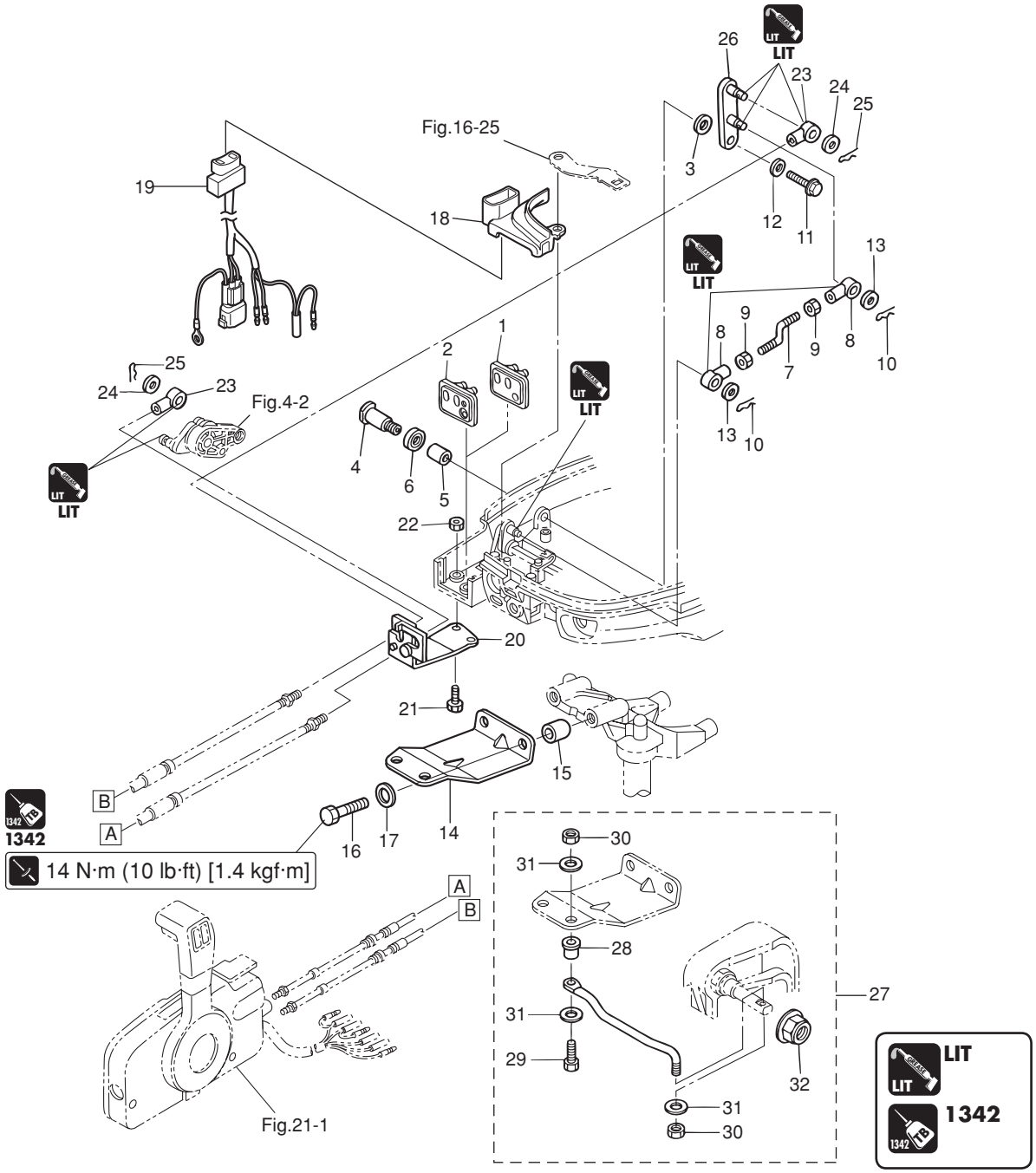
Bottom Cowl



Ref. No.	Description	Q'ty	Remarks
1	Bottom Cowl	1	
2	Fuel Connector Protector	1	
3	Neutral Switch	1	for EF/EFT
4	Neutral Switch Actuator	1	for EF/EFT
5	Stop Switch Ass'y	1	for MF & EF/EFT
6	Stop Switch Lanyard Ass'y	1	
7	Main Switch Ass'y	1	for EF/EFT
8	Nipple 6.8-3-10	1	
9	Bolt	2	for MF Clamp, Cable Bracket
	Bolt	1	for EF/EFT & EP/EPT Cable Bracket
10	Pilot Lamp Ass'y	1	
11	Starter Lock Cable Bracket	1	
12	Bushing	1	for MF & EF/EFT
13	Grommet	1	for MF & EF/EFT
14	Grommet	1	Throttle Cable
15	Grommet 25-15-3	1	Battery Cable
16-1	Grommet 17-2.7	1	Main Swich for MF

Ref. No.	Description	Q'ty	Remarks
16-2	Grommet 17-2.7	2	Main Swich, Stop Swich for EP/EPT
17	Grommet 40-18-3	2	Shift Rod PTT Cord
18	Grommet 16-17.5	1	for MF & EF/EFT Throttle Shaft
19	Cowl Latch Ass'y	1	
20	Bolt	4	
21	Fuel Connector (Male)	1	
22	Bolt	1	
23	Sub-water Inlet Hose Plug	1	
24	Shift Lever Bracket Cover	1	
25	Stay	1	for EFT/EPT
26	Bolt	1	
27	Shift Decal	1	for MF & EF/EFT
28	Choke Rod	1	for MF & EF/EFT
29	Bolt	1	
30	Storage Decal	1	

Remote Control Parts



Ref. No.	Description	Q'ty	Remarks
1	Grommet	1	for EP
2	Grommet	1	for EPT
3	Wave Washer d=14	1	
4	Pivot	1	
5	Hook Lever Bushing	1	
6	Seal Ring 13.8-22-3.7	1	
7	Shift Lever Rod	1	
8	Cable Joint 4.5-40.5	2	Rod End
9	Nut	2	
10	Snap Pin d=8	2	Rod End
11	Bolt	1	
12	Washer 6.5-21-1	1	
13	Washer 8.5-18-1.6	2	Rod End
14	Steering Hook Plate	1	
15	Collar 10.1-20-15	2	
16	Bolt	2	

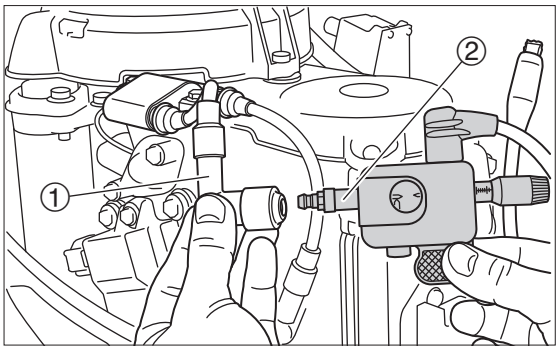
Ref. No.	Description	Q'ty	Remarks
17	Washer	2	
18	Remote Cont Cable Stay Cover	1	
19	Ptt Switch Ass'y	1	
20	Cable Clip Ass'y	1	
21	Bolt	2	
22	Nut	2	
23	Cable Joint	2	Cable End
24	Washer 8.5-18-1.6	2	Cable End
25	Snap Pin d=8	2	Cable End
26	Shift Arm (Remote Control)	1	Mark 3V2
27	Drag Link Ass'y	1	for EP
28	Spacer 9.6-19-13	1	
29	Bolt 3/8-35	1	
30	Nylon Nut 3/8-24UNF	2	
31	Washer 9.6-18-2	3	
32	Seal Ring	1	

4. Ignition System and Ignition Control System

1) Inspection of Ignition Sparks

1. Disconnect plug caps from spark plugs.

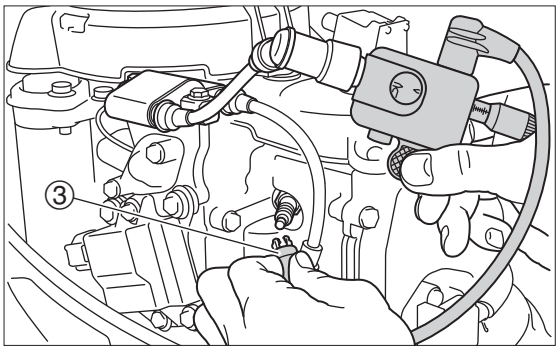
2. Connect plug cap ① to spark tester ②.



3. Connect spark tester clip ③ to spark plug tip electrode.

Spark Tester ② :
P/N. 3F3-72540-0

Spark Performance :
10 mm (0.4 in) or over

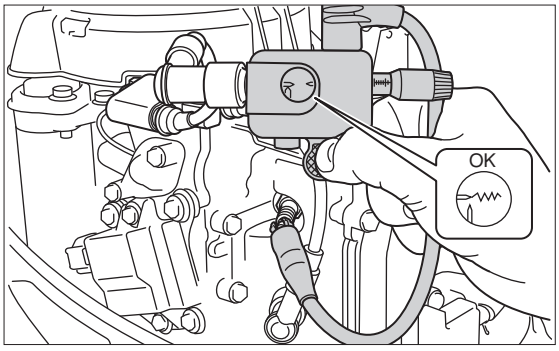


4. Start engine and check sparks. Check spark system if sparks are weak.

This test can be made without removing parts.

⚠ 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 inflammable gas, fuel, oil and fat away from tester to prevent them from catching sparks.**



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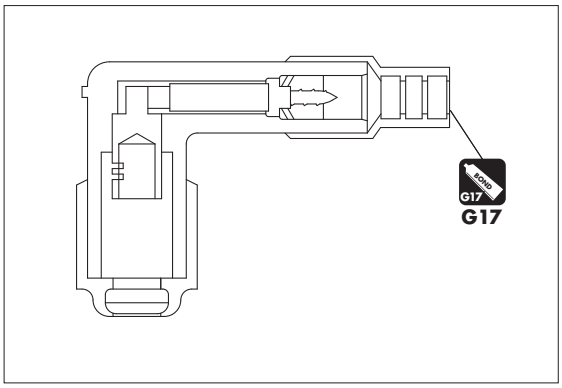
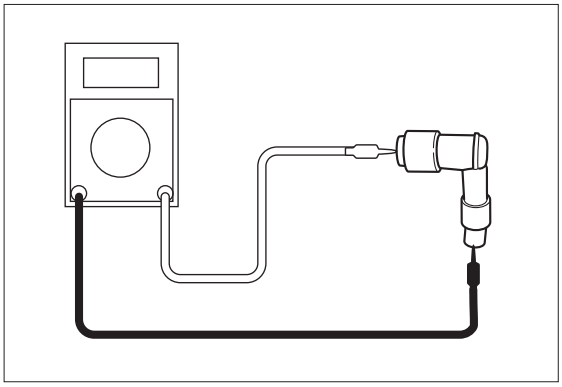
2) Inspection of Plug Cap

Remove the part and test it as a separate unit.

1. Disconnect plug caps from spark plugs.
2. Remove plug cap from high tension cable.
   (Cap screws on to wire)
   Remove by twisting counterclockwise.
3. Measure plug cap resistance. Replace if out of specification.

Plug Cap Resistance :
3.0 - 7.0 kΩ





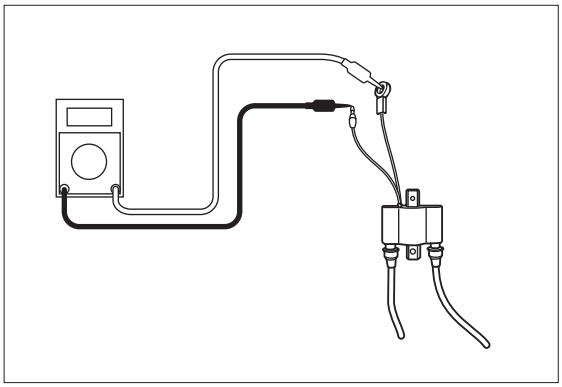
3) Inspection of Ignition Coils

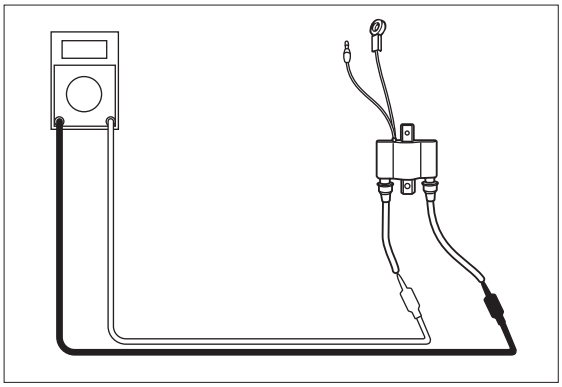
1. Remove ignition coil coupler.
2. Remove spark plug cap from high tension cable.
3. Measure ignition coil resistance. Replace if out of specification.

This test can be made without removing parts.

Ignition Coil Resistance :
Primary Coil : Between Orange (Or) - Ground (B)
0.26 - 0.35 Ω
Secondary Coil : Between High Tension Cord - High Tension Cord
6.8 - 10.2 kΩ

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

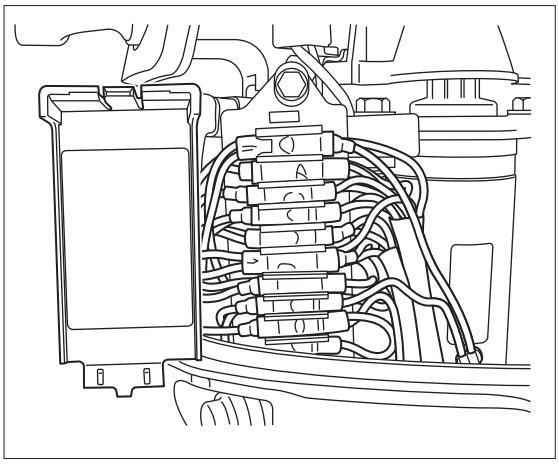




4) Inspection of Pulser Coil

1. Remove cable terminal holder cover.

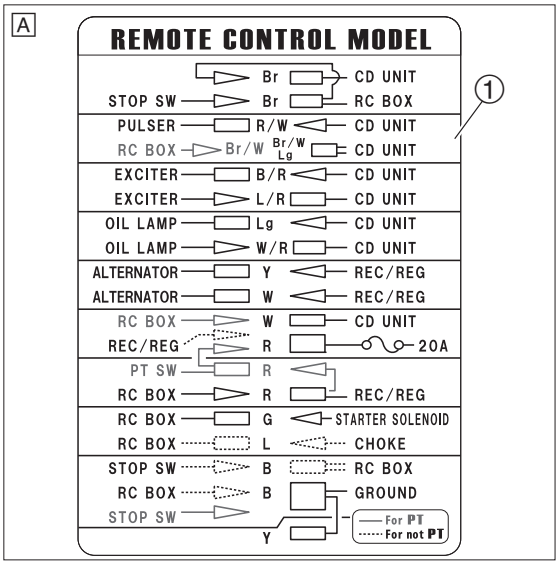
2. Disconnect cable coupler from pulser coil, and measure resistance.



