

250G
L250G

SERVICE MANUAL

6S3-28197-5H-11 ●

NOTICE

This manual has been prepared by Yamaha primarily for use by Yamaha dealers and their trained mechanics when performing maintenance procedures and repairs to Yamaha equipment. It has been written to suit the needs of persons who have a basic understanding of the mechanical and electrical concepts and procedures inherent in the work, for without such knowledge attempted repairs or service to the equipment could render it unsafe or unfit for use.

Because Yamaha has a policy of continuously improving its products, models may differ in detail from the descriptions and illustrations given in this publication. Use only the latest edition of this manual. Authorized Yamaha dealers are notified periodically of modifications and significant changes in specifications and procedures, and these are incorporated in successive editions of this manual.

Important information

Particularly important information is distinguished in this manual by the following notations:

 The Safety Alert Symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

⚠ WARNING

Failure to follow WARNING instructions could result in severe injury or death to the machine operator, a bystander, or a person inspecting or repairing the outboard motor.

CAUTION:










A CAUTION indicates special precautions that must be taken to avoid damage to the outboard motor.

NOTE:

A NOTE provides key information to make procedures easier or clearer.

**250G, L250G
SERVICE MANUAL
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How to use this manual

Manual format

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

- Parts are shown and detailed in an exploded diagram and are listed in the components list (see ① in the figure below for an example page).
- The component list consists of part names and quantities, as well as bolt and screw dimensions (see ② in the figure below).
- Symbols are used to indicate important aspects of a procedure, such as the grade of lubricant and lubrication point (see ③ in the figure below).
- Tightening torque specifications are provided in the exploded diagrams (see ④ in the figure below for an example), and in the related detailed instructions. Some torque specifications are listed in stages as torque figures or angles in degrees.
- Separate procedures and illustrations are used to explain the details of removal, checking, and installation where necessary (see ⑤ in the figure below for an example page).

NOTE:

For troubleshooting procedures, see Chapter 9, "Troubleshooting."

LOWR

Lower unit

③ ④

Lower unit

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

6-5

62Y6480K

62Y6480K

②

LOWR

Lower unit

Removing the drive shaft

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

CAUTION:

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

Bearing separator ①: 90890-06534

Disassembling the drive shaft

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

CAUTION:

Do not press the drive shaft threads ③ directly.

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

Bearing inner race attachment ③: 90890-06539

Disassembling the forward gear

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

CAUTION:

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

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

6-19

62Y6750K

62Y6750K

⑤

Symbol

The symbols below indicate the content of a chapter.

General information



Fuel system



Bracket unit



Specification



Power unit



Electrical system



Periodic check and adjustment



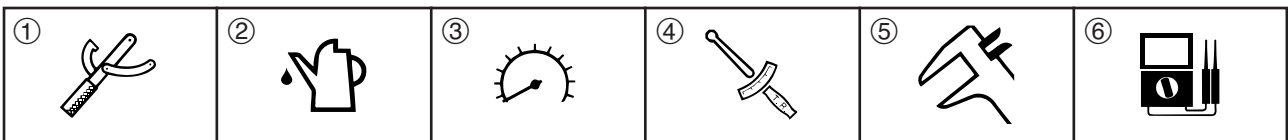
Lower unit



Troubleshooting

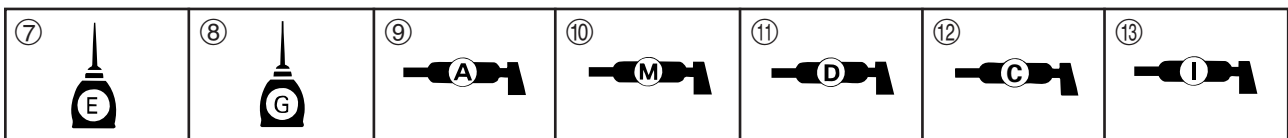


Symbols ① to ⑥ indicate specific data.



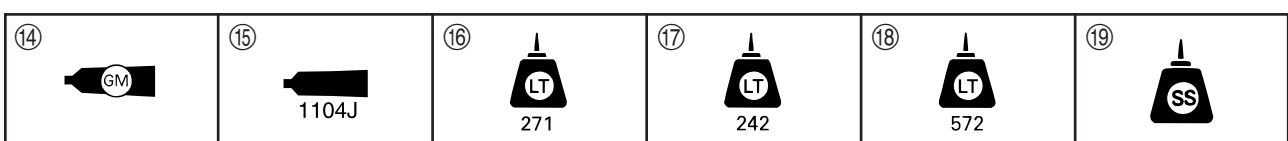
- ① Special tool
- ② Specified oil or fluid
- ③ Specified engine speed
- ④ Specified tightening torque
- ⑤ Specified measurement
- ⑥ Specified electrical value (resistance, voltage, electric current)

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



- ⑦ Apply Yamaha 2-stroke outboard motor oil
- ⑧ Apply gear oil
- ⑨ Apply water resistant grease (Yamaha grease A)
- ⑩ Apply molybdenum disulfide grease
- ⑪ Apply corrosion resistant grease (Yamaha grease D)
- ⑫ Apply low temperature resistant grease (Yamaha grease C)
- ⑬ Apply injector grease

Symbols ⑭ to ⑰ in an exploded diagram or illustration indicate the type of sealant or locking agent and the application point.



- ⑭ Apply Gasket Maker
- ⑮ Apply ThreeBond 1104J
- ⑯ Apply LOCTITE 271 (red)
- ⑰ Apply LOCTITE 242 (blue)
- ⑱ Apply LOCTITE 572
- ⑲ Apply silicon sealant

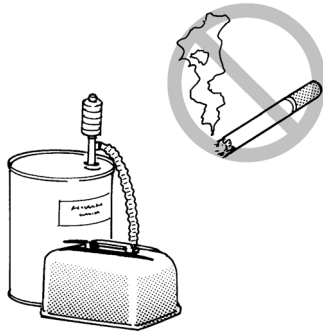


Safety while working

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

Fire prevention

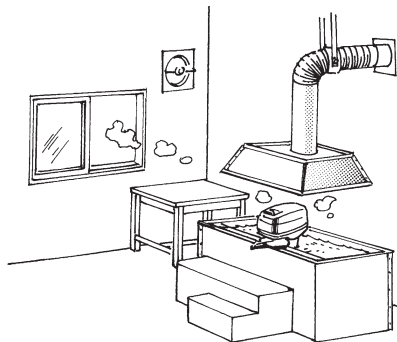
Gasoline is highly flammable. Keep gasoline and all flammable products away from heat, sparks, and open flames.



S69J1010

Ventilation

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

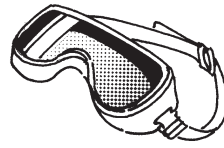


S69J1020

Self-protection

Protect your eyes by wearing safety glasses or safety goggles during all operations involving drilling and grinding, or when using an air compressor.

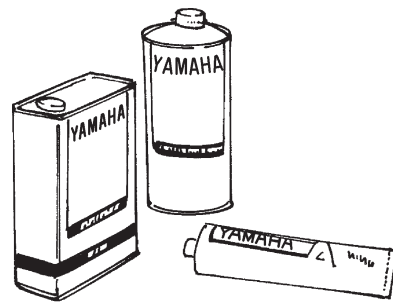
Protect your hands and feet by wearing protective gloves and safety shoes when necessary.



S69J1030

Parts, lubricant, and sealant

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



S69J1040

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

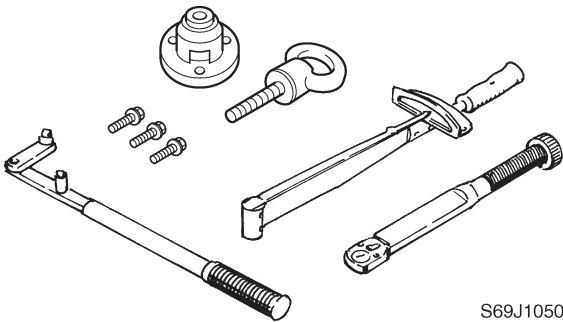
1. Maintain good standards of personal and industrial hygiene.
2. Change and wash clothing as soon as possible if soiled with lubricants.
3. Avoid contact with skin. Do not, for example, place a soiled rag in your pocket.
4. Wash hands and any other part of the body thoroughly with soap and hot water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

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

Good working practice

Special service tool

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



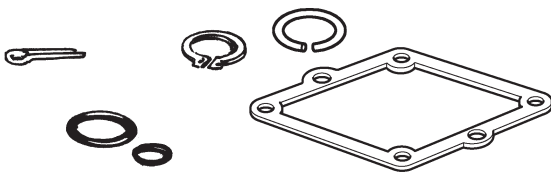
S69J1050

Tightening torque

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

Non-reusable parts

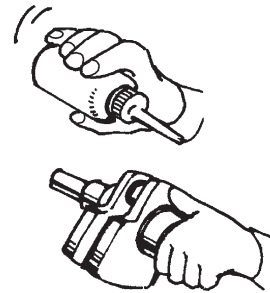
Always use new gaskets, seals, O-rings, cotter pins, circlips, etc., when installing or assembling parts.



S69J1060

Disassembly and assembly

1. Use compressed air to remove dust and dirt during disassembly.
2. Apply engine oil to the contact surfaces of moving parts before assembly.



S69J1070

3. Install bearings with the manufacture identification mark in the direction indicated in the installation procedure. In addition, be sure to lubricate the bearings liberally.
4. Apply a thin coat of water-resistant grease to the lip and periphery of an oil seal before installation.
5. Check that moving parts operate normally after assembly.



Identification

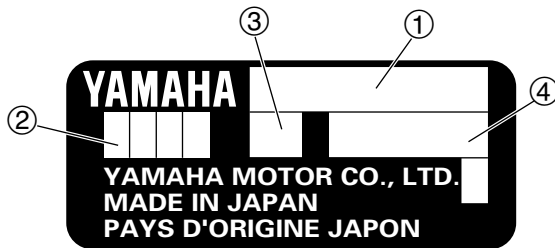
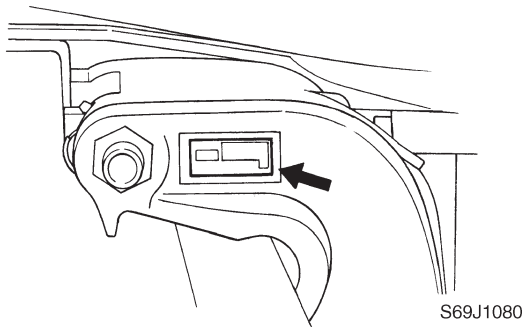
Applicable model

This manual covers the following model.

Applicable model
250GETO, L250GETO

Serial number

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



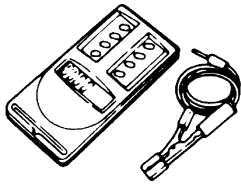
6B410020

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

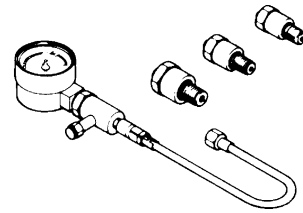
Model name	Approved model code	Starting serial No.
250G	6S3	1000001-
L250G	6S4	1000001-

Special service tool

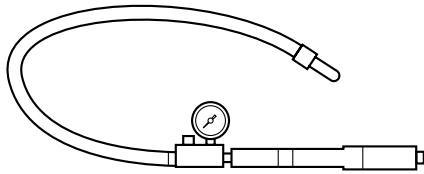
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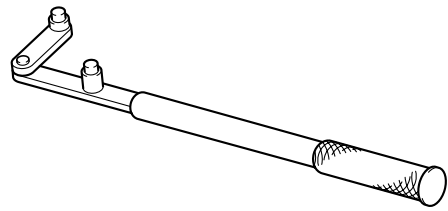
Digital tachometer
90890-06760



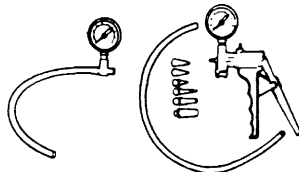
Compression gauge
90890-03160



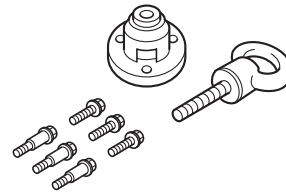
Leakage tester
90890-06840



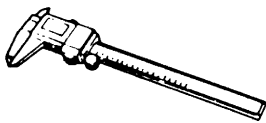
Flywheel holder
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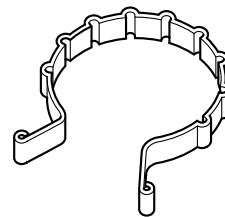
Vacuum/pressure pump gauge set
90890-06756



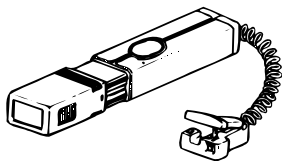
Flywheel puller
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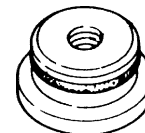
Digital caliper
90890-06704