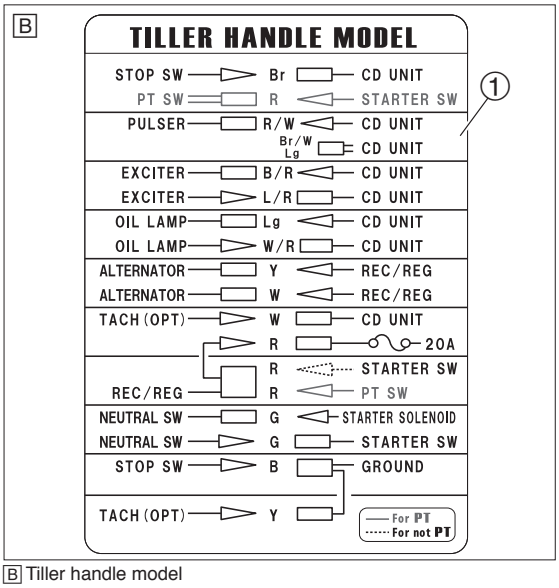
This test can be made without removing parts.

Pulser Coil Resistance (Reference value) :
Between Red/White (R/W) - Black (B) : 148 - 222Ω

Check the connection by referring to coupler connection chart ① located on the back of cable terminal holder cover.



A Remote control model



B Tiller handle model

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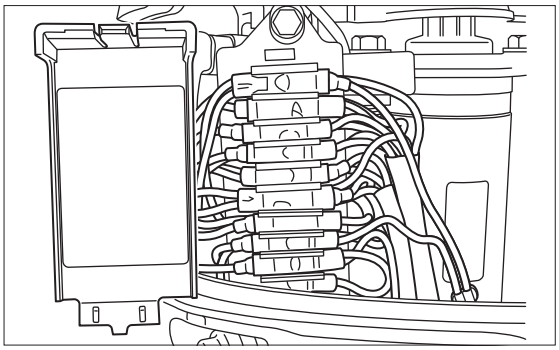
5) Inspection of Exciter Coil



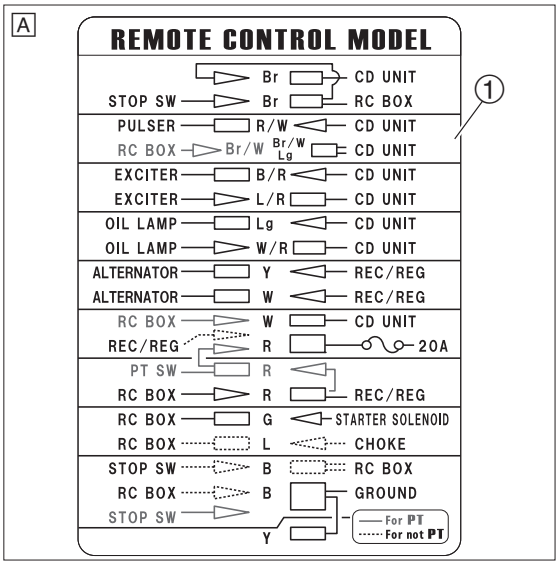
1. Remove cable terminal holder cover.

2. Disconnect cable coupler from exciter coil, and measure resistance.

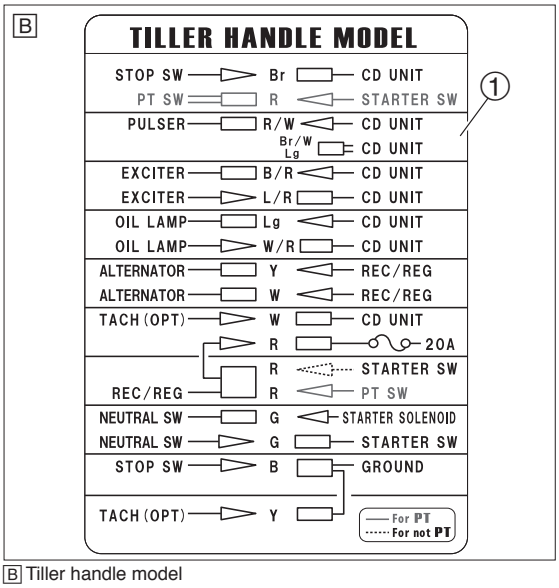
This test can be made without removing parts.

Exciter Coil Resistance (Reference value) :
Between Black/Red (B/R) - Blue (L) : 236 - 354 kΩ

Check the connection by referring to coupler connection chart ① located on the back of cable terminal holder cover.



A Remote control model



B Tiller handle model

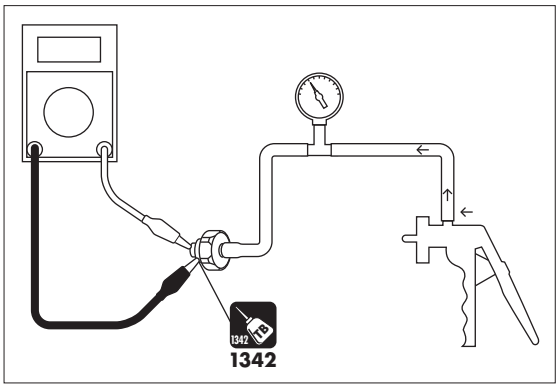
6) Inspection of Oil Pressure Switch

Remove the part and test it as a separate unit.

1. Check electrical conductivity of oil pressure switch. Replace if no conductivity.

2. Connect vacuum/pressure gauge to oil pressure switch.

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



3. Apply pressure slowly with vacuum/pressure gauge.

4. Check that oil pressure switch is not conductive with specified pressure applied. Replace if conductive.

Specified Pressure :
0.020 - 0.029 MPa (2.8 - 4.0 psi) [0.2 - 0.3 kgf/cm²]

5. Reinstall the part.

⚠ CAUTION

Over tighten can damage block.

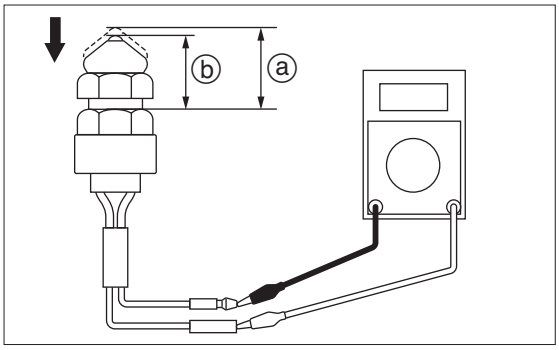
Oil Pressure Switch :
8 N · m (6 lb · ft) [0.8 kgf · m]

7) Inspection of Neutral Switch (Tiller Handle Model)

This test can be made without removing parts.

1. Check electrical conductivity of neutral switch. Replace if no conductivity.

Switch Position	Lead Wire Color	
	Green (G)	Green (G)
Released ⓐ		
Pushed ⓑ	○	○

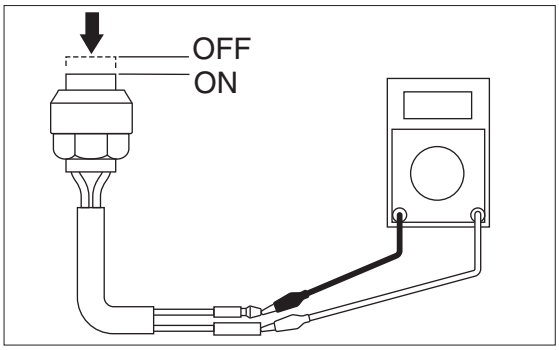


8) Inspection of Start Switch (Tiller Handle Model)

1. Check conduction of stop switch, and replace if not conductive.

This test can be made without removing parts.

Switch Position	Lead Wire Color	
	Green (G)	Red (R)
Released : OFF		
Pushed : ON	○	○



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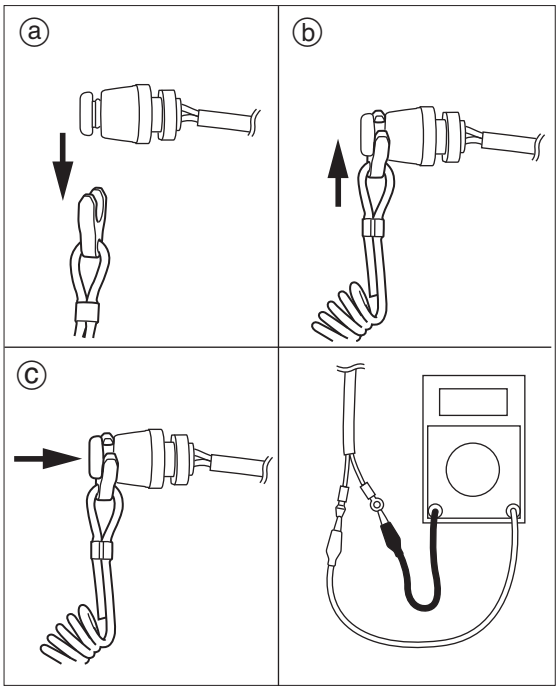
9) Inspection of Stop Switch

1. Check conduction of stop switch, and replace if not conductive.

This test can be made without removing parts.

Switch Position	Lead Wire Color	
	Brown (Br)	Black (B)
Remove lock ⓐ	○	○
Attach lock ⓑ		
Press switch ⓒ	○	○



5. Power Tilt (PT) System

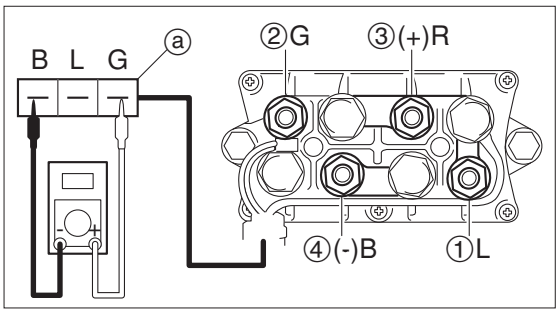
1) Inspection of PT Relay

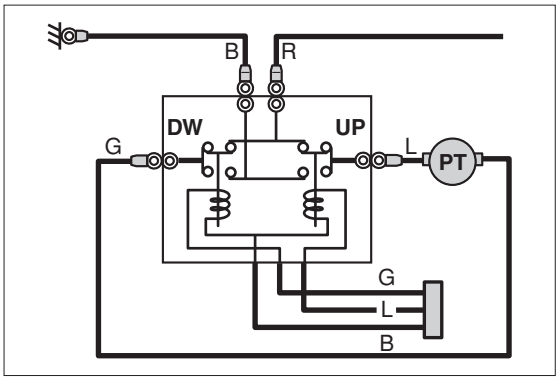
This test can be made without removing parts.

1. Disconnect positive terminal (R) ③ and negative terminal (B) ④ cables from battery.

2. Remove PT lead wire coupler ⓐ from PT switch socket, then disconnect PT lead wire from terminal ① and ②.

3. Check PT relay wires in accordance with the following table. Replace if out of specification.



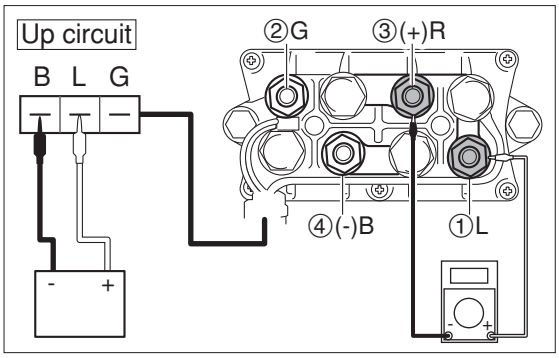


Conductivity of PT relay		
Coupler	Blue (L) - Black (B)	Conductive
	Green (G) - Black (B)	
	Terminal ① - Terminal ④ (-)	Conductive
	Terminal ② - Terminal ④ (-)	
	Terminal ① - Terminal ③ (+)	Non-conductive
	Terminal ② - Terminal ③ (+)	

Inspection of UP side relay

4. As shown in the figure, connect blue terminal (L) in the coupler to battery positive terminal and black terminal (B) to negative terminal, and then, connect circuit tester leads to PT relay terminals ① and ③.

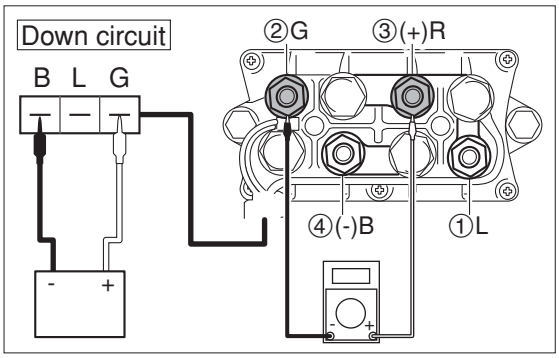
5. Check electrical conductivity between terminals ① and ③. Replace relay if non-conductive.



Inspection of DOWN side relay

6. As shown in the figure, connect green terminal (G) in the coupler to battery positive terminal and black terminal (B) to negative terminal, and then, connect circuit tester leads to PT relay terminals ② and ③.

7. Check electrical conductivity between terminals ② and ③. Replace relay if non-conductive.

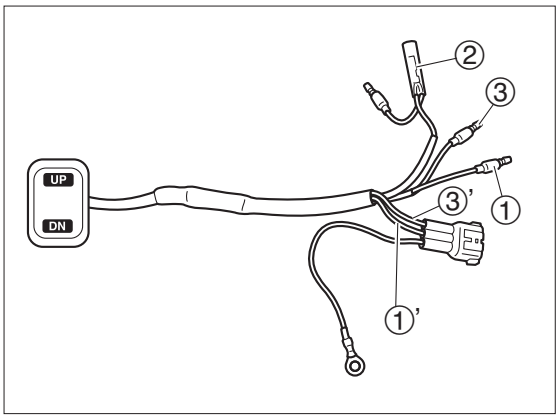


2) Inspection of PT Switch

1. Check electrical conductivity of PT switch. Replace if out of specification.

Lead Wires

Switch Position	Sky Blue (Sb) ① and ①'	Red (R) ②	Pink (P) ③ and ③'
UP (Tilt Up)	○	○	
Free			
DOWN (Tilt Down)		○	○

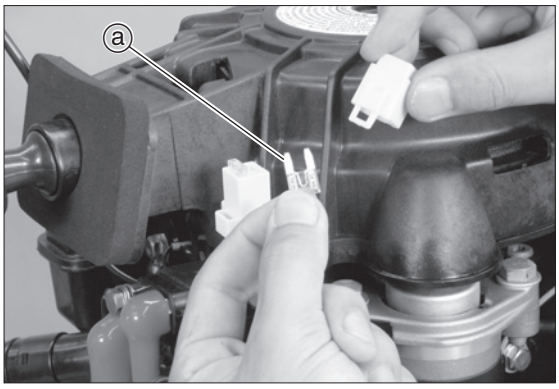


6. Starting System

1) Inspection of Fuse

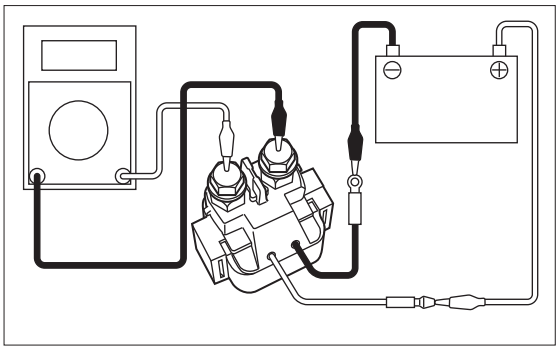
1. Check electrical conductivity of fuse ⓐ. Replace if no conductivity.

Flat or small sized plate fuse (20A) is adopted.