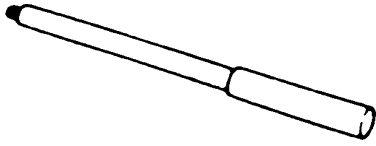
Piston slider ø85
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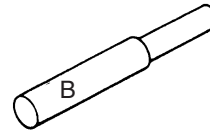
Timing light
90890-03141



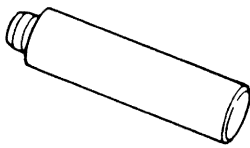
Needle bearing attachment
90890-06608, 90890-06610, 90890-06653
90890-06654, 90890-06611



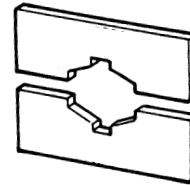
Driver rod L3
90890-06652



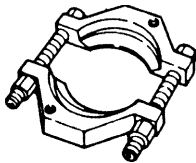
Pressure pin B
90890-02390



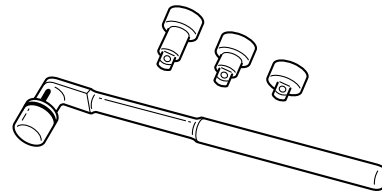
Driver rod LS
90890-06606



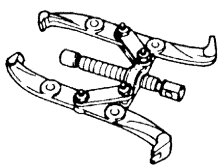
Support
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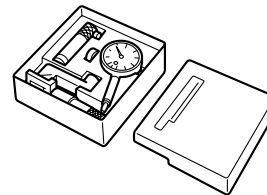
Bearing separator
90890-06534



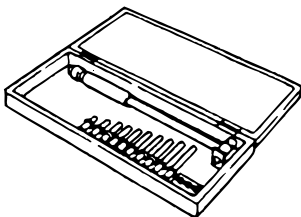
Pinion nut holder
90890-06715



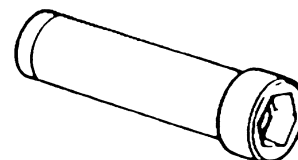
Gear puller
90890-06540



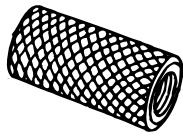
Dial gauge set
90890-01252



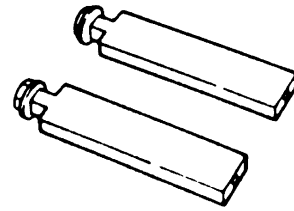
Cylinder gauge
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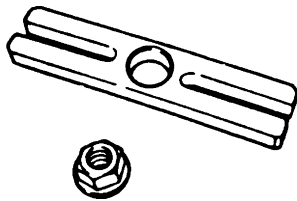
Ring nut wrench extension
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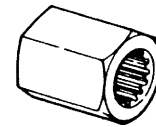
Puller head
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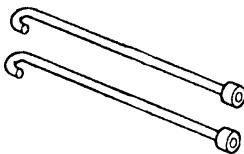
Stopper guide stand
90890-06538



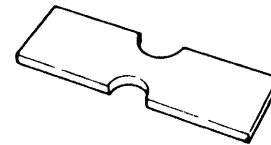
Stopper guide plate
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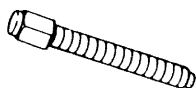
Drive shaft holder 6
90890-06520



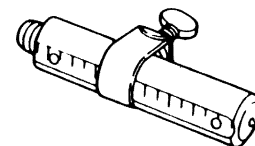
Bearing housing puller claw L
90890-06502



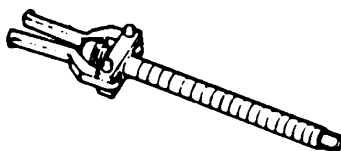
Bearing depth plate
90890-06603



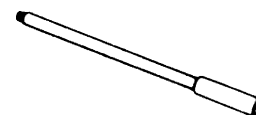
Center bolt
90890-06504



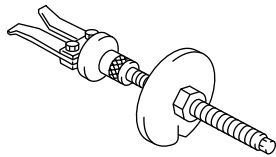
Driver rod SS
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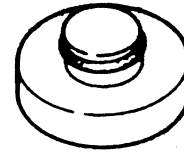
Bearing puller assembly
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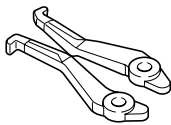
Driver rod LL
90890-06605



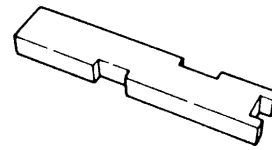
Bearing outer race puller assembly
90890-06523



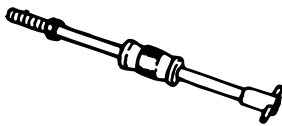
Ball bearing attachment
90890-06635, 90890-06655, 90890-06656
90890-06657



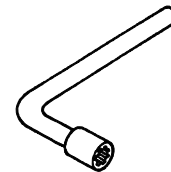
Outer race puller claw B
90890-06533



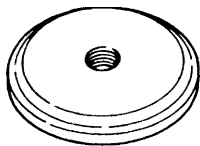
Shimming plate
90890-06701



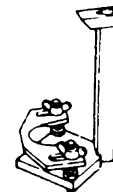
Slide hammer handle
90890-06531



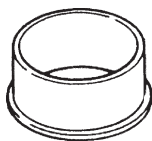
Shift rod push arm
90890-06052



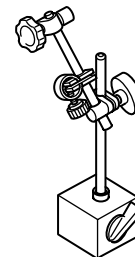
Bearing outer race attachment
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90890-06628, 90890-06658



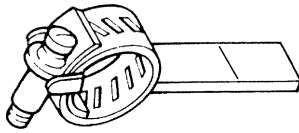
Pinion height gauge
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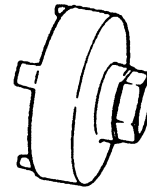
Bearing inner race attachment
90890-06640, 90890-06659



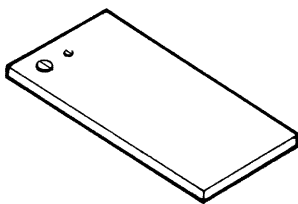
Magnet base B
90890-06844



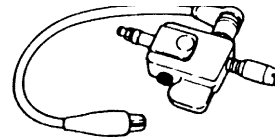
Backlash indicator
90890-06706



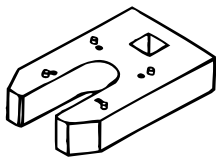
Ring nut wrench 4
90890-06510



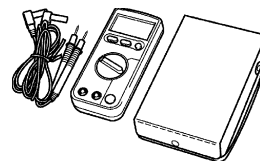
Magnet base plate
90890-07003



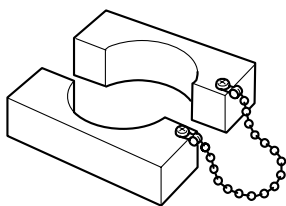
Ignition tester
90890-06754



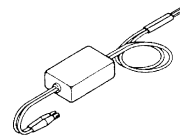
Cylinder-end screw wrench
90890-06568



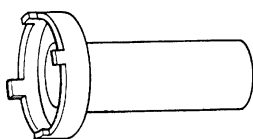
Digital circuit tester
90890-03174



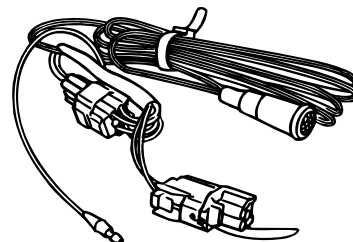
PTT piston vice attachment
90890-06572



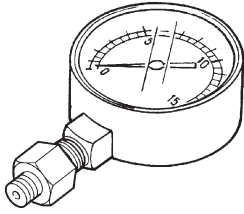
Peak voltage adaptor B
90890-03172



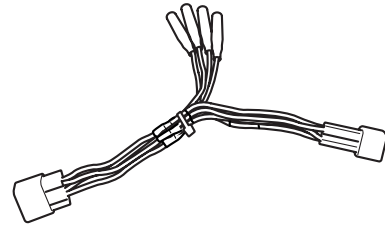
Ring nut wrench
90890-06578



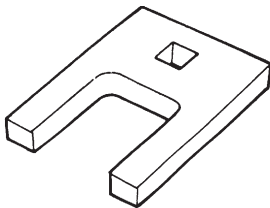
Diagnostic flash indicator B
90890-06865



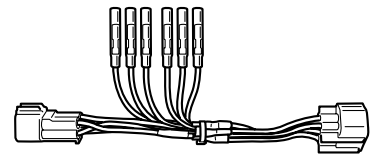
PTT oil pressure gauge assembly
90890-06580



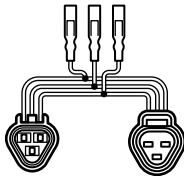
Test harness (4 pins)
90890-06871



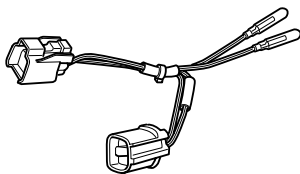
Tilt rod wrench
90890-06569



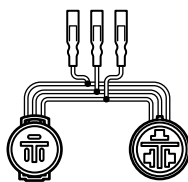
Test harness (6 pins)
90890-06872



Test harness (3 pins)
90890-06857



Test harness (2 pins)
90890-06867



Test harness (3 pins)
90890-06870

Feature and benefit

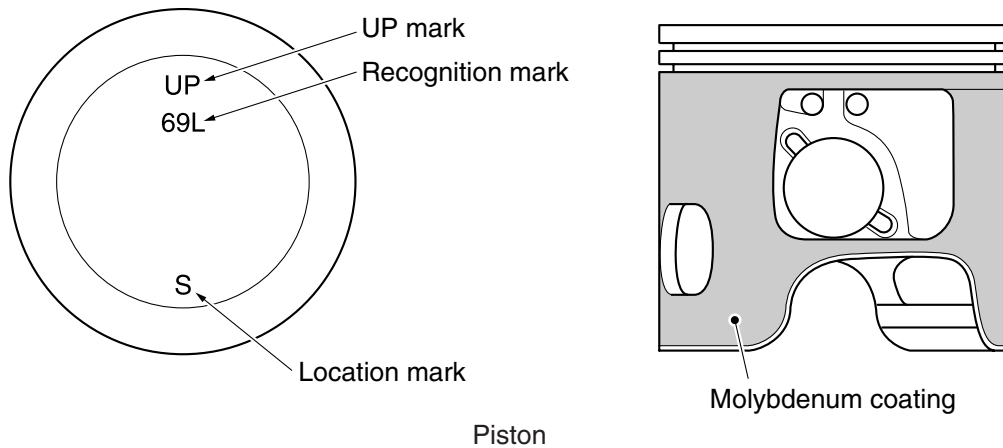
Power unit

Piston

An aluminum piston with heat treatment is used to obtain durability and reliability. Molybdenum coating is given to the skirt of piston to obtain more lubrication and reduce friction. 1st or 2nd oversized piston is available for overhaul service.

NOTE:

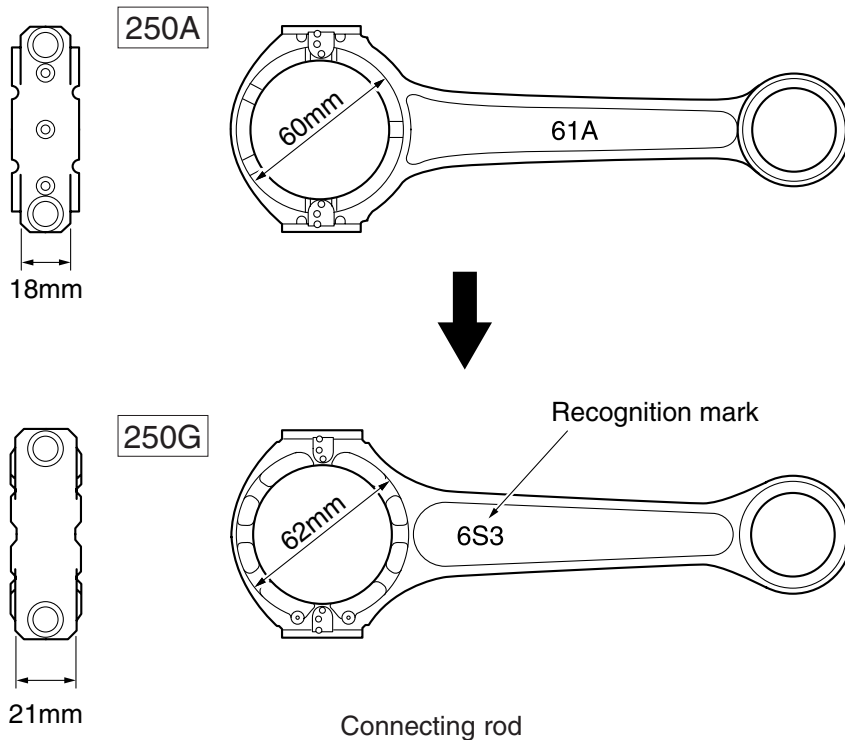
This piston is the same as the electronic fuel injected V6 3.1L models.



Connecting rod

The following treatment has been given to the connecting rod to enhance the stiffness.

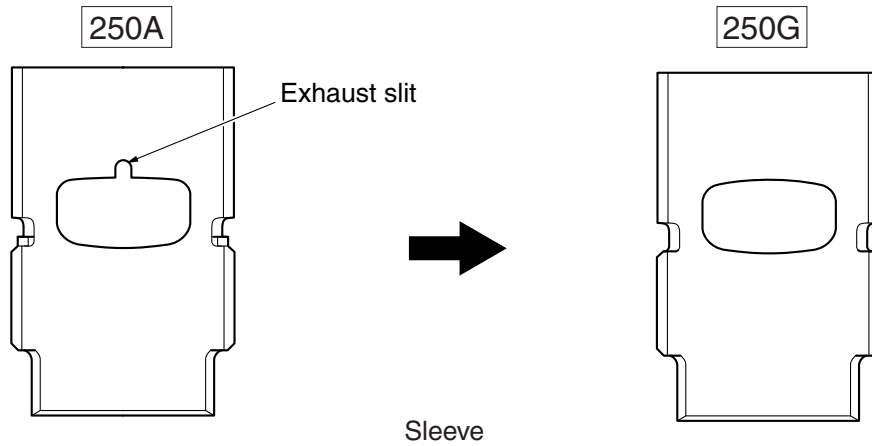
- Silver plating is given to the side of big end.
- A carbonizing is given to the big end portion.
- Larger size big-end is adopted.





Cylinder sleeve

The slit of exhaust port is removed and smoother curved exhaust port is used on, which can prevent the piston rings from scuffing with lesser fuel.

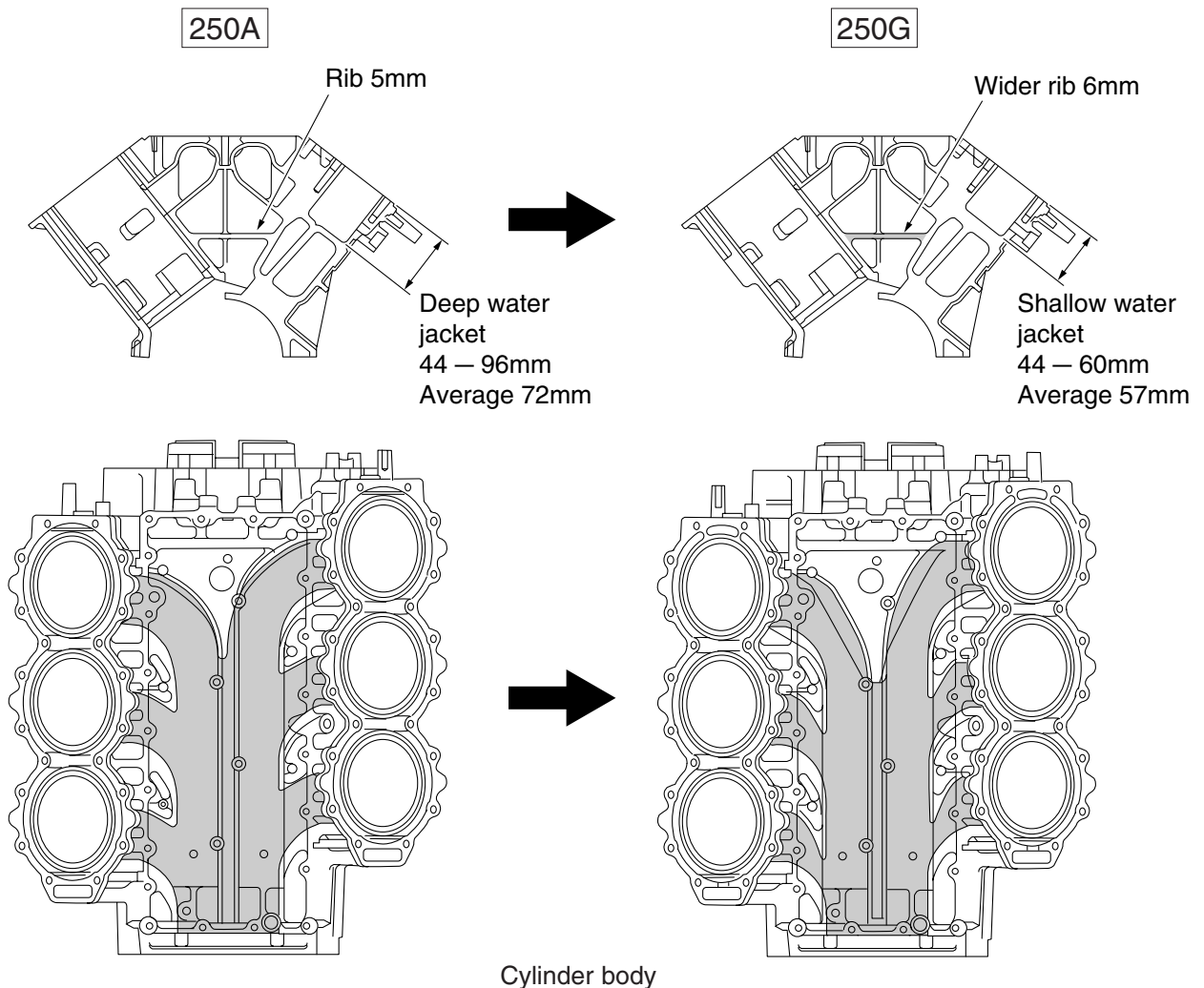


Cylinder body

The shallow water jacket is designed to increase the rigidity of cylinder body.

Wider rib is used to obtain rigid cylinder body.

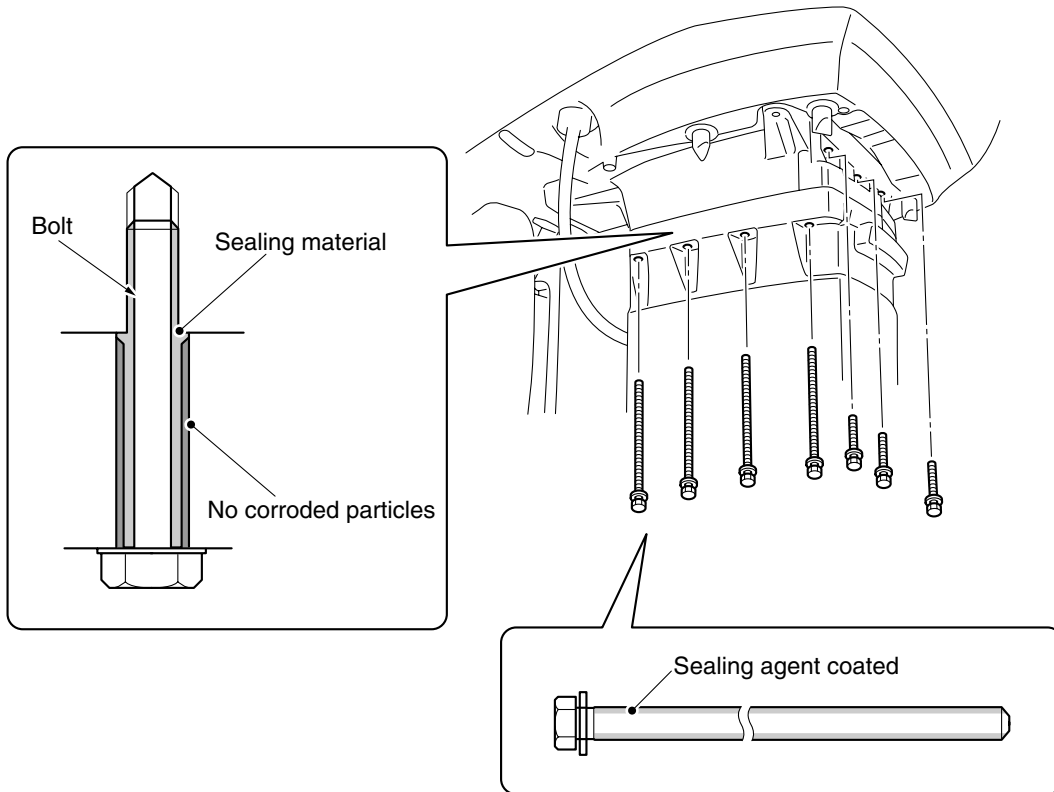
Smoother curve structure is given to the #1 and #2 exhaust passages to reduce resistance of exhaust gases.



Engine mount bolt

A fully thread bolt coated with a sealing agent has been used for mounting the engine. This gives a sealing function to the bolt, which will prevent the bolt from sticking by saltwater entering into the bolt hole for crystallizing and corroding. Therefore, the bolts can be removed easily, which obtained better servicing.

NOTE: _____
If the bolt is reused, apply LOCTITE 572 to the bolt threads.

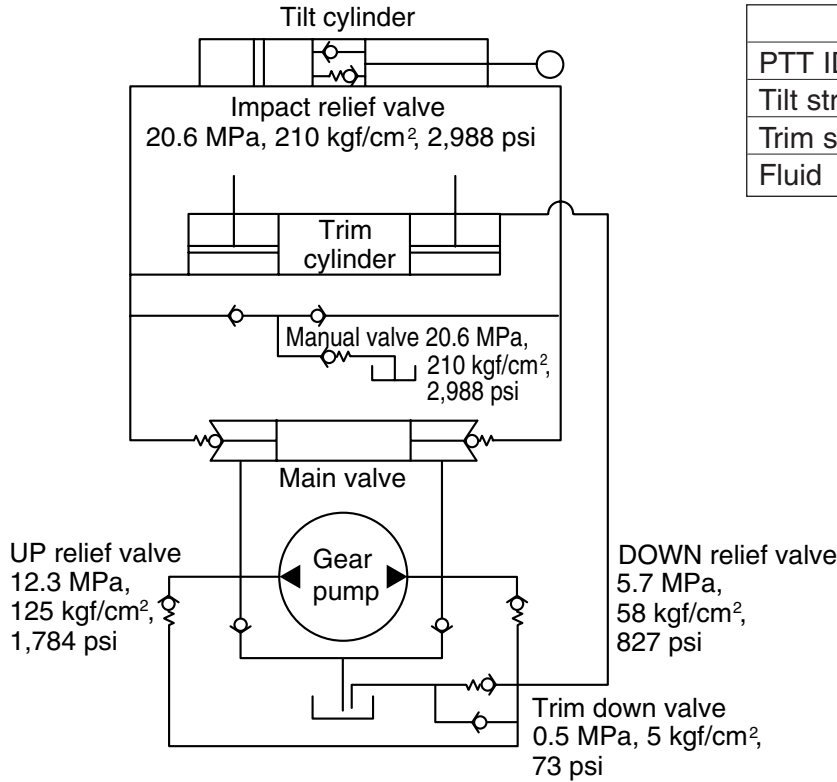


Engine mount bolt

Bracket/upper case

Ptt unit

The components of clamp bracket and PTT unit are the same as 250A.

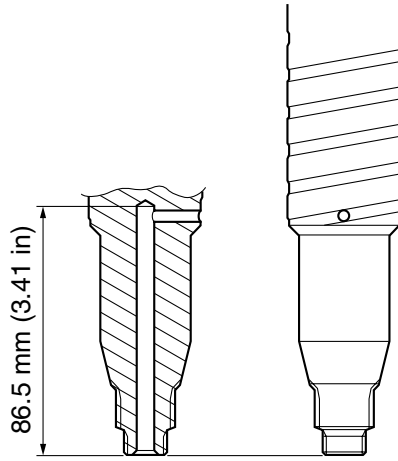


PTT specifications	
PTT ID mark	61A-25
Tilt stroke	147 mm, 5.8 in
Trim stroke	99 mm, 3.9 in
Fluid	ATF Dexron- II

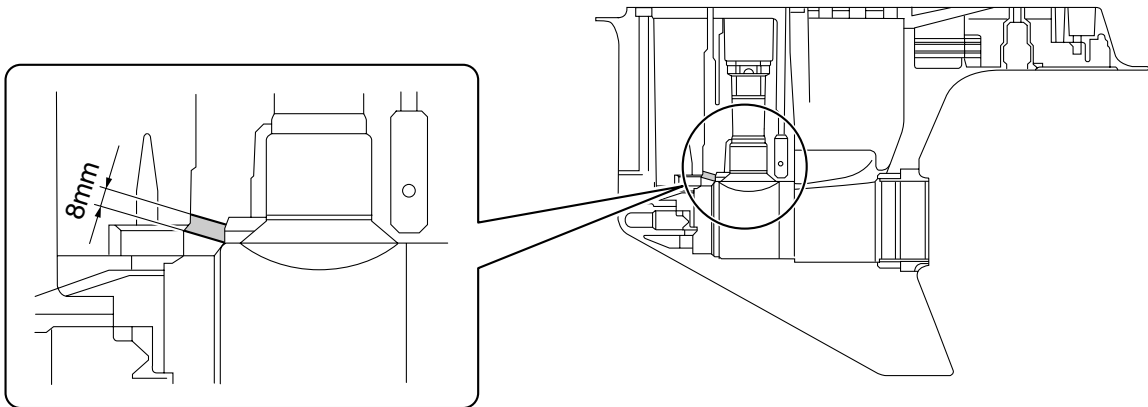
PTT fluid flow diagram

**Lower unit
Oil passage**

The oil passages have been added to the drive shaft at pinion end and the lower case between gear housing and shifter room to increase the gear oil fluidity, so that the lubrication ability has increased.