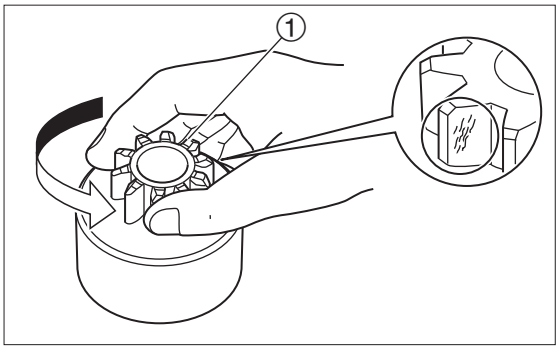
8

2) Inspection of Starter Solenoid



1. Connect tester lead wires to both terminals 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.

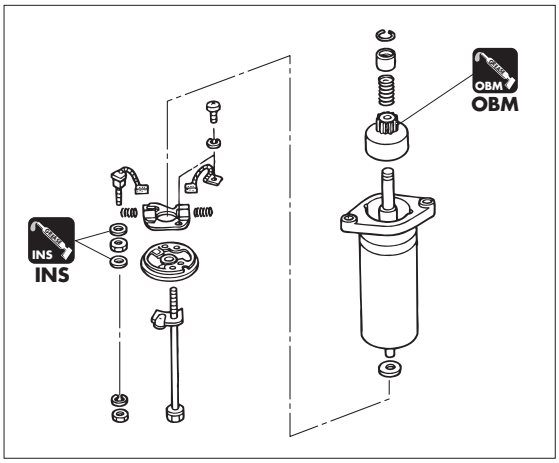
3) Inspection of Starter Motor Pinion



1. Check pinion teeth for crack and wear. Replace if necessary.
2. Turn only pinion to check that pinion ① can be rotated smoothly in one direction. Replace if necessary.

> Turn pinion ① counterclockwise to check that it can move up smoothly.

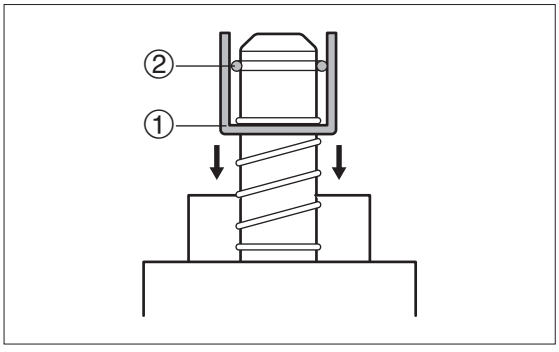
4) Disassembly of Starter Motor



1. Put locating mark between starter motor body and cap. (This mark facilitates reassembly.)
2. Slide pinion stopper ① downward as shown and remove clip ②.

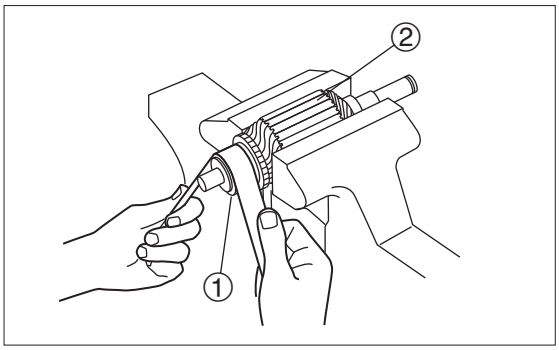
> Use small bladed screw driver to remove clutch. Be careful not to cut hand because clip is secured firmly.

3. Remove bolt and disassemble starter motor.



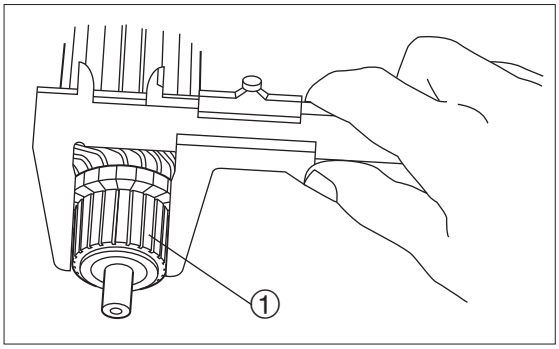
5) Inspection of Armature

1. Check commutator ① for dirt. If necessary, clean by using sand paper of No. 600 or by air-blowing.



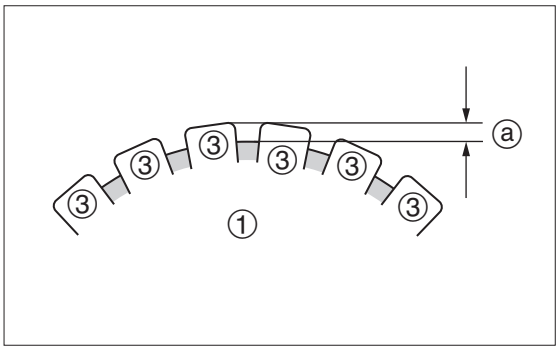
2. Measure commutator ① outer diameter. Replace starter motor ass'y if outer diameter is less than specified value.

Commutator Outer Diameter : Standard Value	20.0 mm (0.788 in)
Wear Limit :	19.7 mm (0.776 in)



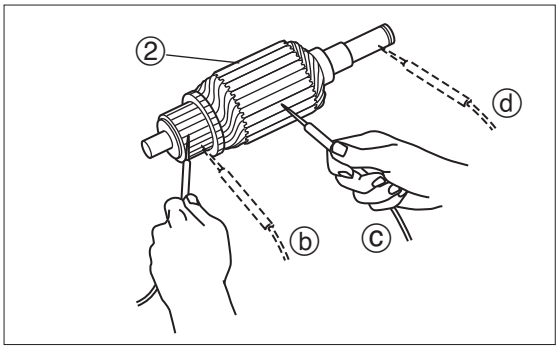
3. Measure undercut ⓐ of commutator ①. Replace starter motor ass'y if less than specified value.

Commutator Undercut : Standard Value	0.5 - 0.8 mm (0.020 - 0.031 in)
Wear limit ⓐ :	0.3 mm (0.012 in)



4. Check electrical conductivity of armature ②. Replace starter motor ass'y if other than specified condition.

Armature Conductivity :	
ⓑ between commutator segments ③-③	Conductive
ⓒ Between Segment - Armature Core	Non-conductive
ⓓ Between Segment - Armature Shaft	Non-conductive

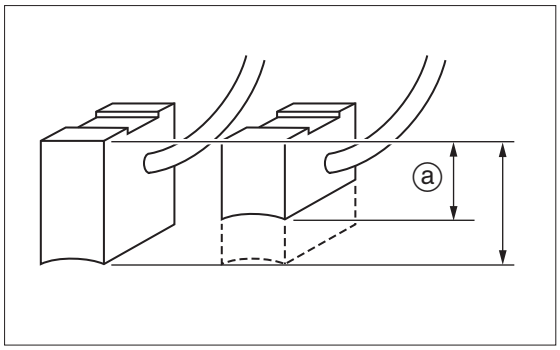


8

6) Inspection of Brushes

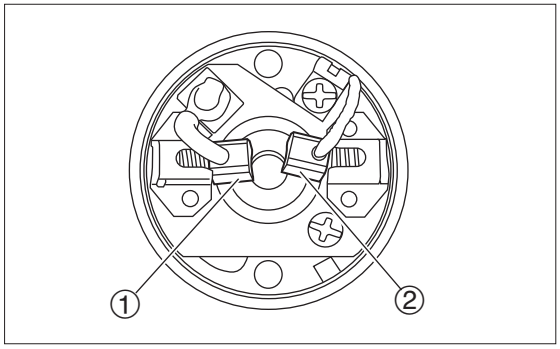
1. Measure brush length. Replace brush holder ass'y if brush length is less than specified value.

Brush Length ⓐ : Standard Value	7.5 mm (0.295 in)
Wear limit ⓐ :	4.0 mm (0.157 in)



2. Check conductivity of brush holder ass'y. Replace if out of specification.

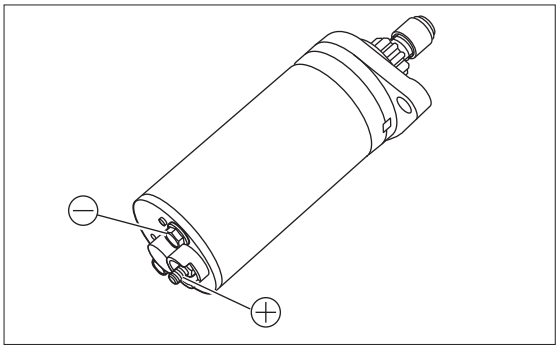
Conductivity Between Brushes	
Brush ① - Brush ②	Non-conductive
Between Brush ② - Ground	Non-conductive



7) Inspection of Starter Motor Operation

1. Assemble starter motor, and check, before and after installing it on the power unit, by applying voltage between points "+" and "-" that it operates normally.

Energizing starter motor produces sparks, and thus, any flammable matter must be kept away from the motor.

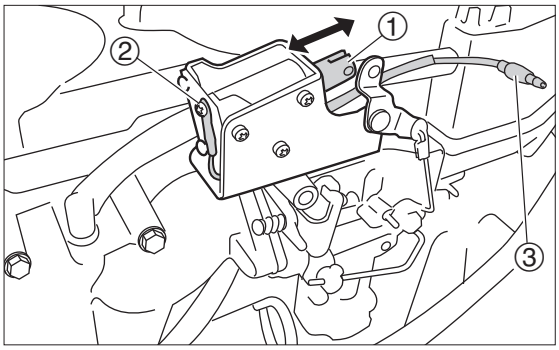


8) Inspection of Choke Solenoid (some models only)

· Before checking operation of choke solenoid, remove lock plate from stop switch.
· This test can be made without removing parts.

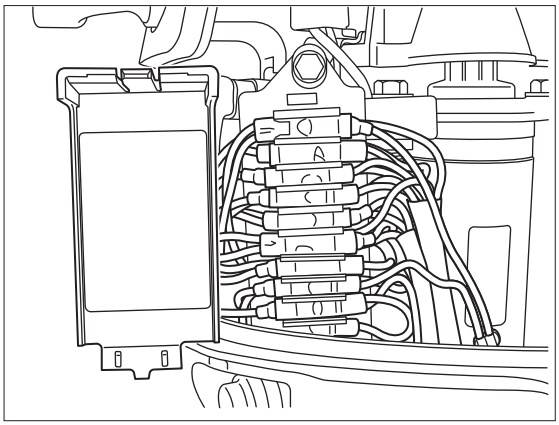
1. Check if plunger ① operates when main switch is set to ON and pushed inward. If not, check if ground wire is attached surely.Check conductivity between choke solenoid wire ② and ground wire. Replace if no conductivity.
Check for linkage bind or disconnection.

2. Check conductivity between choke solenoid wire ③ and ground wire ②. Replace if no conductivity.



7. Battery Charging System

1) Inspection of Charge Coil



1. Remove cable terminal holder cover.

2. Disconnect cable coupler from charge coil, and measure resistance.

This test can be made without removing parts.

Alternator (Charge Coil) Resistance
: Reference Value (at 20°C)
White (W) – Yellow (Y)
0.58 - 0.86 Ω

2) Inspection of Rectifier

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

This test can be made without removing parts.

"ON" means "conductive", and "OFF" means "non-conductive".

Rectifier Tester Check Chart

		Tester Lead Positive (+) Side (Red)			
		Red R	White W	Black B	Yellow Y
Tester Lead Negative (-) Side (Black)	Red R		ON (7kΩ)	ON (5kΩ)	ON (7kΩ)
	White W	OFF		ON (7kΩ)	OFF
	Black B	OFF	OFF		OFF
	Yellow Y	OFF	OFF	ON (7kΩ)	

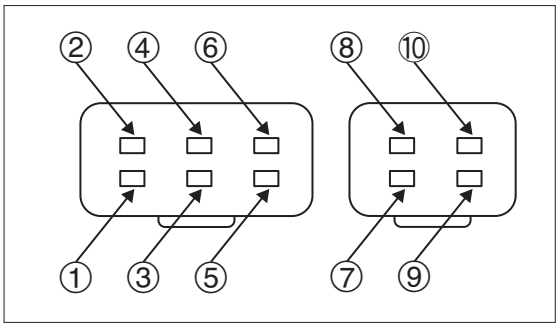
· Measurement condition Circuit tester to be used : HIOKI3030
Measurement Range : 1kΩ
· Permissible Error of Resistance : ±20%

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

8. CD Unit Wire Harness

1) Inspection of Wire Harness

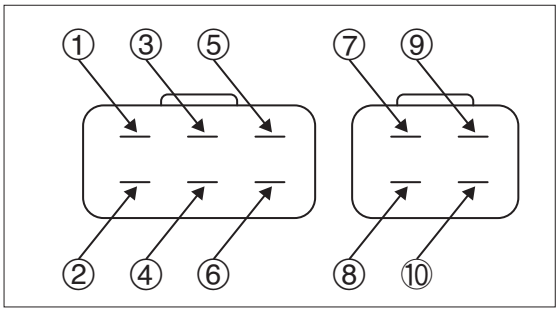
1. Check wire harness for disconnection of lead wire and defective connection.
   - Terminals are arranged and numbered as shown.
   - The following table shows names of terminals and lead wire colors.



No.	Name	Lead Wire Color	
1	Warning Lamp	White/Red	W/R
2	Oil Pressure Switch	Light Green	Lg
3	Vacant	—	—
4	Tachometer	White	W
5	Ignition Coil (+)	Orange	Or
6	GND	Black	B
7	Exciter Coil (H)	Blue/Red	L/R
8	Stop Switch	Brown	Br
9	Exciter Coil (L)	Black/Red	B/R
10	Pulser Coil	Red/White	R/W

2) Inspection of CD unit

1. Use following tester check chart to check conductivity and measure resistance.



		Tester Lead Positive (+) Side (Red)								
		①White/Red (W/R) Warning Lamp	②Light Green (Lg) Oil Pressure Switch	④White (W) Tachometer	⑤Orange (Or) Ignition Coil	⑥Black (B) GND	⑦Blue/Red (L/R) Exciter Coil (H)	⑧Brown (Br) Stop Switch	⑨Black/Red (B/R) Exciter Coil (L)	⑩Red/White (R/W) Pulser Coil
Tester Lead Negative (–) Side (Black)	①White/Red (W/R) Warning Lamp		CON (45kΩ)	CON (55kΩ)	CON (∞)	CON (22kΩ)	CON (35kΩ)	CON (100kΩ)	CON (45kΩ)	CON (28kΩ)
	②Light Green (Lg) Oil Pressure Switch	OFF (∞)		OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)
	④White (W) Tachometer	OFF (∞)	CON (35kΩ)		CON (∞)	CON (18kΩ)	CON (26kΩ)	CON (75kΩ)	CON (38kΩ)	CON (22kΩ)
	⑤Orange (Or) Ignition Coil	CON (∞)	ON (14kΩ)	ON (18kΩ)		ON (4kΩ)	ON (13kΩ)	ON (45kΩ)	ON (14kΩ)	ON (8kΩ)
	⑥Black (B) GND	OFF (∞)	ON (4kΩ)	ON (6kΩ)	CON (∞)		ON (4kΩ)	ON (14kΩ)	ON (5kΩ)	ON (3kΩ)
	⑦Blue/Red (L/R) Exciter Coil (H)	CON (∞)	ON (130kΩ)	ON (130kΩ)	CON (∞)	ON (100kΩ)		ON (4kΩ)	ON (130kΩ)	ON (100kΩ)
	⑧Brown (Br) Stop Switch	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)		OFF (∞)	OFF (∞)
	⑨Black/Red (B/R) Exciter Coil (L)	OFF (∞)	CON (33kΩ)	CON (40kΩ)	CON (∞)	CON (17kΩ)	CON (23kΩ)	CON (65kΩ)		CON (20kΩ)
	⑩Red/White (R/W) Pulser Coil	OFF (∞)	ON (8kΩ)	ON (10kΩ)	CON (∞)	ON (3kΩ)	ON (8kΩ)	ON (20kΩ)	ON (8kΩ)	

Note) ① It is recommended to use "HIOKI HiTESTER MODEL 3030" for this measurement. Use of other instrument model for the measurement can cause indication of abnormal value for normal condition, resulting in inaccurate measurement.

② Disconnect all connections to measure as an independent unit.

③ Any movement of pointer indicates "ON" or "conductive" state.

④ "CON" means that the pointer moves once and then returned to the value shown in ( ) because of characteristic of capacitor.

⑤ The value in ( ) is the condition applied when "1kΩ" range is used. The measurement varies widely among types of instrument, situations (such as inner power supply), or measurement ranges due to diodes used in the unit.

⑥ Perform this inspection only as a guide.

9

Troubleshooting

1.Troubleshooting Chart

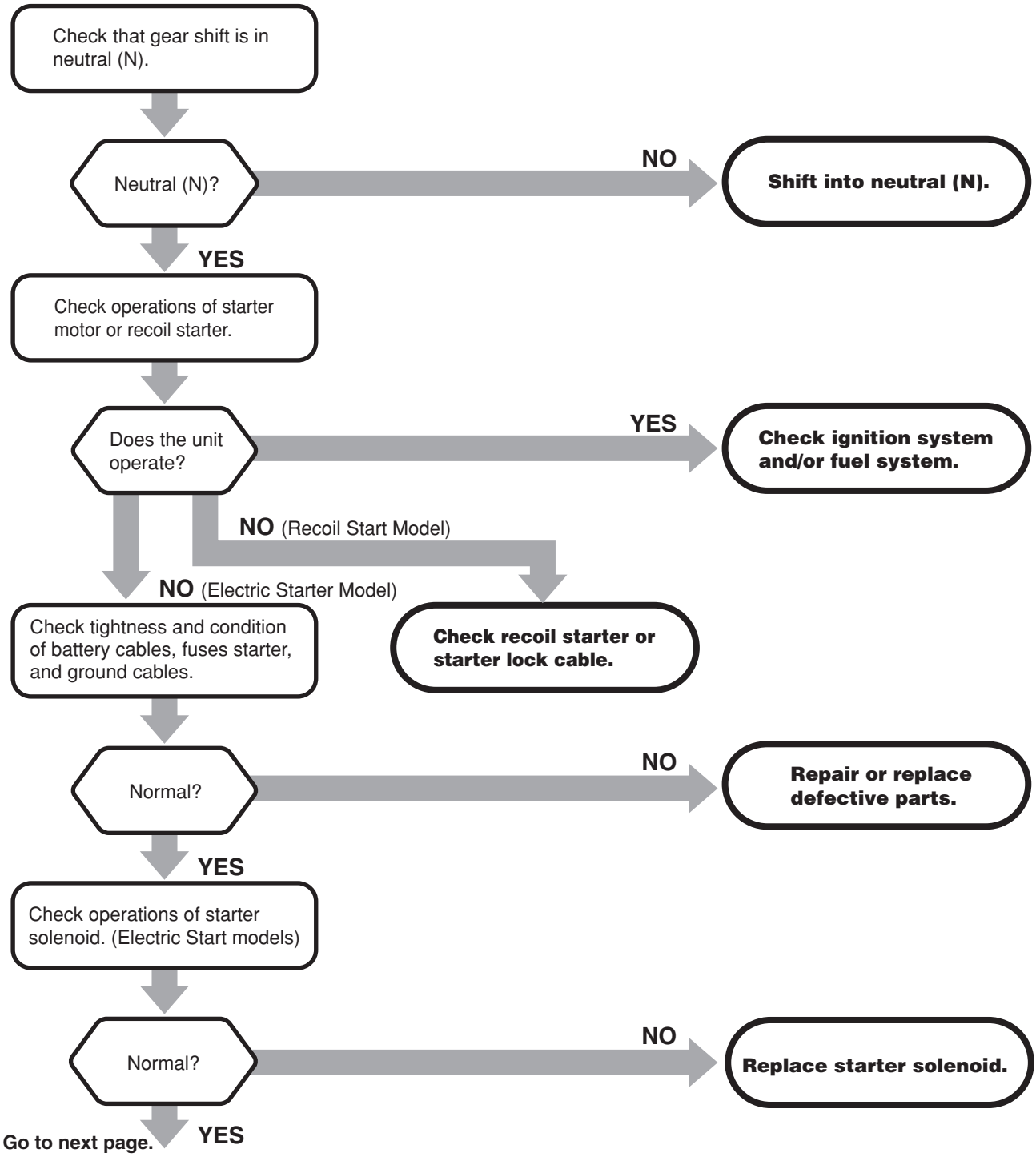
	Engine will not start.	Engine stalls immediately after starting.	Idles abnormally.	Defective acceleration.	Engine speed is very high causing high speed ESG to operate.	Engine speed is very low, causing low speed ESG to operate.	Boat cannot run at high speed.	Engine overheats.	Battery is not charged.	Starter motor will not operate.	Power tilt will not operate.	Estimated Cause	Refer to page
Fuel and Lubrication Systems	○	○										Fuel level is low in the tank.	Chapter 1
	○	○	○	○		○	○	○				Fuel system connection is incomplete.	Chapter 2
	○	○	○	○		○	○	○				Air suctioned through fuel system	-
	○	○	○	○		○	○	○				Fuel pipe is twisted.	Chapter 3
	○	○	○	○		○	○	○				Cap vent is closed.	-
	○	○	○	○		○	○	○				Fuel filter, fuel pump or carburetor is clogged.	Chapter 4
	○	○	○	○			○	○				Low quality gasoline is used.	-
	○	○	○	○		○	○					Fuel pump malfunction	Chapter 4
	○			○								Choke system malfunction	-
			○	○		○	○	○				Fuel is fed excessively.	Chapter 4
						○※		○				Engine oil is lacking (Oil warning lamp is lit).	Chapter 3
			○	○								Engine oil quantity excessive (Exhaust smoke is generated.)	Chapter 3
						○※		○				Oil pump malfunction (Oil warning lamp is lit)	Chapter 5
Compression	○	○	○	○			○					Incorrect valve timing due to stretching or incorrect installation of timing belt.	Chapter 3
	○	○	○	○			○					Valve clearance is incorrect.	Chapter 3
	○	○	○	○			○					Intake or exhaust valve sealing is defective.	Chapter 5
			○	○			○					Piston, piston ring and/or cylinder is worn excessively.	Chapter 5
			○					○				Combustion chamber carbon deposition is too much.	Chapter 5
			○	○			○	○				Spark plug is loose.	Chapter 3
Electrical System	○	○	○	○		○	○	○				Use of spark plugs not specified	Chapter 3
	○	○	○	○		○	○					Spark plug is contaminated.	Chapter 3
	○	○	○	○		○	○					No sparks or weak sparks	Chapter 8
	○											Stop switch short-circuited	Chapter 8
	○		○	○		○	○					Ignition timing is not properly adjusted.	Chapter 3
	○											Stop switch lock is not attached.	Chapter 1
	○								○	○	○	Main switch malfunction	Chapter 8
	○								○	○	○	Disconnection of lead wires or loose earth wire	Chapter 8
	○								○	○	○	Battery is out of service life, or electrode is eroded. Battery electrolyte level is low.	Chapter 3
	○									○	○	Battery charged insufficiently	Chapter 3
	○									○		Shift lever neutral (N) position is not proper.	Chapter 3
	○									○		Starter motor or starter solenoid malfunction	Chapter 8
											○	PT switch or PT solenoid malfunction.	Chapter 7
Others							○	○				Cooling water is not fed or low due to malfunction or clogging of pump	Chapter 6
			○		○		○	○				Thermostat operation is defective.	Chapter 3
				○	○		○	○				Anti-cavitation plate is damaged.	-
				○	○	○	○	○				Use of mismatched propeller.	Chapter 1
			○	○	○	○	○	○				Propeller is damaged or deformed.	Chapter 3
				○	○		○	○				Trim position is not correct.	-
				○	○	○	○	○				Boat is unbalanced due to improper load position.	-
				○		○	○	○				Transom is too high or too low.	Chapter 1
	○		○	○		○	○					Throttle link adjustment is defective.	Chapter 3
											○	Power tilt fluid contains air bubble.	Chapter 7

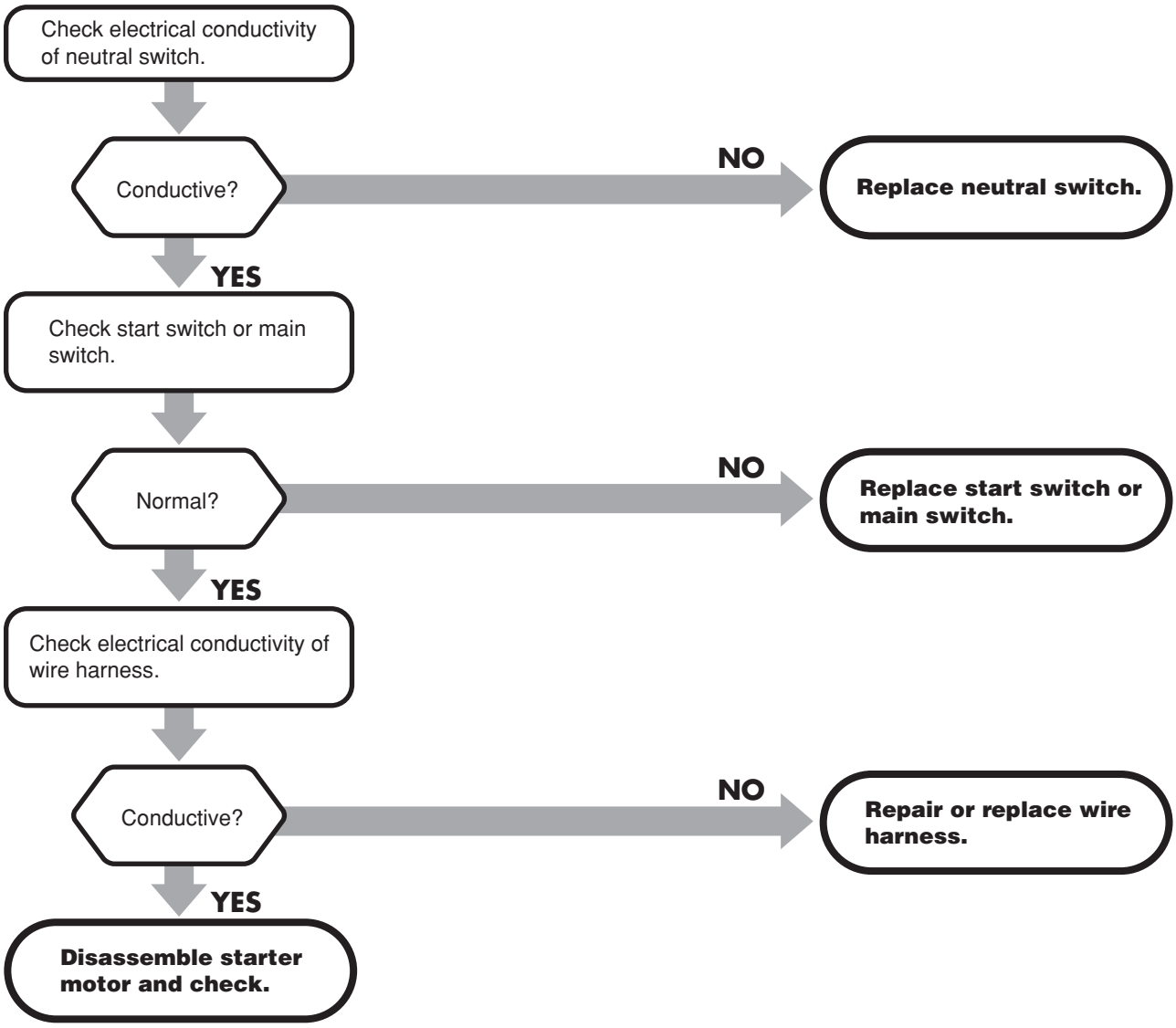
Before working on the engine, check that hull, rigging and engine installation are normal, and then battery is fully charged. For mechanical troubleshooting, refer to relevant troubleshooting section in this chapter. For checking and servicing the machine, refer to service procedures described in this manual to perform the works safely.