Drive shaft oil passage



Lower case oil passage

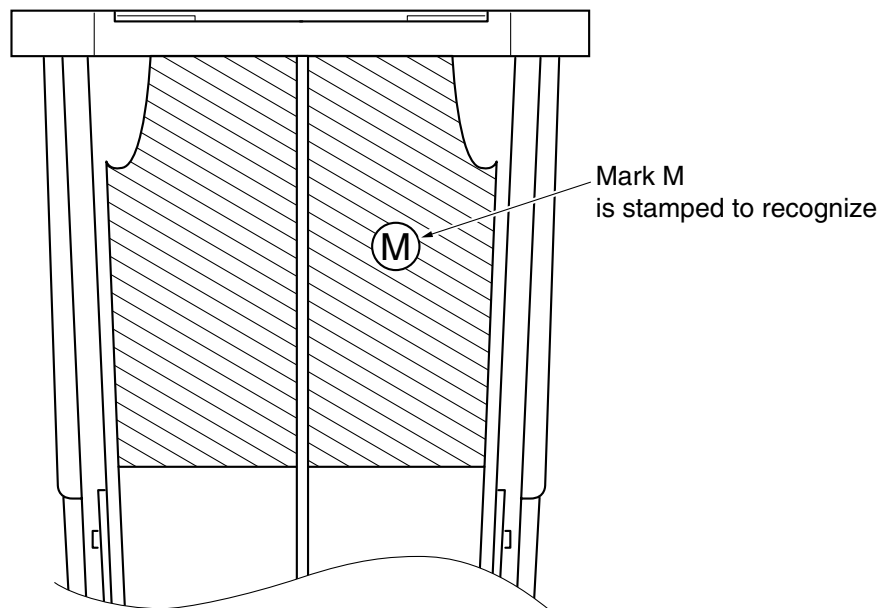
**Exhaust passage components**

A hard anodic oxide coating has been given to the exhaust passage's components to obtain corrosion-resistance.

The effected components are as follows,

- Exhaust pipe 61A-41132-20
- Muffler 61A-14711-30

Example; Muffler

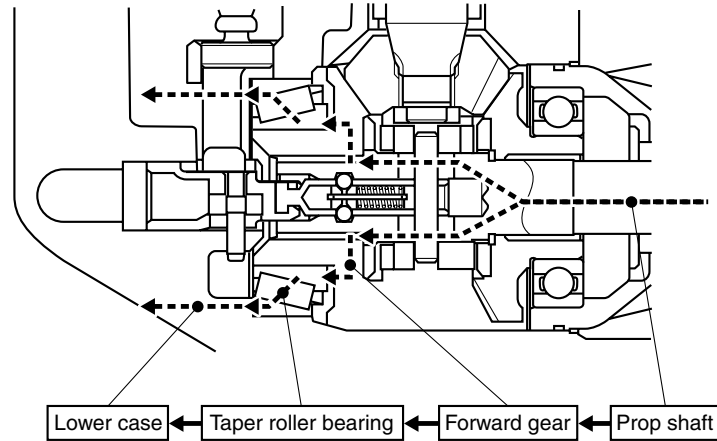


Hard anodic oxide coated components

Forward gear thrust bearing

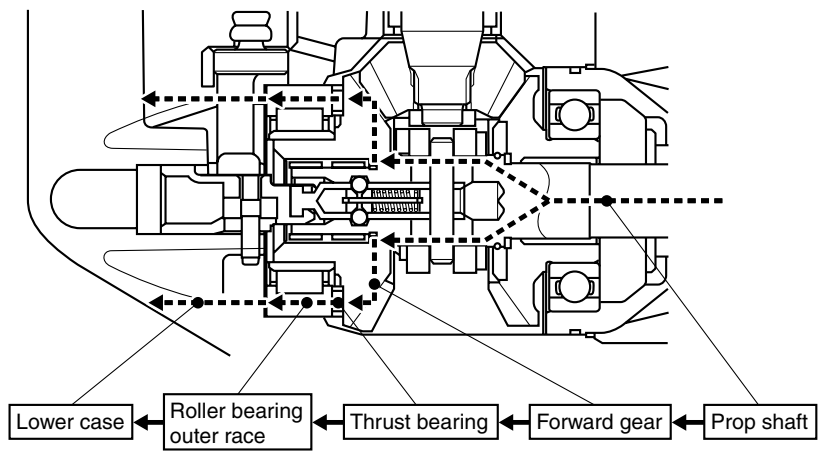
The forward gear bearing is newly designed to receive the thrust force from propeller at the outer race, which can obtain durability and reliability. Compared with the taper roller bearing, this structure can remove the thrust load from the taper rollers of bearing.

250A



Thrust force transmitting

250G



Thrust power transmission structure



Fuel system

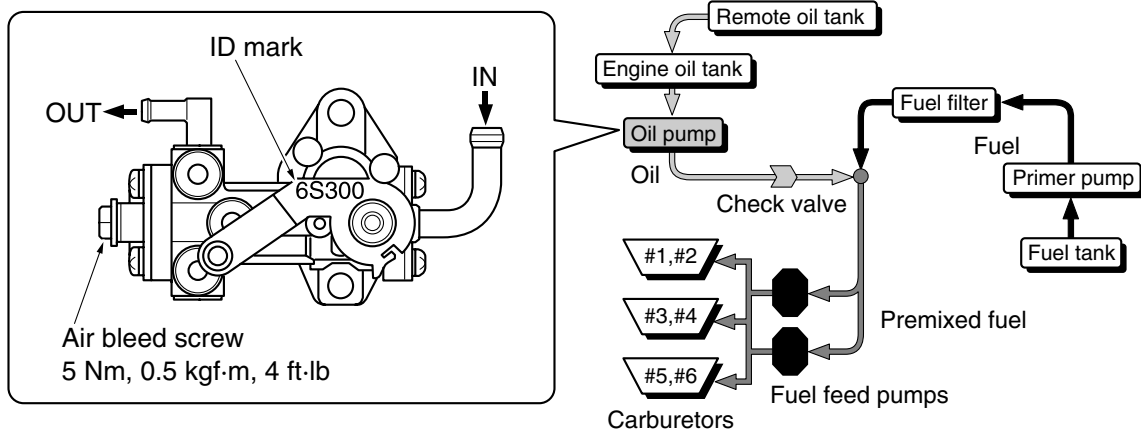
Premixing system

New auto lube system (auto oil blend system) is used to obtain simple structure.

The oil is supplied to the fuel line via the mechanical oil pump, and obtained simple oil hose delivery layout.

This can obtain easier servicing.

The oil volume discharging from the pump is decided by the engine RPM with compensating the throttle angle.



Fuel system diagram

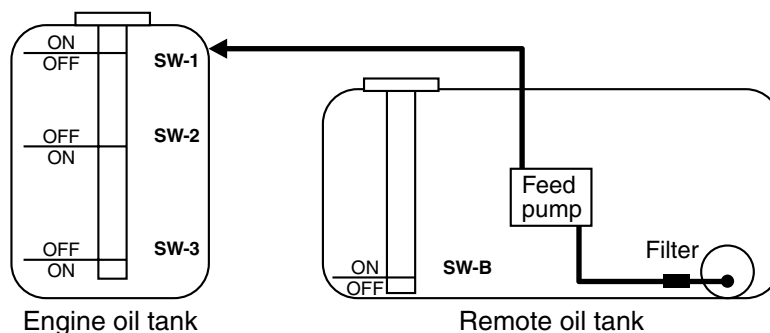
Oil control system

1) Oil feed pump control

This engine has the remote oil tank.

The oil feed pump is controlled as below.

Oil level switch				Oil pump operation
SW-1	SW-2	SW-3	SW-B	
ON	OFF	OFF	ON	OFF
OFF	OFF ON → OFF	OFF	ON	OFF ON
OFF	ON	OFF	ON	ON
OFF	ON	ON	ON	ON
ON	OFF	OFF	OFF	OFF
OFF	OFF	OFF	OFF	OFF
OFF	ON	OFF	OFF	OFF
OFF	ON	ON	OFF	OFF
For 5 seconds after key switch is on.				OFF
Key switch is off.				OFF



2) Oil indicator control

This engine has the oil warning indicators.

When the key switch is turned to ON, all indicators light for 3 seconds to check the bulbs.

The indicators on tachometer show the oil level condition as below.

		For 30 seconds after switch ON			Over 30 seconds after switch ON			Note
		Oil indicator			Oil indicator			
SW-3	SW-B	RED	YELLOW	GREEN	RED	YELLOW	GREEN	
OFF	ON	○	—	●	—	—	●	Normal
ON	ON	○	—	●	○	—	●	Feed pump malfunctions, or filter is clogged
ON	OFF	○	—	—	○	🛢️	—	Pump out remote tank oil into engine oil tank using emergency switch
OFF	OFF	○	—	—	—	🛢️	—	Add oil to remote oil tank

NOTE:

SW-3 is ON: Engine oil tank is empty, and the buzzer sounds.

SW-B is OFF: Remote oil tank is empty. However, oil is still left 1.5 liters in the remote tank as a reserve.

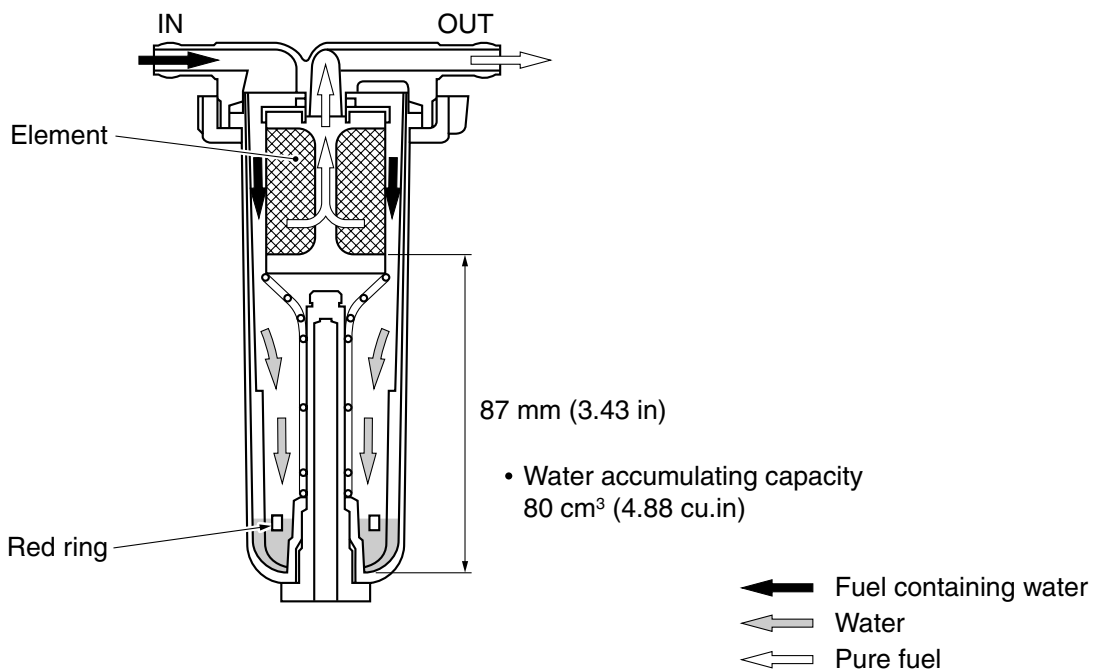
3) Fuel filter

A large fuel filter with water separator including water detection device has been used on.

If fuel containing water is accumulated into the fuel filter, water is precipitated to the bottom of cup because water is heavier than fuel.

Therefore, top clear layer fuel passes through the filter element, and flows to the carburetors.

The red ring will float to the boundary between fuel and water to indicate water in fuel.

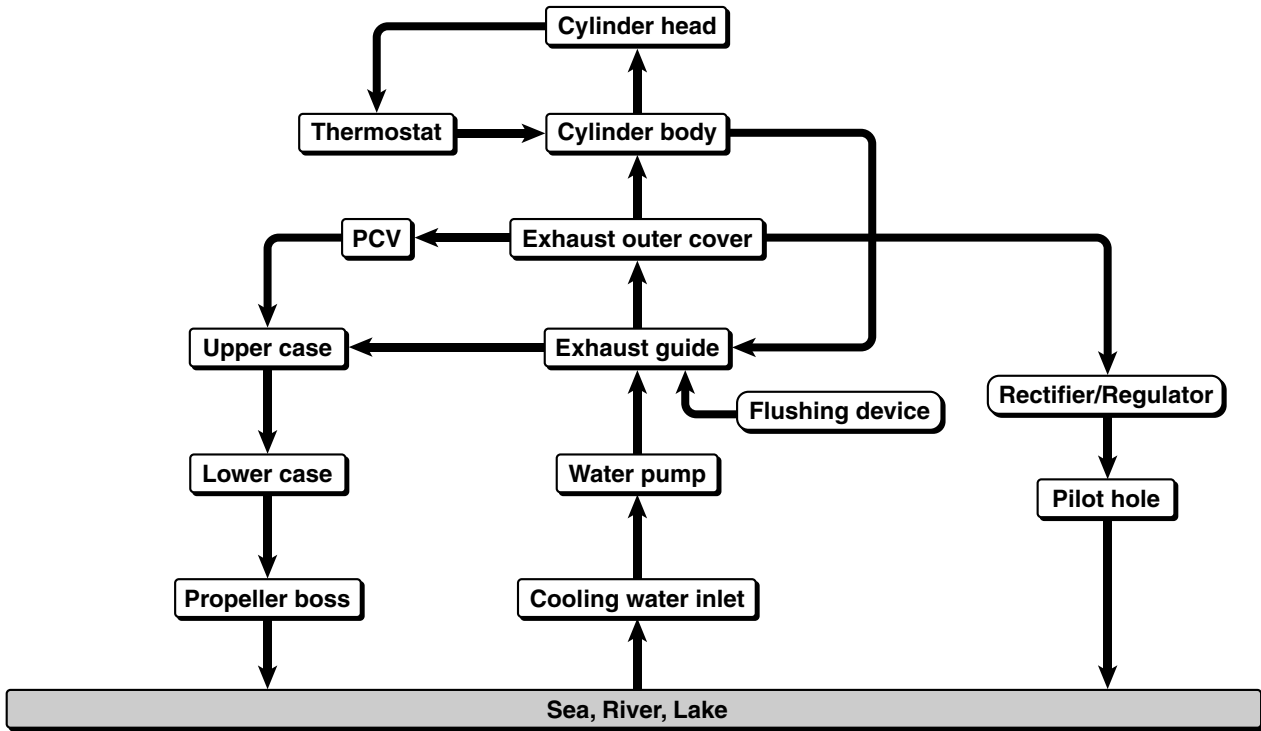


Fuel filter with water separator



Cooling system

The cooling water flow diagram is as follows.



Cooling water flow chart

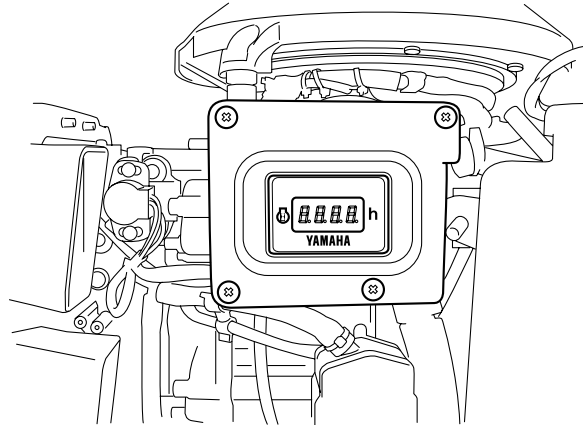
NOTE:

The cylinder head gasket has been newly designed for 250G. This gasket controls the cooling-water flow between the cylinder head and the cylinder body. Be sure to use the original gasket to obtain proper cooling-water flow.

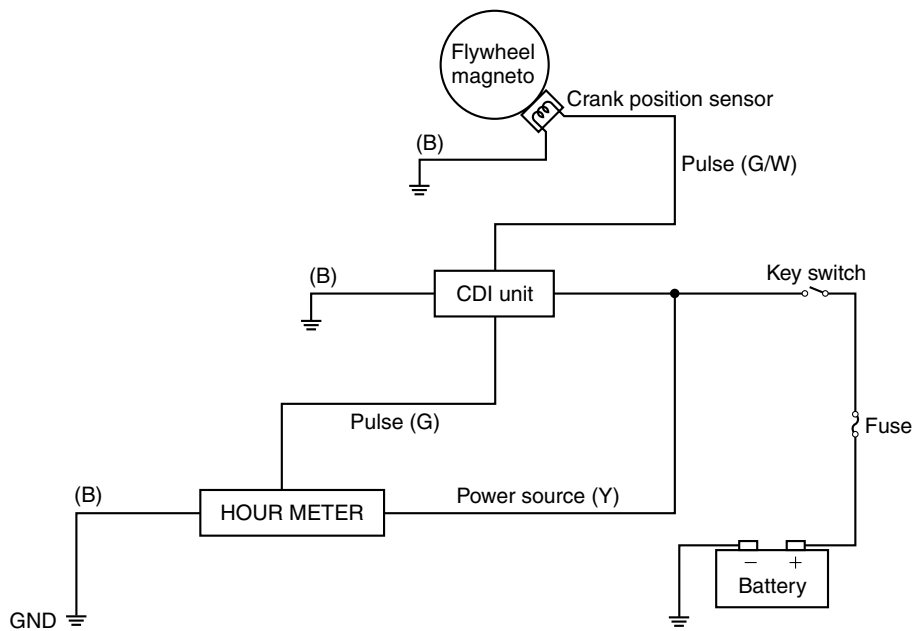
Electrical system

Hour meter

Hour meter has been built in the engine for easier management of service interval. The meter shows the elapsed engine operation hours after the engine was manufactured. Hour is counted by the signal of crank position sensor, and kept even if the engine is turned off. When the key switch is turned on, all of segments light for 2 seconds to check the display.



Hour meter



Hour meter wiring diagram



Ignition control

The micro-computer controls the ignition timing due to the throttle valve angle and engine RPM at every 0.01 seconds.

When starting the engine, the ignition timing is fixed to BTDC7.

If the engine condition is in an emergency, the ignition is controlled to misfire.

1) Warm-up control

When starting a cold engine, the ignition timing range is controlled by the engine temperature as below.

Engine temp.	Ignition timing
Above 40°C (104°F)	ATDC4-BTDC20
30-40°C (86-104°F)	BTDC2-BTDC20
Below 30°C (86°F)	BTDC4-BTDC20

2) Over-rev control

This engine has an over-rev limiter.

When the engine speed exceeds 6,100 rpm for example jumping with boat, misfire is immediately started to prevent the engine from damage because of over-rev.

For detail ignition control, see the table below.

Engine RPM	Misfiring cylinder
Below 6,099	Non
6,100 - 6,124	One of 6-cylinder
6,125 - 6,149	Two of 6-cylinder
6,150 - 6,174	Three of 6-cylinder
6,175 - 6,199	Four of 6-cylinder
6,200 - 6,224	Five of 6-cylinder
Above 6,225	All (6-cylinder)

NOTE:

If the wire (Gy) of CDI unit has been cut off, the over-rev limiter is no longer activated.

This is a tuning for competition use.

If the gear wire is cut off, the warranty never covers your outboard motor.

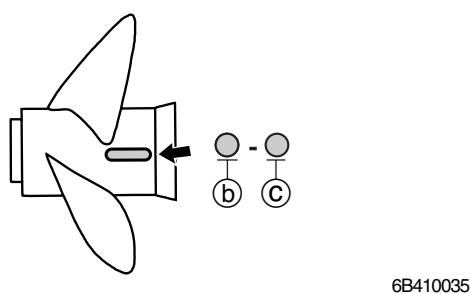
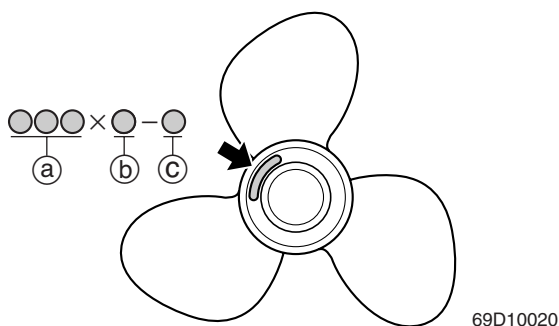
Propeller selection

The performance of a boat and outboard motor will be critically affected by the size and type of propeller you choose. Propellers greatly affect boat speed, acceleration, engine life, fuel economy, and even boating and steering capabilities. An incorrect choice could adversely affect performance and could also seriously damage the engine.

Use the following information as a guide for selecting a propeller that meets the operating conditions of the boat and the outboard motor.

Propeller size

The size of the propeller is indicated as shown.



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

Selection

When the engine speed is at the full throttle operating range (4,500–5,500 r/min), the ideal propeller for the boat is one that provides maximum performance in relation to boat speed and fuel consumption.

CAUTION:

Select the propeller which is not exceed 5,500 r/min. Otherwise can not obtain the correct engine performance, it becomes could result engine damaged.

Regular rotation model

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

Counter rotation model

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

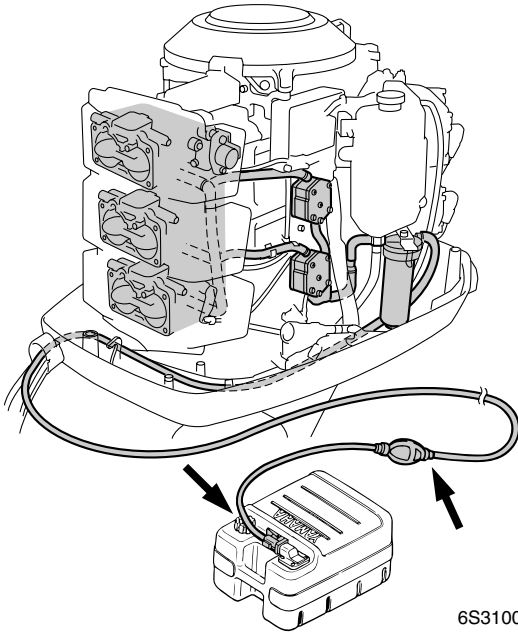


Predelivery check

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

Checking the fuel system

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



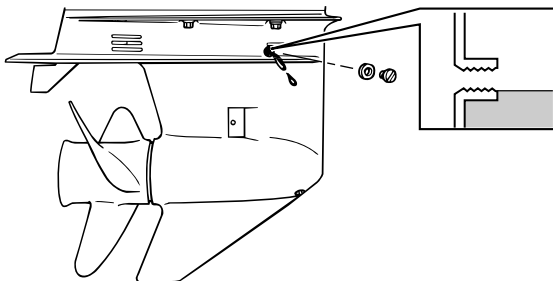
6S310010

CAUTION:

For break-in period, use the fuel and oil mixing ratio is 50:1. When finished it, straight gasoline shall be used.

Checking the gear oil

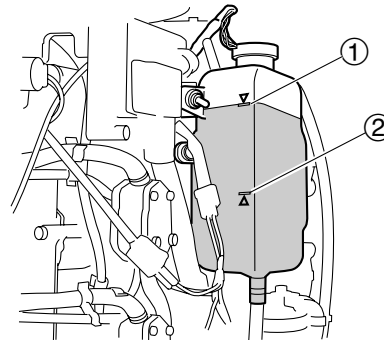
1. Check the gear oil level.



69D10055

Checking the engine oil level

1. Check the engine oil level.
2. Fill in the engine oil into the remote oil tank, turn the engine start switch to “ON” and check that the oil injection system automatically feed the engine oil from the remote oil tank to engine oil tank.
3. Make sure the oil level is between the upper ① and lower level marks ②.



6S330250



Recommended engine oil:
YAMALUBE 2-stroke outboard motor oil

NOTE:

Make sure that air bleeding must be operate after fill the engine.
Refer to the chapter 4, “Bleeding the oil pump”.

Checking the battery

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

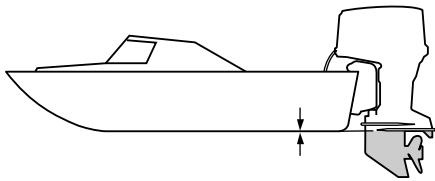


Recommended battery capacity:
CCA/EN: 711 A
20HR/IEC: 100 Ah
Electrolyte specified gravity:
1.280 at 20°C (68°F)

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

Checking the outboard motor mounting height

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



69D10080

NOTE:

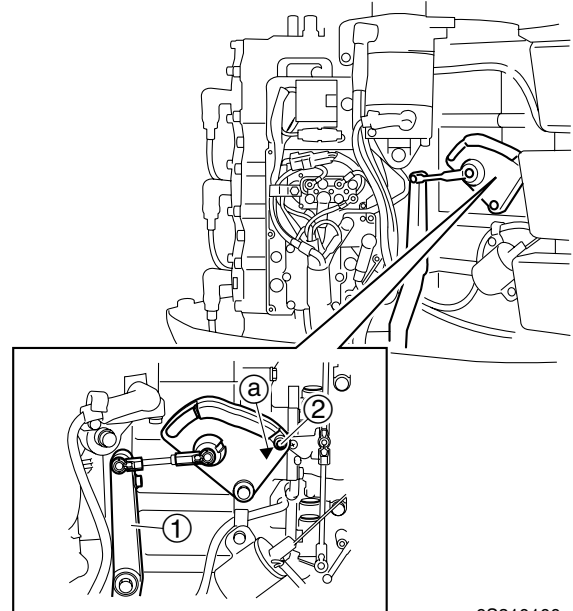
The optimum mounting height is affected by the combination of the boat and the outboard motor. To determine the optimum mounting height, test run the outboard motor at different heights.