2.Power Unit

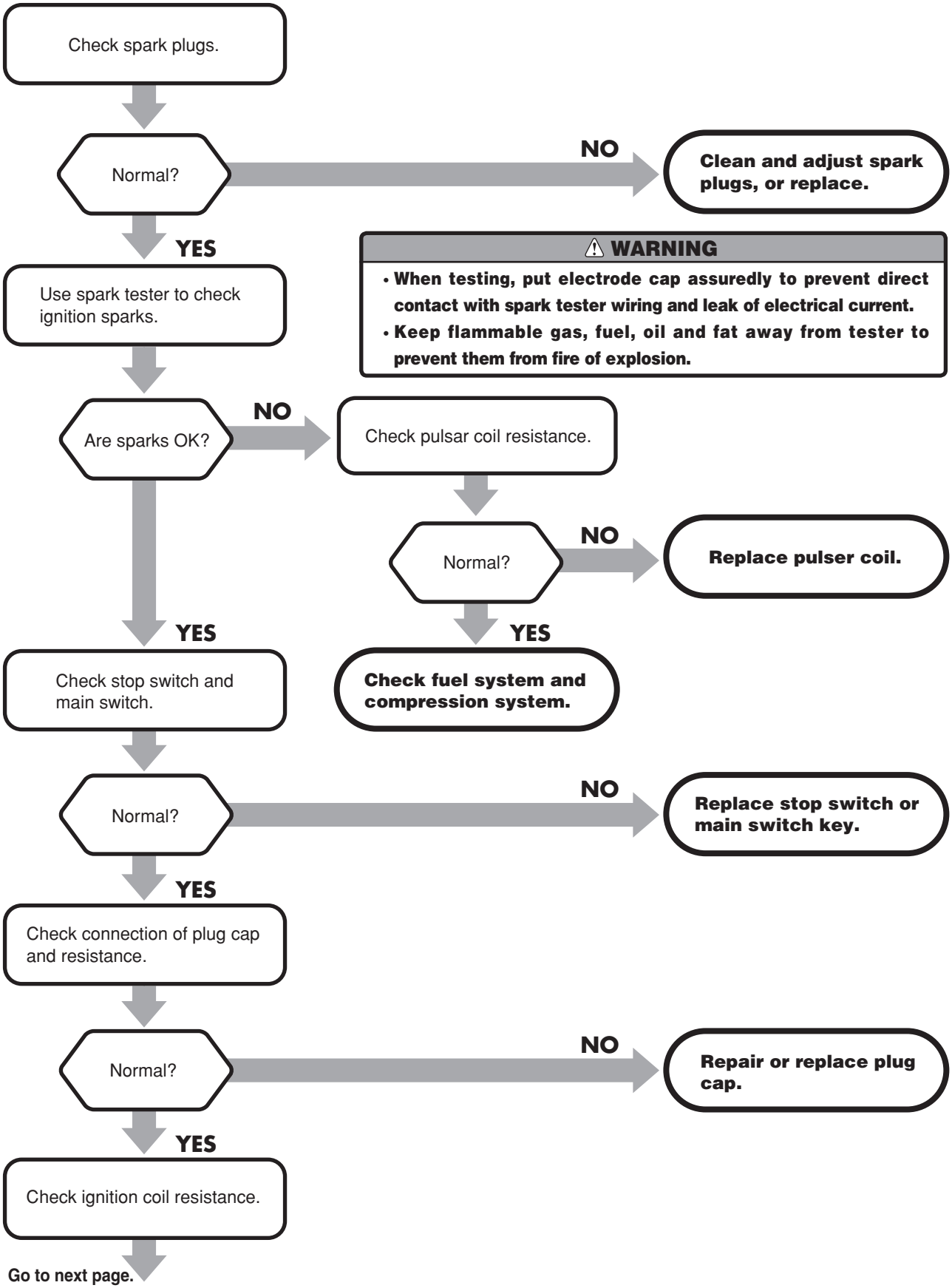
State 1 **Engine will not start.**

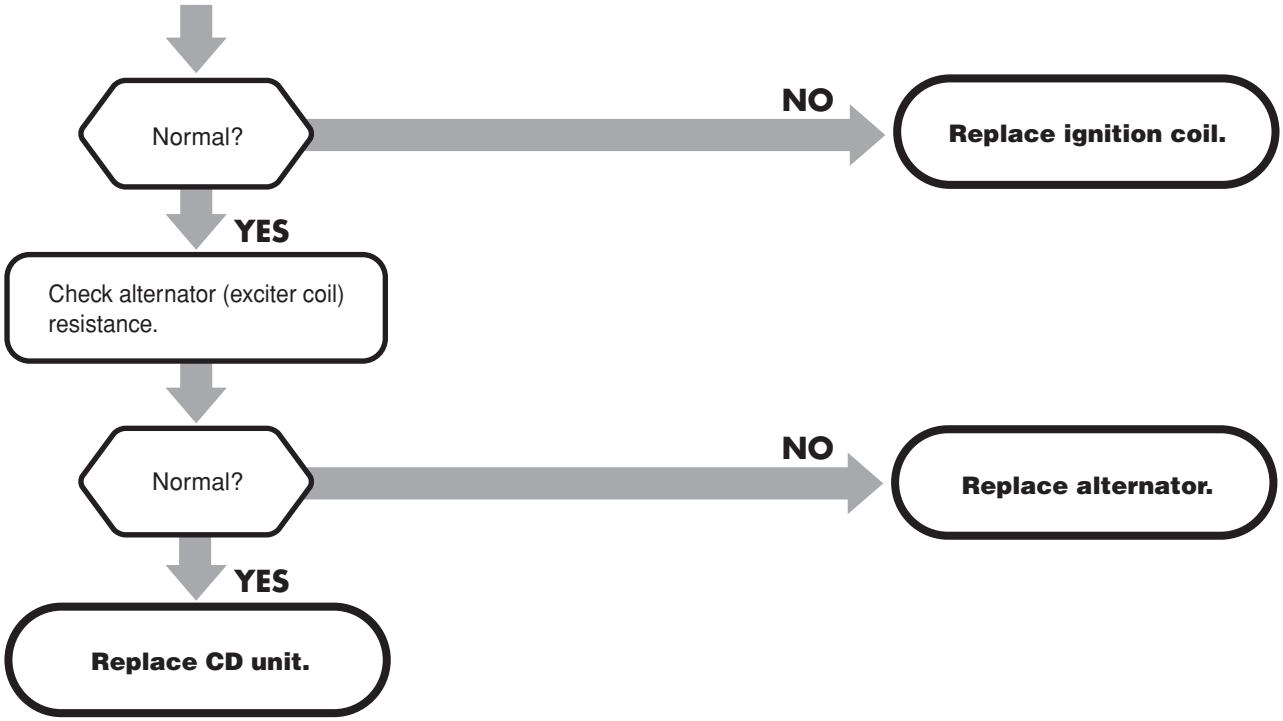
Starting System



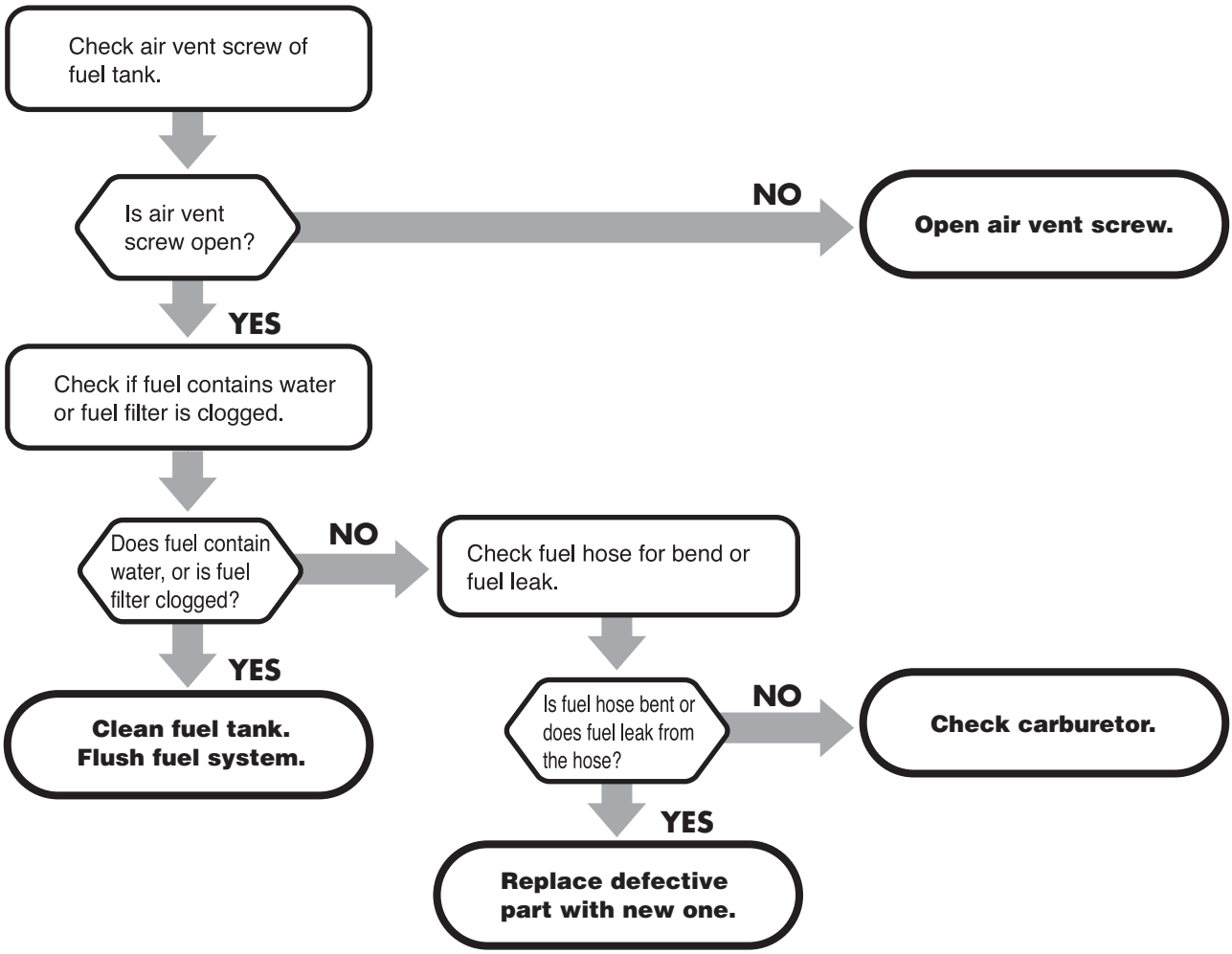

Check electrical conductivity of neutral switch.
Conductive?
NO
Replace neutral switch.
YES
Check start switch or main switch.
Normal?
NO
Replace start switch or main switch.
YES
Check electrical conductivity of wire harness.
Conductive?
NO
Repair or replace wire harness.
YES
Disassemble starter motor and check.

Ignition System

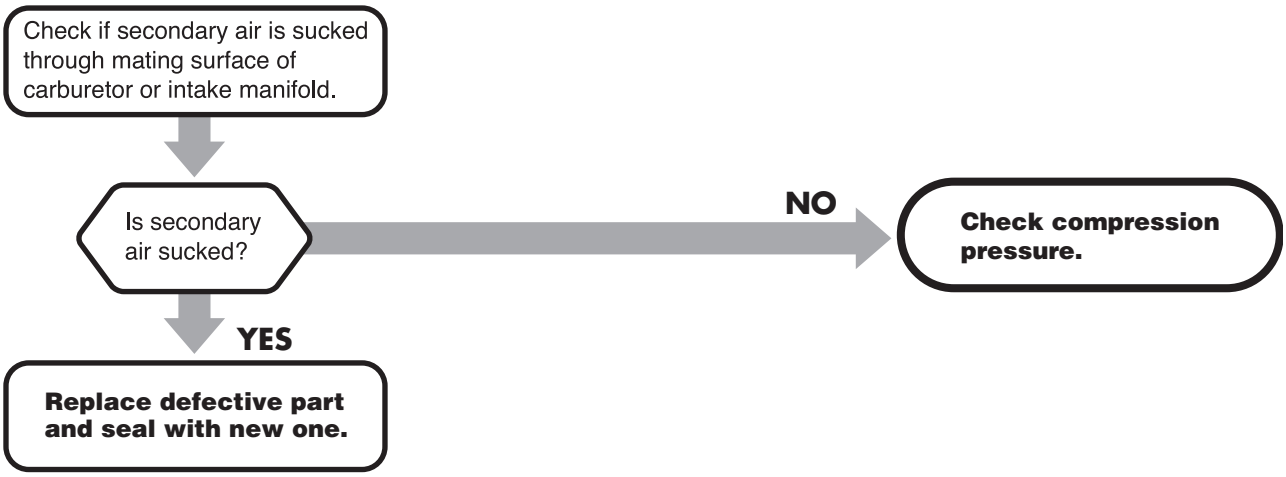



Normal?
NO
Replace ignition coil.
YES
Check alternator (exciter coil) resistance.
Normal?
NO
Replace alternator.
YES
Replace CD unit.

Fuel System


Check air vent screw of fuel tank.
Is air vent screw open?
NO
Open air vent screw.
YES
Check if fuel contains water or fuel filter is clogged.
Does fuel contain water, or is fuel filter clogged?
NO
Check fuel hose for bend or fuel leak.
YES
Clean fuel tank. Flush fuel system.
Is fuel hose bent or does fuel leak from the hose?
NO
Check carburetor.
YES
Replace defective part with new one.