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

Checking the remote control cable

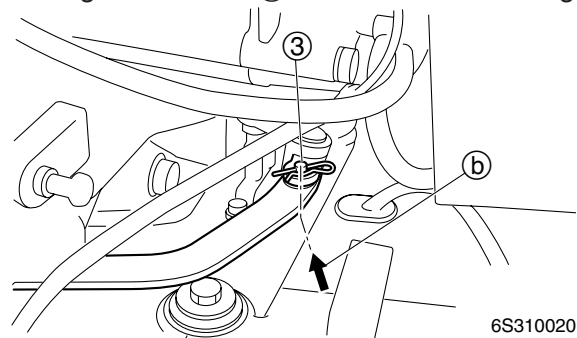
1. Set the remote control lever to the neutral position and fully close the throttle lever.

2. Check that the control lever ① is in its fully closed position, and check that the center of the throttle cam roller ② aligned with the alignment mark ③.

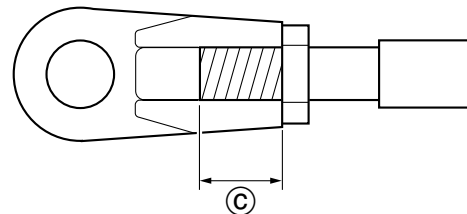


6S310100

3. Check that the remote control lever is in the neutral position, and check that the center of the set pin ③ is aligned with the alignment mark ④ on the bottom cowling.



6S310020



6S310050

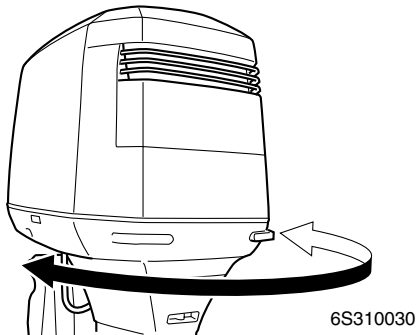
CAUTION:

The shift / throttle cable joint must be screwed in a minimum of 8.0 mm (0.31 in) ③.



Checking the steering system

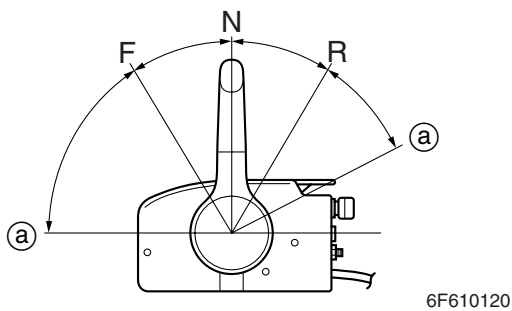
1. Check that the steering operates smoothly.



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

Checking the gear shift and throttle operation

1. Check that the gear shift operates smoothly when the remote control lever is shifted from neutral to forward or reverse.
2. Check that the throttle operates smoothly when the remote control lever is shifted from the fully closed position to the fully open position (a).

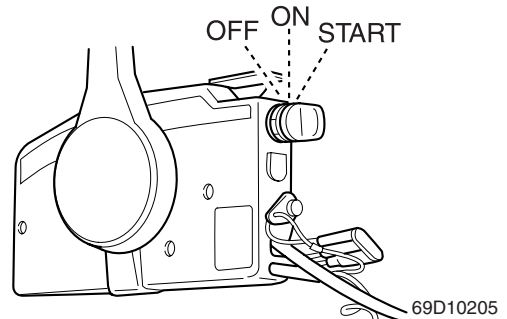


Checking the PTT system

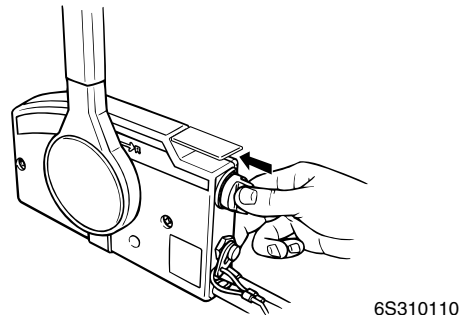
1. Check that the outboard motor tilts up and down smoothly when operating the PTT unit.
2. Check that there is no abnormal noise produced when the outboard motor is tilted up or down.
3. Check that there is no interference with wires or hoses when the tilted up outboard motor is steered.
4. Check that the trim meter points down when the outboard motor is tilted all the way down.

Checking the engine start switch and engine stop lanyard switch

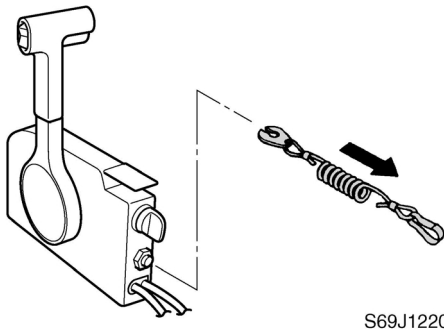
1. Check that the engine starts when the engine start switch is turned to START.
2. Check that the engine turns off when the engine start switch is turned to OFF.



3. Check that the choke solenoid operates when the engine start switch is pushed in.

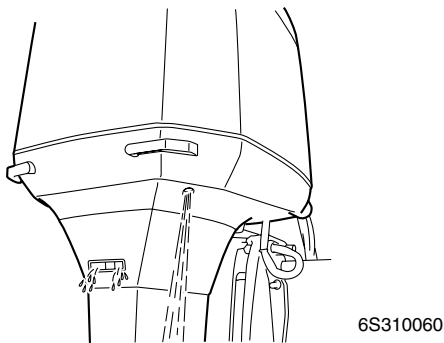


4. Check that the engine turns off when the lock plate of engine stop lanyard is pulled from the engine stop lanyard switch.



Checking the cooling water pilot hole

1. Start the engine, then check that the cooling water is discharged from the cooling water pilot hole.



Test run

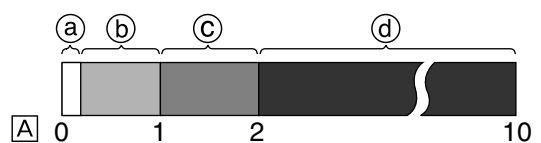
1. Start the engine, and then check that the gear shift operates smoothly.
2. Check the engine idle speed after the engine has been warmed up.
3. Operate at trolling speed.
4. Run the outboard motor for 1 hour at 3,000 r/min or at half throttle, then for another hour at 4,000 r/min or at 3/4 throttle.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

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

Break-in

During the test run, perform the break-in operation in the following 5 stages.

1. 10 minutes (a) at the lowest possible speed. A fast idle in neutral is best.
2. 50 minutes (b) at 1/2 throttle (approximately 3,000 r/min) or less. Vary engine speed occasionally. On an easy-planing boat, accelerate at full throttle onto plane, then immediately reduce the throttle to 3,000 r/min or less.
3. 1 hour (c) at 3/4 throttle (approximately 4,000 r/min). Vary engine speed occasionally. Run at full throttle for 1 minute, then allow about 10 minutes of operation at 3/4 throttle or less to let the engine cool.
4. 8 hours (d) at any speed, but avoid operating at full throttle for more than 5 minutes at a time. Let the engine cool between full-throttle runs. Vary engine speed occasionally.
5. After the first 10 hours. Use only straight gasoline into the fuel tank. Refer to page 1-25.

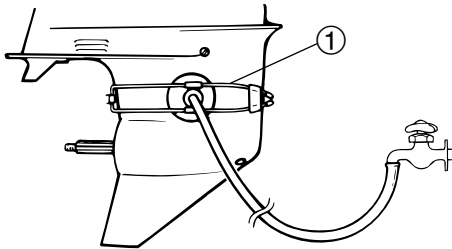


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[A] Hours

**After test run**

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

**CAUTION:** _____

Be sure to supply sufficient water when flushing the cooling water passage, otherwise the engine may overheat.

Specification

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General specification

Item	Unit	Model	
		250GET	L250GET
Dimension			
Overall length	mm (in)	854 (33.6)	
Overall width	mm (in)	562 (22.1)	
Overall height			
(X)	mm (in)	1,785 (70.3)	
(U)	mm (in)	1,912 (75.3)	
Boat transom height			
(X)	mm (in)	635 (25.0)	
(U)	mm (in)	762 (30.0)	
Weight			
(with stainless propeller)			
(X)	kg (lb)	240 (529)	242 (534)
(U)	kg (lb)	245 (540)	247 (545)
Performance			
Maximum output	kW (hp)	183.9 (250) at 5,000 r/min	
Full throttle operating range	r/min	4,500 – 5,500	
Maximum fuel consumption	L (US gal, Imp gal)/hr	106 (28.0, 23.3) at 5,500 r/min	
Engine idle speed	r/min	675–725	
Power unit			
Engine type		2-stroke, V	
Cylinder quantity		6	
Total displacement	cm ³ (cu. in)	3,130 (190.94)	
Bore x stroke	mm (in)	90.0 × 82.0 (3.54 × 3.23)	
Compression ratio		5.7:1	
Intake system		Reed valve	
Scavenging system		Loop charge	
Control system		Remote control	
Starting system		Electric	
Fuel system		Carburetor	
Ignition control system		CDI (micro computer)	
Maximum generator output	V, A	12, 35.0	
Starting enrichment		Choke valve	
Spark plug		BR8HS-10 (NGK)	
Cooling system		Water	
Exhaust system		Propeller boss	
Lubrication system		Oil injection	

General specification

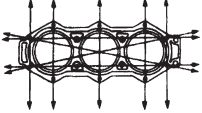

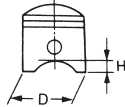


Item	Unit	Model	
		250GET	L250GET
Fuel and oil			
Fuel type	RON (*1)	Regular unleaded gasoline 87	
Engine oil		2-stroke outboard motor oil	
Engine oil grade		NMMA-certified TC-W3	
Engine oil tank capacity	L (US gt, Imp gt)	1.2 (1.27, 1.06)	
Oil tank			
Remote oil tank	L (US gt, Imp gt)	10.5 (11.10, 9.24)	
Gear oil type	API SAE	Hypoid gear oil	
Gear oil grade (*2)		GL-4	
		90	
Gear oil quantity	cm ³ (US oz, Imp oz)	1,150 (38.88, 40.56)	1,000 (33.81, 35.27)
Bracket unit			
Trim angle (at 12° boat transom)	Degree	-3 to 16	
Tilt-up angle	Degree	70	
Steering angle	Degree	32 + 32	
Drive unit			
Gear shift positions		F-N-R	
Gear ratio		1.81 (29/16)	
Reduction gear type		Spiral bevel gear	
Clutch type		Dog clutch	
Propeller shaft type		Spline	
Propeller direction (rear view)		Clockwise	Counterclockwise
Propeller ID mark		T, M	TL, ML
Electrical			
Battery minimum capacity (*3)	A Ah		
CCA/EN		711	
20HR/IEC		100	

- (*1) RON: Research Octane Number
- (*2) Meeting both API and SAE requirements
- (*3) CCA: Cold Cranking Ampere
 EN: European Norm (European standard)
 IEC: International Electrotechnical Commission

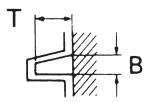
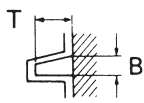
Maintenance specification

Power unit

Item	Unit	Model	
		250GET	L250GET
Power unit Minimum compression pressure (*1)	kPa (kgf/cm ² , psi)	430 (4.3, 61)	
Cylinder head Warpage limit  (lines indicate straightedge position)	mm (in)	0.10 (0.0039)	
Cylinders Bore size 	mm (in)	90.000–90.020 (3.5433–3.5441)	
Pistons Piston diameter (D) Measuring point (H) Piston clearance Piston pin boss bore Oversize piston 1st 2nd Oversize piston diameter 1st 2nd	 mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in)	89.840–89.860 (3.5370–3.5378) 10.0 (0.39) 0.155–0.161 (0.0061–0.0063) 26.004–26.015 (1.0238–1.0242) 0.25 (0.010) 0.50 (0.020) 90.090–90.110 (3.5468–3.5476) 90.340–90.360 (3.5567–3.5575)	
Piston pins Piston pin diameter	mm (in)	25.995–26.000 (1.0234–1.0236)	

(*1) Measuring conditions:

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

Item	Unit	Model	
		250GET	L250GET
Piston rings			
Top ring			
Dimension B 	mm (in)	1.970–1.990 (0.0776–0.0783)	
Dimension T	mm (in)	2.700–2.900 (0.1063–0.1142)	
End gap	mm (in)	0.30–0.50 (0.0118–0.0197)	
Side clearance	mm (in)	0.02–0.06 (0.0008–0.0024)	
Oversize outside diameter			
1st	mm (in)	90.25 (3.5531)	
2nd	mm (in)	90.50 (3.5630)	
2nd piston ring			
Dimension B 	mm (in)	1.970–1.990 (0.0776–0.0783)	
Dimension T	mm (in)	2.700–2.900 (0.1063–0.1142)	
End gap	mm (in)	0.30–0.40 (0.0118–0.0157)	
Side clearance	mm (in)	0.02–0.06 (0.0008–0.0024)	
Oversize outside diameter			
1st	mm (in)	90.25 (3.5531)	
2nd	mm (in)	90.50 (3.5630)	
Connecting rods			
Small-end inside diameter	mm (in)	31.000–31.012 (1.2205–1.2209)	
Connecting rod big-end side clearance	mm (in)	0.080–0.400 (0.0032–0.0157)	
Small-end axial play limit	mm (in)	2.0 (0.08)	
Crankshaft			
Crankshaft journal diameter	mm (in)	58.975–58.991 (2.3219–2.3225)	
Crankpin diameter	mm (in)	40.485–40.500 (1.5939–1.5945)	
Runout limit	mm (in)	0.02 (0.0008)	
Thermostat			
Opening temperature	°C (°F)	48–52 (118.4–125.6)	
Fully open temperature	°C (°F)	60 (140)	
Valve open lower limit	mm (in)	3.0 (0.12)	
Reed valves			
Valve stopper height	mm (in)	8.7–9.3 (0.34–0.36)	
Valve bending limit	mm (in)	0.2 (0.0079)	

Item	Unit	Model	
		250GET	L250GET
Carburetor		6S300	
ID mark		158 [SU, PU, PM] 164 [SM, PL] 162 [SL]	
Main jet (M.J.)	#		
Main nozzle (M.N.)	mm (in)	4.5 (0.18)	
Pilot jet (P.J.)	#	74 [SU], 78 [PU], 80 [SM, SL], 84 [PM, PL]	
Pilot air jet (P.A.J.)	#	50 [SU, PU] 60 [SM, PM, SL, PL]	
Pilot screw (P.S.)	turns out	1 [PU], 3/4 [PM], 1 8/3 [PL] 7/8 [SU, SM, SL]	
Valve seat size	mm (in)	1.2 (0.05)	
Float height	mm (in)	15.5 – 16.5 (0.61–0.65)	

PU: Port upper, PM: Port middle, PL: Port lower
 SU: Starboard upper, SM: Starboard middle, SL: Starboard lower

Lower unit

Item	Unit	Model	
		250GET	L250GET
Gear backlash			
Pinion-to-forward	mm (in)	0.13-0.45 (0.0051-0.0177)	0.32-0.52 (0.0126-0.0205)
Pinion-to-reverse	mm (in)	0.64-0.93 (0.0252-0.0366)	
Pinion gear shims	mm	0.10, 0.12, 0.15, 0.18, 0.30, 0.40, 0.50	
Forward gear shims	mm	0.10, 0.12, 0.15, 0.18, 0.30, 0.40, 0.50	
Reverse gear shims	mm	0.10, 0.12, 0.15, 0.18, 0.30, 0.40, 0.50	
Propeller shaft shims	mm	—	0.10, 0.12, 0.15, 0.18, 0.30, 0.40, 0.50
Propeller shaft free play	mm (in)	—	0.25–0.35 (0.0098–0.0138)

Electrical

Item	Unit	Model	
		250GET	L250GET
Ignition and ignition control system			
Ignition timing (full retarded)	Degree	ATDC 2–6	
Ignition timing (full advanced)	Degree	BTDC 18–22	

Maintenance specification



Item	Unit	Model	
		250GET	L250GET
Spark plug gap	mm (in)	0.9–1.0 (0.035–0.039)	
Ignition coil resistance			
Primary coil (B/W–B)	Ω	0.18–0.24	
at 20°C (68°F)			
Secondary coil			
(B/W–spark plug wire)	kΩ	2.72–3.68	
at 20°C (68°F)			
Spark plug cap resistance	kΩ	4.0–6.0	
CDI unit output peak voltage			
(B/W–B)			
at Cranking (loaded)	V	120	
at 1,500 r/min (loaded)	V	150	
at 3,500 r/min (loaded)	V	130	
Pulser coil output peak voltage			
(W/R–B, W/B–B, W/Y–B,			
W/G–B, W/L–B, W/Br–B)			
at Cranking (unloaded)	V	5.0	
at Cranking (loaded)	V	5.0	
at 1,500 r/min (loaded)	V	20.0	
at 3,500 r/min (loaded)	V	38.0	
Pulser coil resistance	Ω	294–398	
at 20°C (68°F)			
(W/R–B, W/B–B, W/Y–B,			
W/G–B, W/L–B, W/Br–B)			
Crank position sensor			
output peak voltage			
(G/W–G/L)			
at Cranking (unloaded)	V	4.0	
at Cranking (loaded)	V	4.0	
at 1,500 r/min (loaded)	V	10.0	
at 3,500 r/min (loaded)	V	15.0	
Crank position sensor	Ω	179–242	
resistance at 20°C (68°F)			
(G/W–G/L)			
Crank position sensor air gap	mm (in)	0.5–1.5 (0.02–0.06)	
Throttle sensor			
Input voltage (O–R)	V	5	
Output voltage (P–O)	V	0.48–0.52	
(at throttle valve fully closed)			
Thermoswitch			
ON temperature	°C (°F)	84.0–90.0 (183–194)	
OFF temperature	°C (°F)	60.0–74.0 (140–165)	
Engine temperature sensor			
resistance			
(B/Y–B/Y)			
at 5°C (41°F)	kΩ	128 (reference)	
at 20°C (68°F)	kΩ	54.2–69.0	
at 100°C (212°F)	kΩ	3.12–3.48	



Item	Unit	Model	
		250GET	L250GET
Charge coil output peak voltage (R-Br)			
at Cranking (unloaded)	V		120
at Cranking (loaded)	V		150
at 1,500 r/min (loaded)	V		170
at 3,500 r/min (loaded)	V		170
(B/R-L)			
at Cranking (unloaded)	V		120
at Cranking (loaded)	V		150
at 1,500 r/min (loaded)	V		170
at 3,500 r/min (loaded)	V		170
Charge coil resistance at 20°C (68°F)			
(R-Br)	Ω		224-336
(B/R-L)	Ω		224-336
Starter motor			
Type			Bendix
Output	kW		1.10
Brushes			
Standard length	mm (in)		17.0 (0.67)
Wear limit	mm (in)		10.0 (0.39)
Commutator			
Standard diameter	mm (in)		33.0 (1.30)
Wear limit	mm (in)		32.0 (1.26)
Standard undercut	mm (in)		0.8 (0.03)
Wear limit	mm (in)		0.2 (0.01)
Charging system			
Fuse	A		80, 20
Lighting coil output peak voltage (G-G)			
at Cranking (unloaded)	V		8.0
at 1,500 r/min (unloaded)	V		45.0
at 3,500 r/min (unloaded)	V		90.0
Lighting coil resistance at 20°C (68°F) (G-G)	Ω		0.2-0.3
Rectifier Regulator output peak voltage (R-B)			
at 1,500 r/min (loaded)	V		13
at 3,500 r/min (loaded)	V		13

Maintenance specification

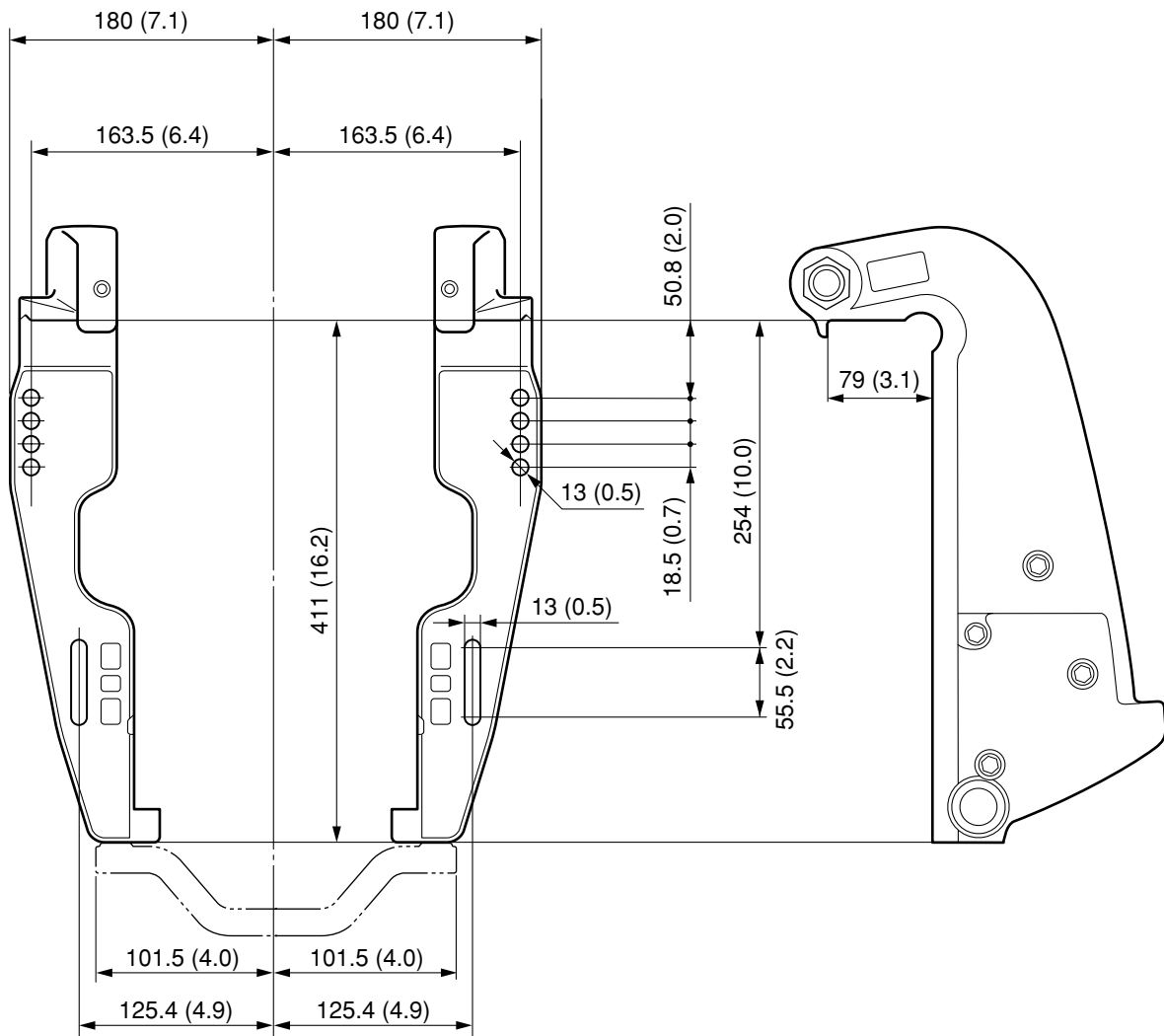
Item	Unit	Model	
		250GET	L250GET
PTT system			
Trim sensor			
Trim sensor resistance at 20°C (68°F) (P-B)	Ω	9–11	
Resistance at 20°C (68°F) (P-B)	Ω	248–388	
Fluid type		ATF Dexron II	
Motor type		61A02	
Output	kW	0.38	
Brushes			
Standard length	mm (in)	12.0 (0.47)	
Wear limit	mm (in)	4.0 (0.16)	
Commutator			
Standard diameter	mm (in)	25.0 (0.98)	
Wear limit	mm (in)	24.0 (0.95)	
Standard undercut	mm (in)	1.8 (0.07)	
Wear limit	mm (in)	1.2 (0.05)	
Hydraulic pressure (down)	MPa (kgf/cm ²)	4.7–6.7 (47–67)	
Hydraulic pressure (up)	MPa (kgf/cm ²)	11.3–13.3 (113–133)	



Clamp bracket

mm (in)

2



6S32002M

Tightening torque Specified torque

Part to be tightened		Thread size	Tightening torques		
			N·m	kgf·m	ft·lb
Fuel system					
Intake silencer screw		—	3	0.3	2.2
Throttle sensor screw		—	4	0.4	3.0
Hour meter cover screw		—	3	0.3	2.2
Oil pump bolt		M6	7	0.7	5.2
Power unit					
Power unit bolt		M8	25	2.5	18.4
Apron bolt		M6	8	0.8	5.9
Flywheel magnet nut		—	200	20	148
Hour meter screw		—	3	0.3	2.2
Control lever bolt		M8	18	1.8	13.3
Accelerator cam bolt		M6	8	0.8	5.9
Shift cut switch plate screw		—	3	0.3	2.2
Shift arm bracket bolt		M8	18	1.8	13.3
PTT relay terminal nut		—	3	0.3	2.2
Starter motor mount bolt		M8	18	1.8	13.3
Starter motor positive terminal nut		—	7	0.7	5.2
Negative battery cable bolt		M8	18	1.8	13.3
Intake manifold bolt	1st	M6	4	0.4	3.0
	2nd		8	0.8	5.9
Reed valve mount screw		—	3	0.3	2.2
Thermostat cover bolt		M6	10	1.0	7.4
Cover bolt (thermostat base)		M6	10	1.0	7.4
PCV cover bolt		M6	11	1.1	8.1
Exhaust cover bolt	1st	M6	5	0.5	3.7
	2nd		10	1.0	7.4
Cylinder head cover bolt	1st	M6	5	0.5	3.7
	2nd		11	1.1	8.1
Cylinder head bolt	1st	M8	15	1.5	11.1
	2nd		30	3.0	22.1
Spark plug		M14	25	2.5	18.4
Crankcase bolt	1st	M10	20	2.0	14.8
	2nd		40	4.0	29.5
	1st	M6	4	0.4	3.0
	2nd		8	0.8	5.9
Crankshaft balancer nut		—	100	10	73.8
Connecting rod bolt	1st	M9	19	1.9	14.0
	2nd		36	3.6	26.6
	3rd		Loosen completely		
	4th		19	1.9	14.0
	5th		36	3.6	26.6
Sensor plug		—	23	2.3	17.0