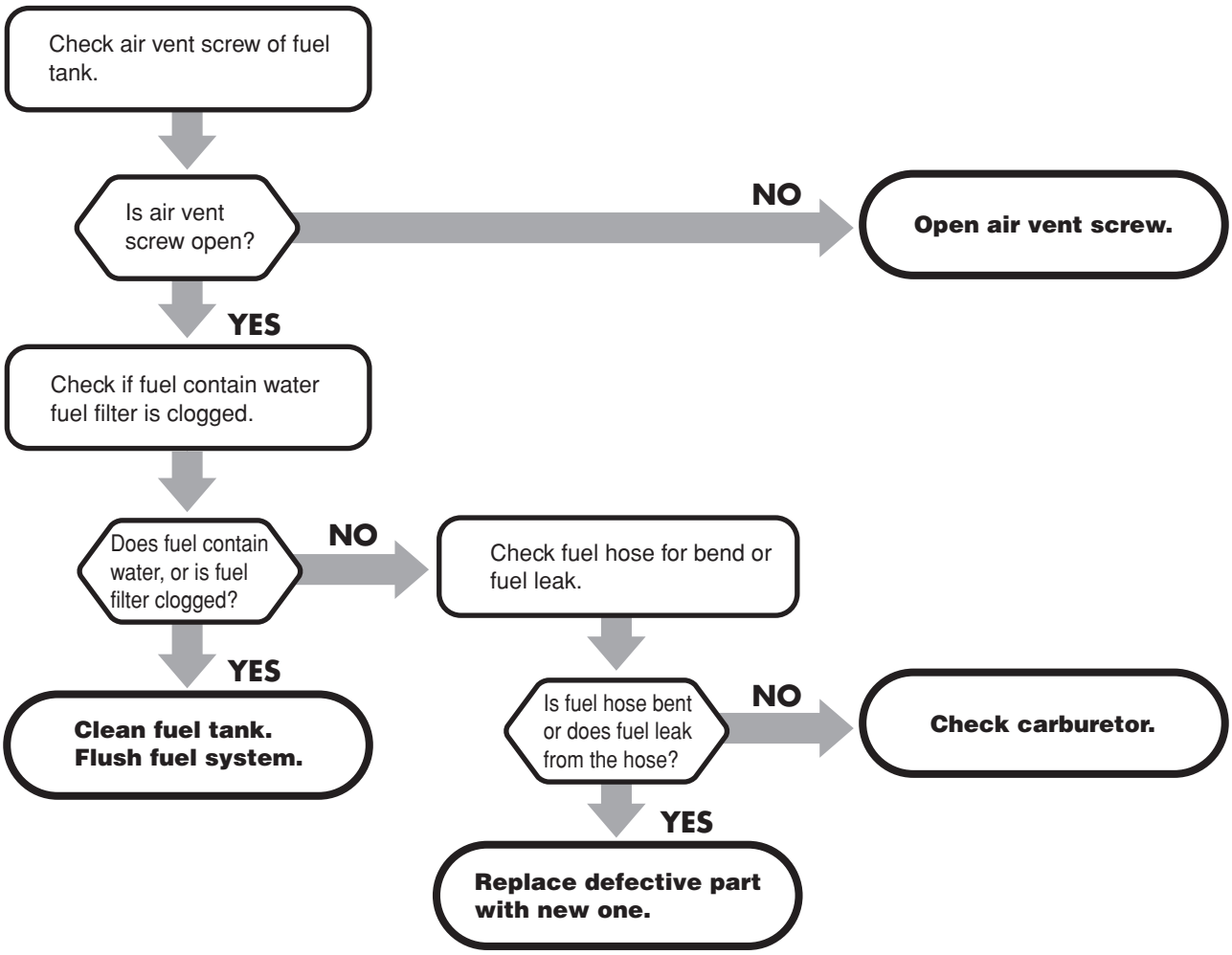
Compression Pressure



State 2 **Engine starts but stalls soon.**

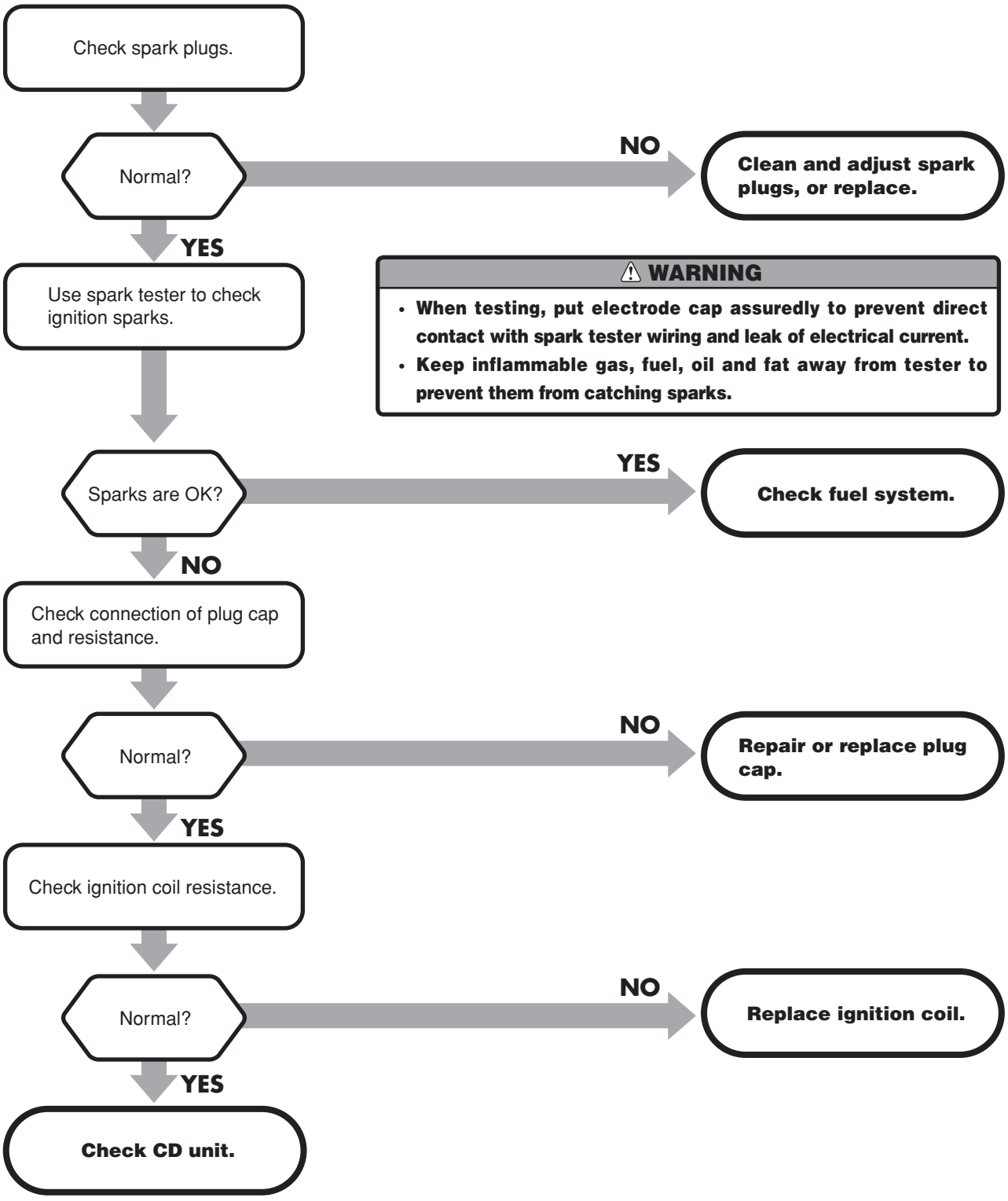
• **Inspection of Fuel System, Ignition System, Compression Pressure.**

Fuel System

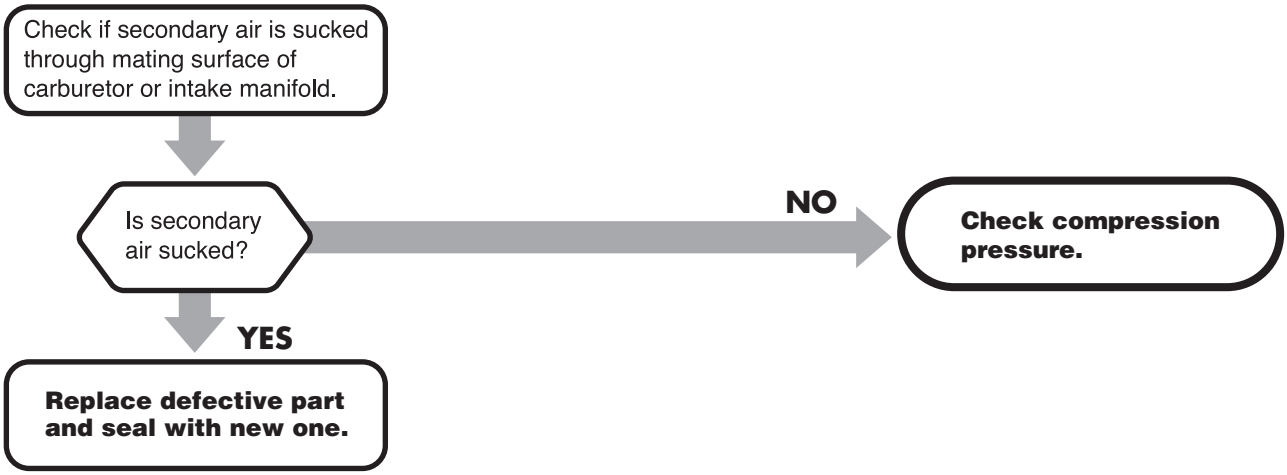


9

Ignition System

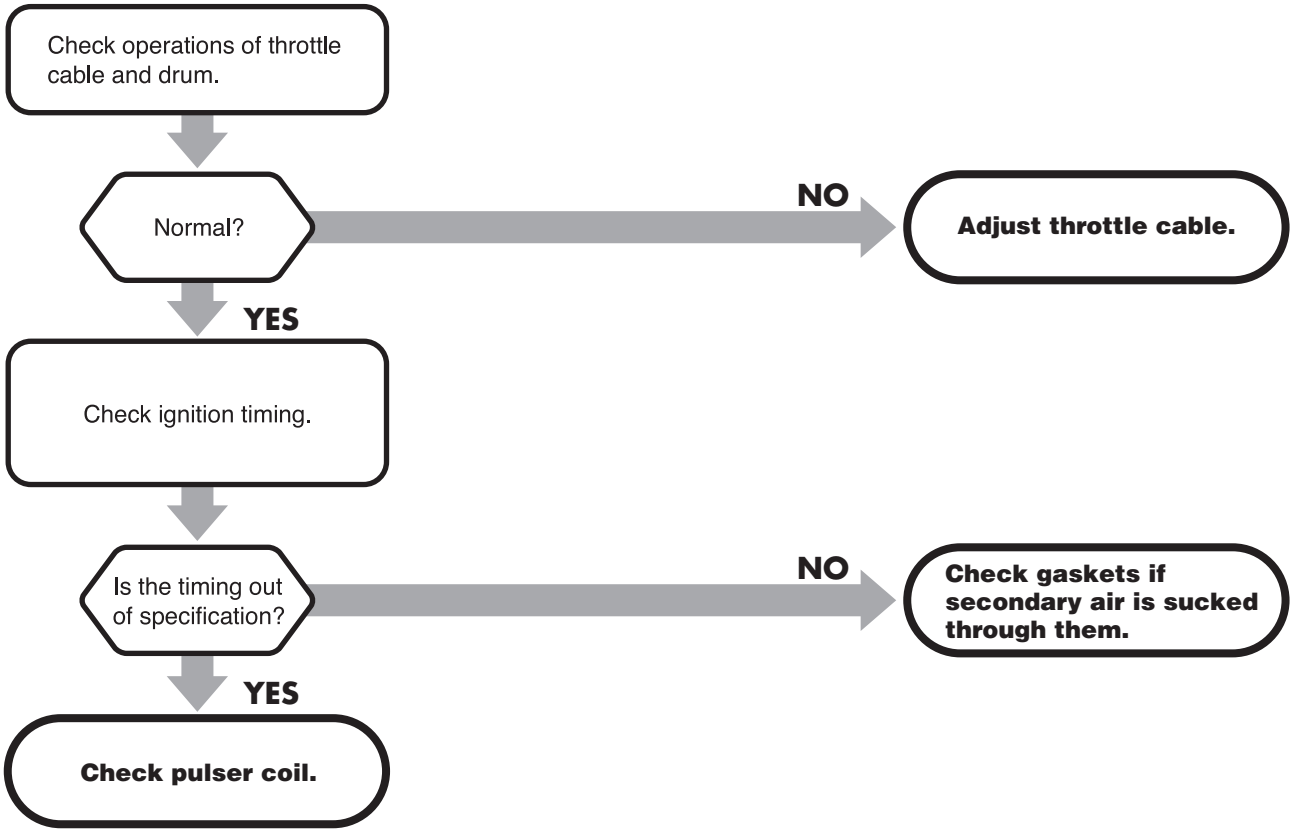


Compression Pressure



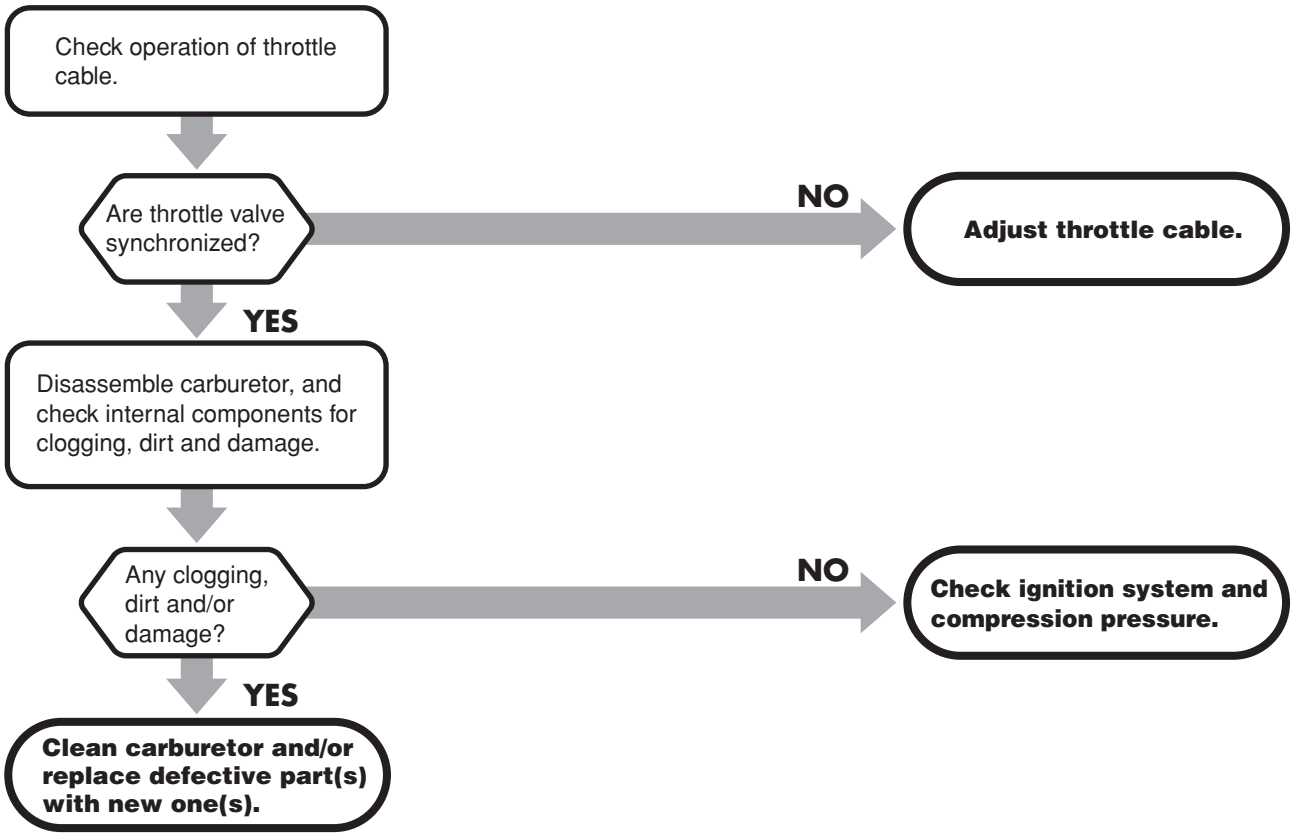
State 3 **Idle engine speed will not stabilize.**

- **Inspection of Intake Manifold, Air Intake System and Ignition System.**

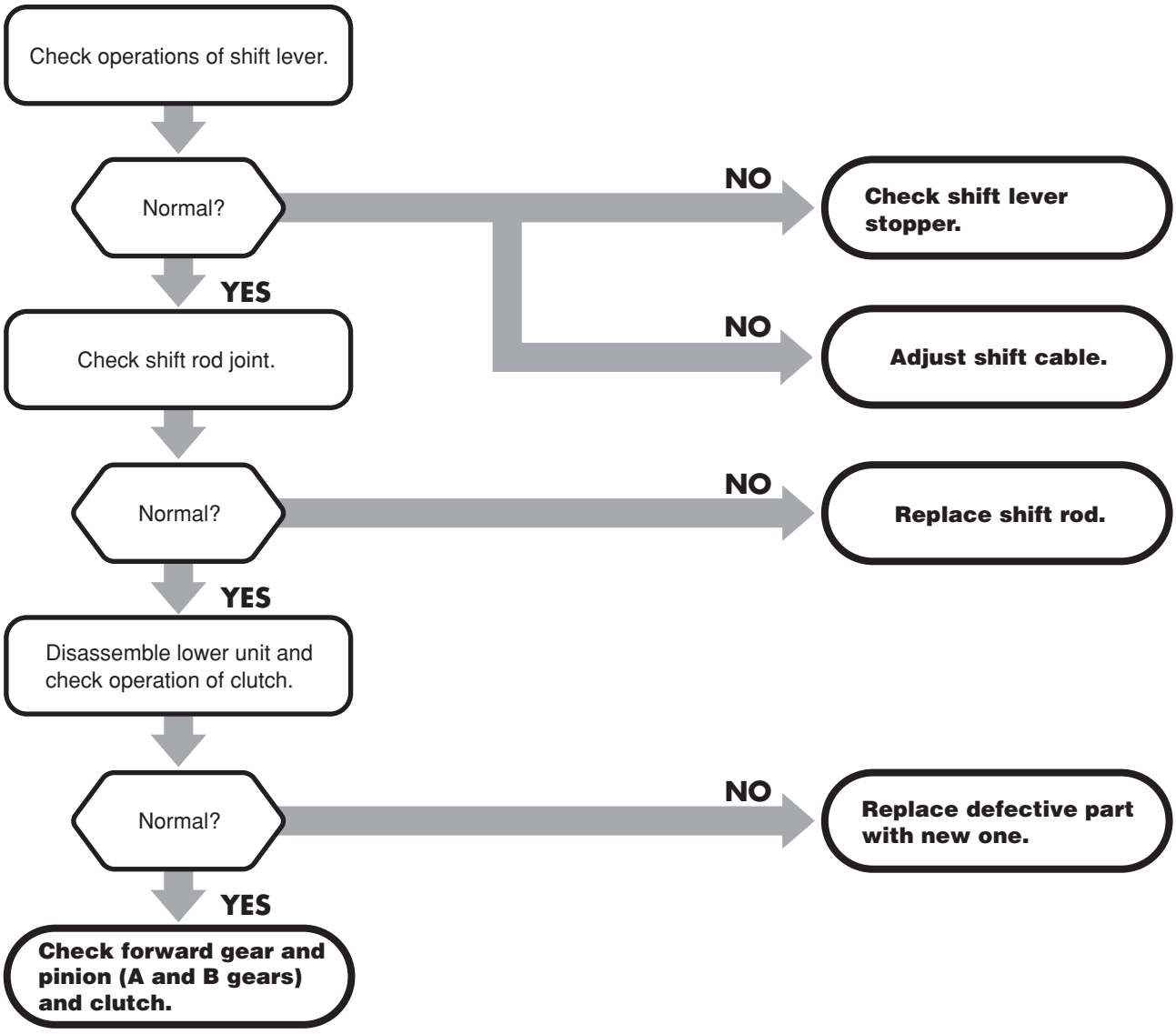


State 4 **Rapid opening of throttle fails acceleration.**

Rapid opening of throttle causes engine to stall. (Stops.)
Acceleration is not smooth.
• Inspection of Carburetor, Ignition System and Compression Pressure.

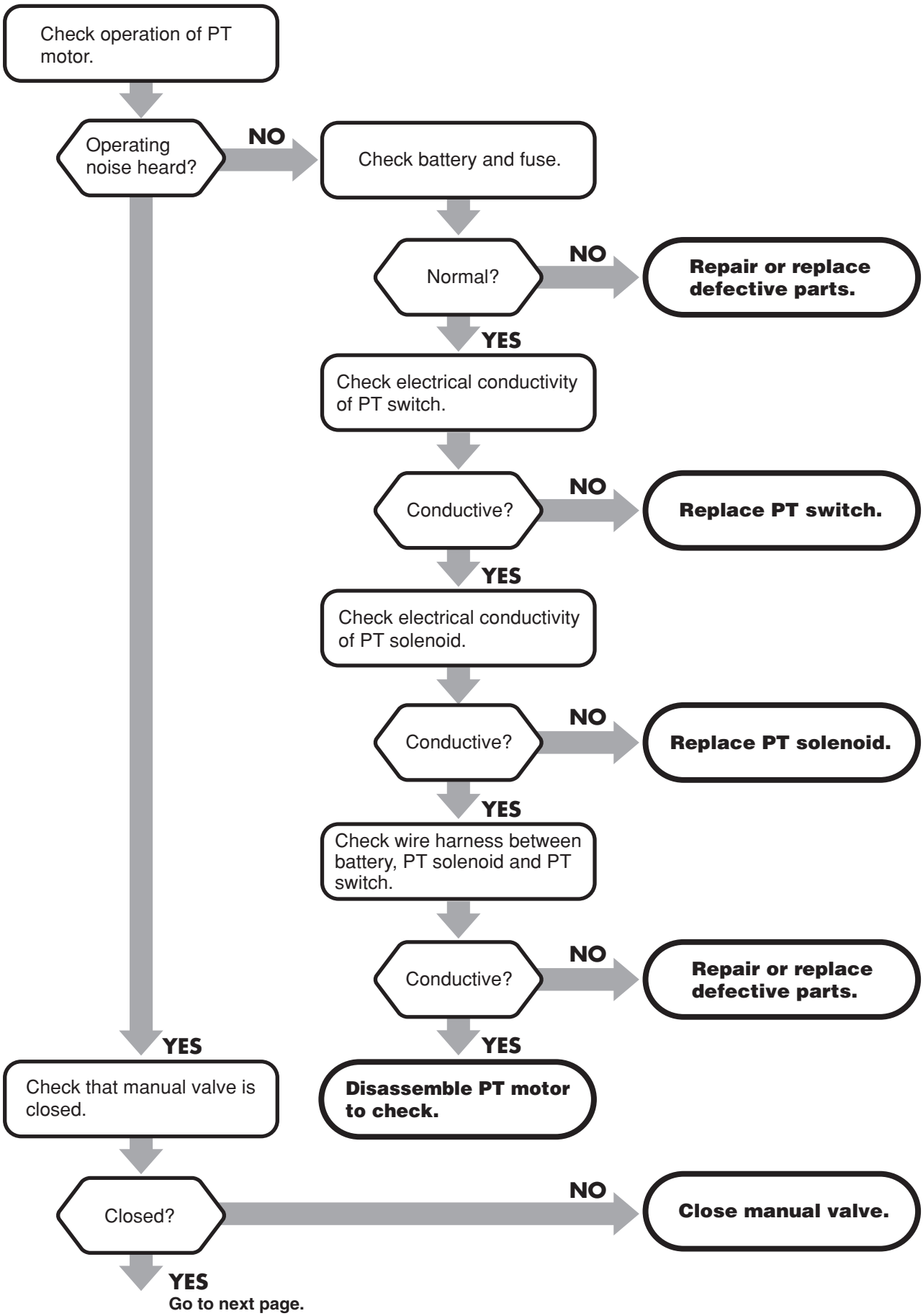


State 5 **Gear shifting cannot be made normally.**

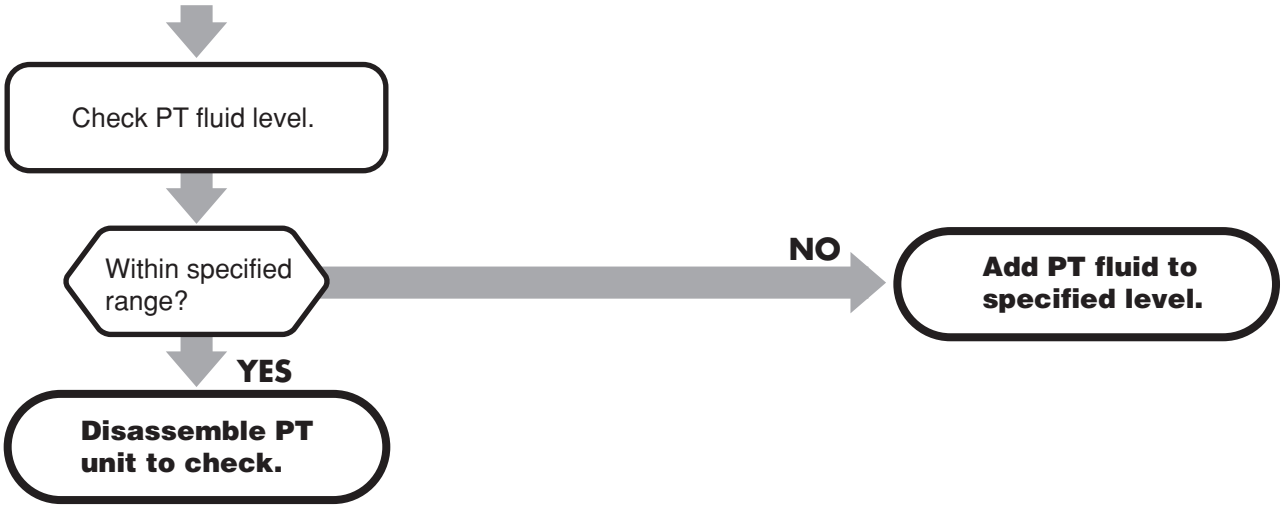


3.PT Unit

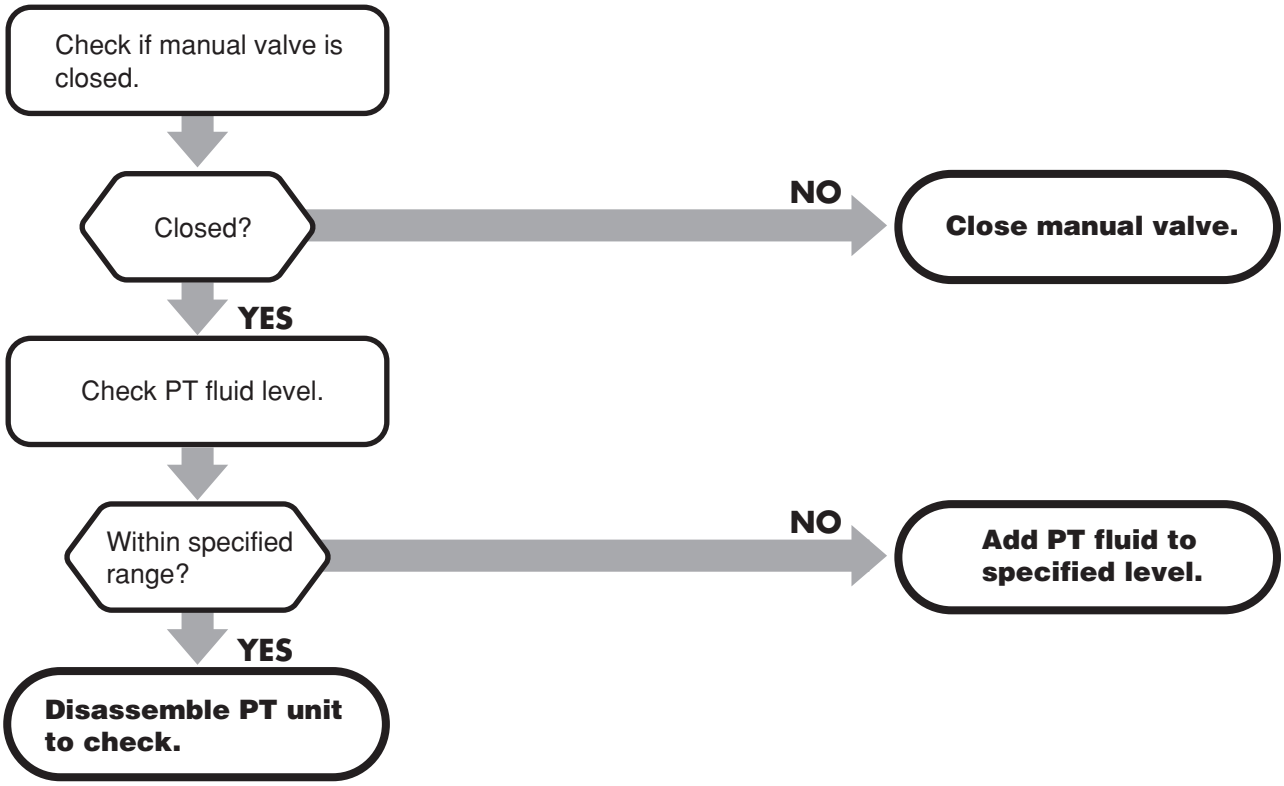
State 1 **PT unit will not operate.**



9



State 2 **PT is not capable of sustaining outboard motor.**

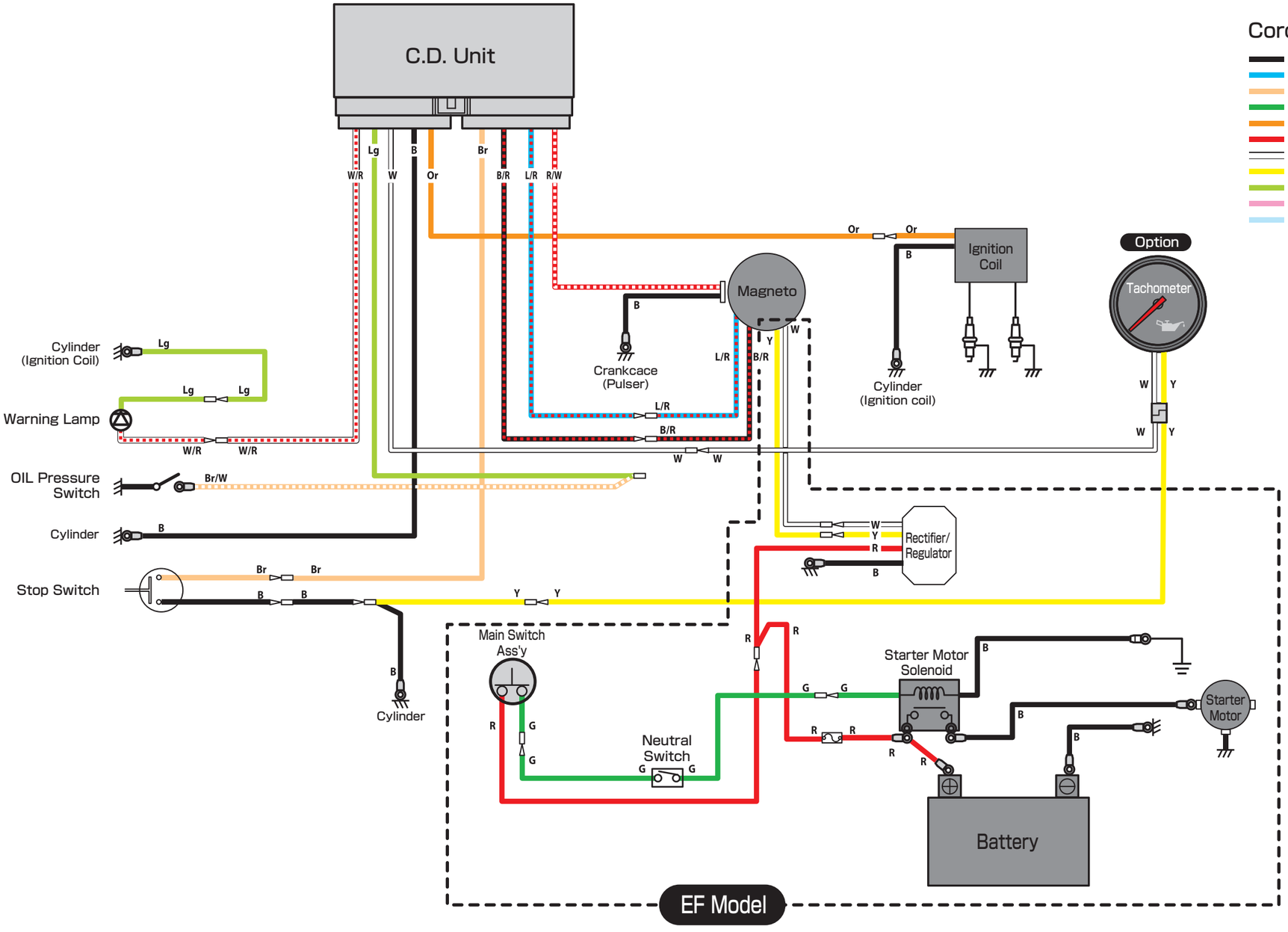


4.Warning Indication
... Display for Abnormalities During Operation

Warning Indication			ESG revolution control	Condition	Reference	Estimated cause and action to be taken
Buzzer	Cowl lamp	Tachometer lamp				
X	X	–	High speed ESG	Engine over-rev. (operates at 6250r/min)	Controls to 6250r/min or less	Check propeller.
–	Lit	Lit	Low speed ESG	Oil pressure reduced (operates at 4psi [0.25kg/cm^{2}])	Controls to 3000r/min or less	Stop engine and check oil level. Test oil pressure.
–	Lit	–	–	–	Warning lamp is lit always at starting engine for several seconds to check the operation.	If not lit, wire is disconnected or no power is generated.

10
Wiring Diagram

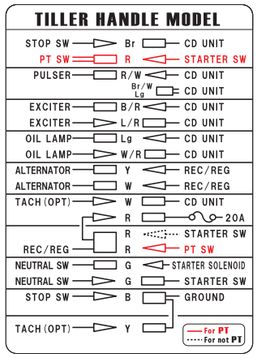
F 8B/9.8B MF/EF



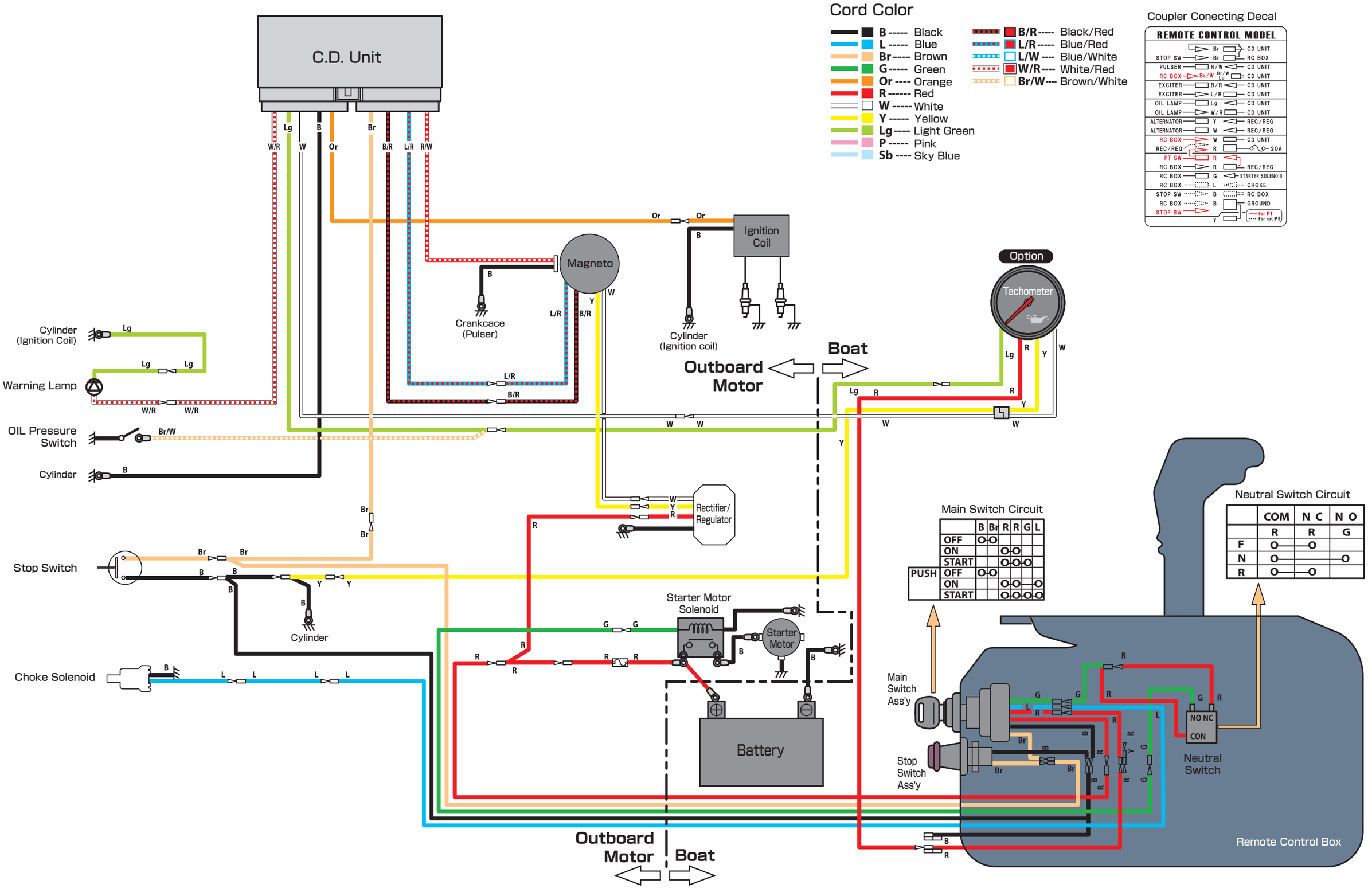
Cord Color

- B ----- Black
- L ----- Blue
- Br ---- Brown
- G ----- Green
- Or ---- Orange
- R ------ Red
- W ----- White
- Y ----- Yellow
- Lg ---- Light Green
- P ----- Pink
- Sb ---- Sky Blue
- B/R ---- Black/Red
- L/R ---- Blue/Red
- L/W ---- Blue/White
- W/R ---- White/Red
- Br/W ---- Brown/White

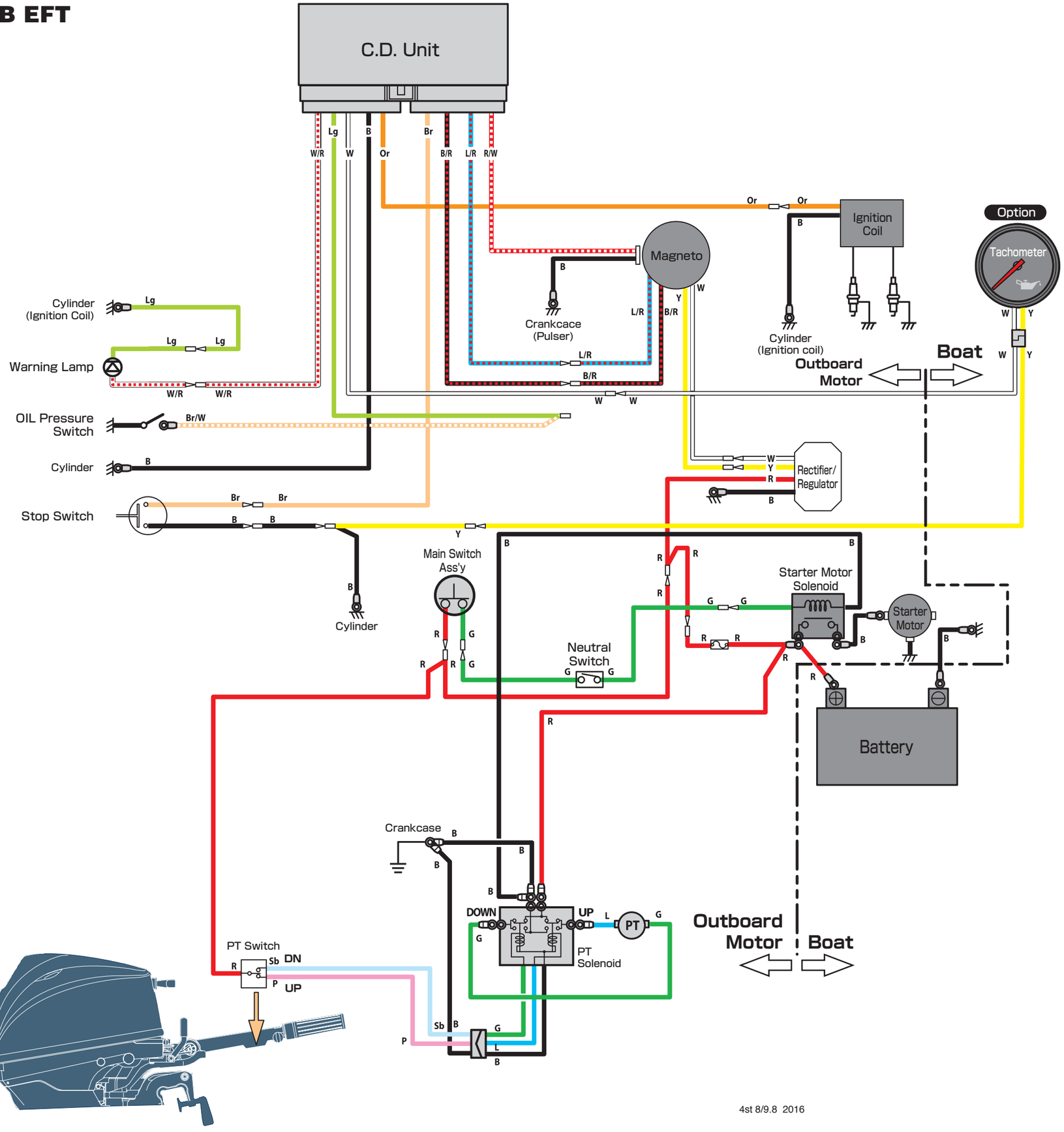
Coupler Conecting Decal



F 8B/9.8B EP


C.D. Unit
W/R
Lg
W
B
Or
Br
B/R
L/R
R/W
Cord Color
B ----- Black
L ----- Blue
Br ---- Brown
G ----- Green
Or ---- Orange
R ------ Red
W ----- White
Y ----- Yellow
Lg ---- Light Green
P ----- Pink
Sb ---- Sky Blue
B/R ---- Black/Red
L/R ---- Blue/Red
L/W ---- Blue/White
W/R ---- White/Red
Br/W --- Brown/White
Coupler Conecting Decal
REMOTE CONTROL MODEL
CD UNIT
RC BOX
REC/REG
STARTER SOLENOID
CHOKE
GROUND
For PT
For not PT
Magneto
Crankcace (Pulser)
Ignition Coil
Cylinder (Ignition coil)
Option
Tachometer
Boat
Outboard Motor
Cylinder (Ignition Coil)
Warning Lamp
OIL Pressure Switch
Cylinder
Br/W
Rectifier/ Regulator
Stop Switch
Cylinder
Choke Solenoid
Starter Motor Solenoid
Starter Motor
Battery
Main Switch Circuit
OFF
ON
START
PUSH
Neutral Switch Circuit
COM
N C
N O
Main Switch Ass'y
Stop Switch Ass'y
NO NC
CON
Neutral Switch
Remote Control Box
Outboard Motor
Boat

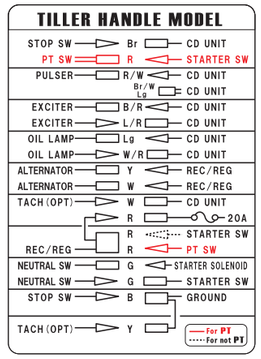
F 8B/9.8B EFT



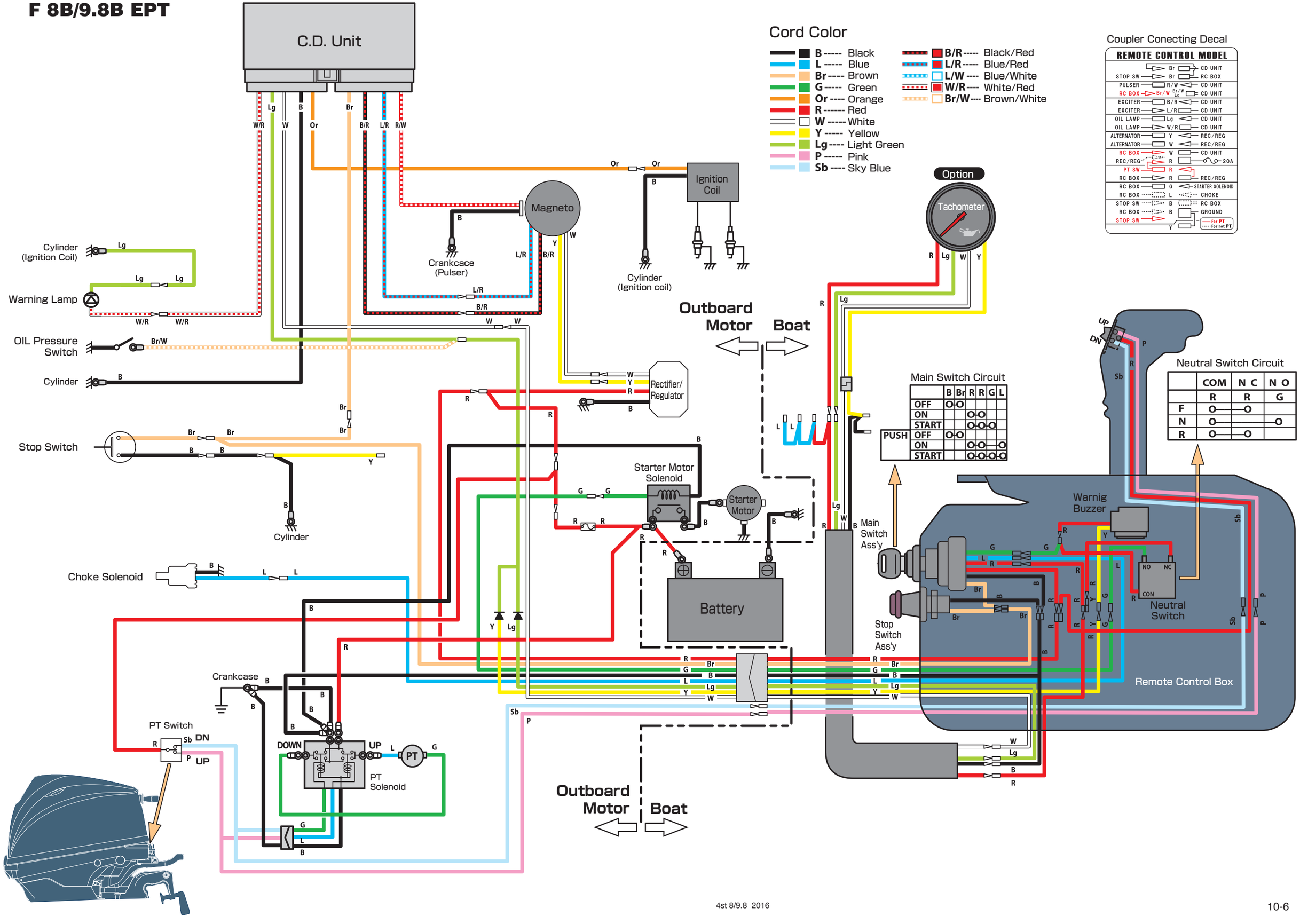
Cord Color

B ----- Black		B/R ----- Black/Red	
L ----- Blue		L/R ----- Blue/Red	
Br ----- Brown		L/W ---- Blue/White	
G ----- Green		W/R ---- White/Red	
Or ---- Orange		Br/W --- Brown/White	
R ------ Red			
W ----- White			
Y ----- Yellow			
Lg ---- Light Green			
P ----- Pink			
Sb ---- Sky Blue			

Coupler Conecting Decal



F 8B/9.8B EPT


C.D. Unit
W/R
Lg
W
B
Or
Br
B/R
L/R
R/W
Magneto
Crankcase (Pulser)
Ignition Coil
Cylinder (Ignition coil)
Cylinder (Ignition Coil)
Warning Lamp
OIL Pressure Switch
Br/W
Cylinder
Rectifier/ Regulator
Stop Switch
Cylinder
Starter Motor Solenoid
Starter Motor
Battery
Choke Solenoid
Crankcase
PT Switch
DN
UP
DOWN
PT
PT Solenoid
Outboard Motor
Boat
Cord Color
B ----- Black
L ----- Blue
Br ---- Brown
G ----- Green
Or ---- Orange
R ------ Red
W ----- White
Y ----- Yellow
Lg ---- Light Green
P ----- Pink
Sb ---- Sky Blue
B/R---- Black/Red
L/R---- Blue/Red
L/W ---- Blue/White
W/R---- White/Red
Br/W---- Brown/White
Option
Tachometer
Main Switch Circuit
OFF
ON
START
PUSH
Main Switch Ass'y
Stop Switch Ass'y
Warnig Buzzer
Neutral Switch
NO
NC
CON
Remote Control Box
Neutral Switch Circuit
COM
N C
N O
F
N
R
Coupler Conecting Decal
REMOTE CONTROL MODEL
CD UNIT
RC BOX
REC/REG
STARTER SOLENOID
CHOKE
GROUND
20A
For PT
For not PT

TOHATSU

SERVICE MANUAL

4 Stroke MFS 8/9.8B Models

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