Tightening torque

Part to be tightened	Thread size	Tightening torques		
		N·m	kgf·m	ft·lb
Lower unit (regular rotation model)				
Check screw	—	9	0.9	6.6
Drain screw	—	9	0.9	6.6
Lower case mount bolt	M10	47	4.7	34.7
Water pump housing bolt	M8	18	1.8	13.3
Shift rod cover bolt	M6	8	0.8	5.9
Trim tab bolt	M10	42	4.2	31.0
Propeller shaft housing bolt	M8	30	3.0	22.1
Ring bolt	M8	18	1.8	13.3
Grease nipple	—	6	0.6	4.4
Pinion nut	—	142	14.2	104.7
Drive shaft housing bolt	M8	18	1.8	13.3
Propeller nut	—	54	5.4	39.8
Cooling water inlet cover screw	—	4	0.4	3.0
Lower unit (counter rotation model)				
Check screw	—	9	0.9	6.6
Drain screw	—	9	0.9	6.6
Lower case mount bolt	M10	47	4.7	34.7
Water pump housing bolt	M8	18	1.8	13.3
Shift rod cover bolt	M6	8	0.8	5.9
Trim tab bolt	M10	42	4.2	31.0
Propeller shaft housing bolt	M8	30	3.0	22.1
Ring bolt	M8	18	1.8	13.3
Ring nut	—	108	10.8	79.7
Grease nipple	—	6	0.6	4.4
Pinion nut	—	142	14.2	104.7
Drive shaft housing bolt	M8	18	1.8	13.3
Propeller nut	—	54	5.4	39.8
Cooling water inlet cover screw	—	4	0.4	3.0
Bracket unit				
Upper mount nut	—	72	7.2	53.1
Lower mount nut	—	72	7.2	53.1
Speed sensor adopter bolt	M6	8	0.8	5.9
Exhaust guide bolt	M8	18	1.8	13.3
Exhaust manifold bolt	M8	18	1.8	13.3
Muffler bolt	M8	18	1.8	13.3
Muffler assembly bolt	M8	18	1.8	13.3
Self-locking nut	—	22	2.2	16.2
Grease nipple	—	3	0.3	2.2
Friction plate screw	—	4	0.4	3.0
Trim stopper nut	—	36	3.6	26.6
Shift handle bolt	M6	8	0.8	5.9
Flushing hose adaptor screw	—	5	0.5	3.7
Spring hook bolt	M8	8	0.8	5.9
Hook bolt	M8	8	0.8	5.9



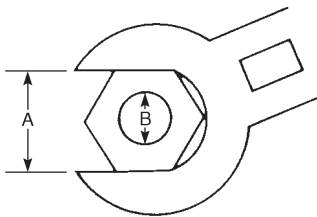
Part to be tightened	Thread size	Tightening torques		
		N·m	kgf·m	ft·lb
PTT unit				
PTT motor mount bolt	M6	7	0.7	5.2
Reservoir tank mount bolt	M6	7	0.7	5.2
Reservoir cap	—	7	0.7	5.2
Main valve	—	11	1.1	8.1
Manual valve	—	2	0.2	1.5
Pipe joint	—	15	1.5	11.1
Gear pump screw	—	2	0.2	1.5
Gear pump bolt	M5	4	0.4	3.0
Tilt ram	—	55	5.5	40.6
Tilt cylinder end screw	—	90	9.0	66.4
Tilt piston bolt	—	7	0.7	5.2
Trim cylinder end screw	—	160	16	118

General torque

This chart specifies tightening torques for standard fasteners with a standard ISO thread pitch. Tightening torque specification for special components or assemblies are provided in applicable sections of this manual.

To avoid warpage, tighten multi-fastener assemblies in a crisscross fashion and progressive stages until the specified torque is reached. Unless otherwise specified, torque specification require clean, dry threads. Components should be at room temperature.

Nut (A)	Bolt (B)	General torque specifications		
		N·m	kgf·m	ft·lb
8 mm	M5	5	0.5	3.6
10 mm	M6	8	0.8	5.8
12 mm	M8	18	1.8	13
14 mm	M10	36	3.6	26
17 mm	M12	43	4.3	31



Periodic check and adjustment

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Checking the fuel filter	3-2
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Checking the engine oil level	3-3
Checking the spark plug	3-3
Checking the thermostat	3-3
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Maintenance interval chart

Use the following chart as a guideline for general maintenance.

Adjust the maintenance intervals according to the operating conditions of the outboard motor.

Item	Actions	Initial		Every		Refer to page
		10 hours (Break-in)	50 hours (3 months)	100 hours (6 months)	200 hours (1 year)	
Anode (s) (external)	Check / replace		○	○		3-13
Anode (s) (internal)	Check / replace				○	3-13
Battery	Check / charge	○				3-14
Cooling water passages	Clean		○	○		3-4
Cowling clamp	Check				○	3-2
Fuel filter (can be dis-assembled)	Check / clean	○	○	○		3-2
Fuel system	Check	○	○	○		3-2
Fuel tank (Yamaha portable tank)	Check / clean				○	—
Gear oil	Change	○		○		3-12
Lubrication points	Lubricate			○		3-14
Idling speed (carburetor model)	Check / adjust	○		○		3-7
PCV	Check				○	5-20
PTT unit	Check / replace		○	○		3-10
Propeller and cotter pin	Check / replace		○	○		3-13
Shift link / shift cable	Check / adjust				○	3-9
Thermostat	Check				○	3-3
Throttle link / throttle cable / throttle pick-up timing	Check / adjust				○	3-7 3-8
Throttle sensor	Check / adjust				○	3-8, 4-12
Water pump	Check				○	6-5, 6-34
Spark plugs	Clean / adjust / replace	○	○	○		3-3

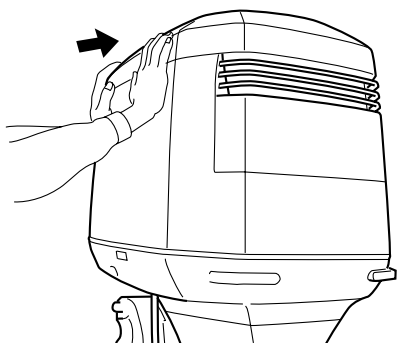
NOTE:

When operating in salt water, turbid or muddy water, the engine should be flushed with clean water after each use.

Top cowling

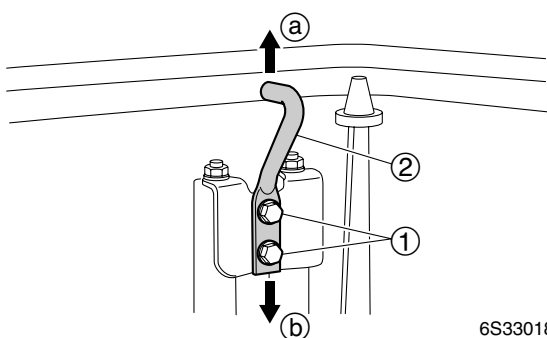
Checking the top cowling

1. Check the fitting by pushing the cowling with both hands. Adjust the fittings if necessary.



6S330170

2. Loosen the bolts ①.
3. Move the hook ② up or down slightly to adjust its position.



6S330180

NOTE:

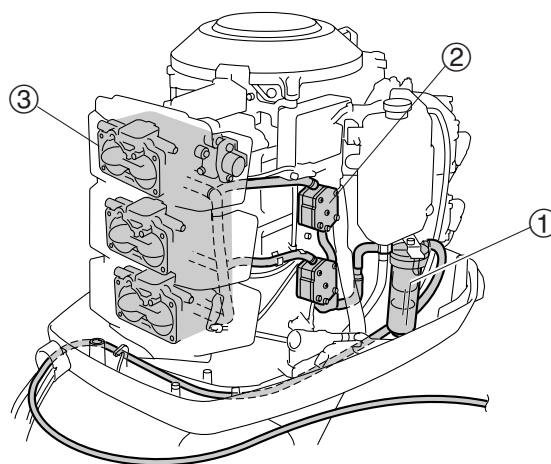
- To loosen the fitting, move the hook ② in direction ①.
- To tighten the fitting, move the hook ② in direction ②.

4. Tighten the bolts ①.
5. Check the fitting again, and if necessary repeat steps 2–4.

Fuel system

Checking the fuel joint and fuel hose (fuel joint-to-carburetor)

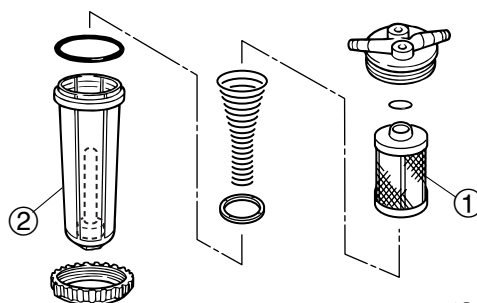
1. Check the fuel hose connections and fuel joint for leaks. Replace them if necessary. Also, check the fuel filter ①, fuel pumps ②, and carburetors ③ for leaks or deterioration. Replace if necessary.



6S330150

Checking the fuel filter

1. Check the fuel filter element ① for dirt and residue and check the fuel filter cup ② for foreign substances and cracks. Clean the cup with straight gasoline and replace the element if necessary.



6S330010

NOTE:

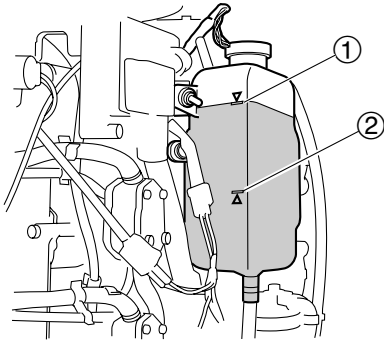
Be sure not to spill any fuel when removing the fuel filter cup.



Power unit

Checking the engine oil level

1. Place the outboard motor in an upright position.
2. Check the engine oil level.
3. Make sure the oil level is between the upper ① and lower ② level marks.



6S330250



Recommended engine oil:
YAMALUBE 2-stroke outboard
motor oil

Checking the spark plug

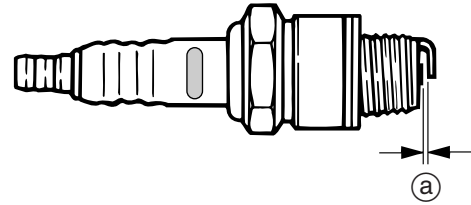
1. Disconnect the spark plug caps, and then remove the spark plugs.
2. Clean the electrodes ① with a spark plug cleaner or wire brush. Replace the spark plug if necessary.



6B430025

3. Check the electrodes for erosion and excessive carbon or other deposits, and the gasket for damage. Replace the spark plug if necessary.

4. Check the spark plug gap ①. Adjust if out of specification.



6B430030



Specified spark plug:
BR8HS-10 (NGK)
Spark plug gap ①:
0.9–1.0 mm (0.035–0.039 in)

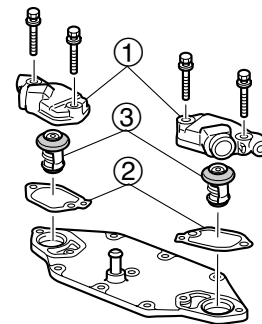
5. Install the spark plug temporary tight, then to the specified torque with a spark plug wrench.



Spark plug:
25 N·m (2.5 kgf·m, 18.4 ft·lb)

Checking the thermostat

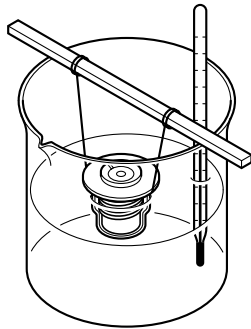
1. Remove the thermostat covers ①, gaskets ②, and thermostats ③.



6S330110

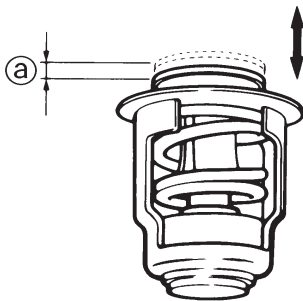
2. Suspend the thermostats ③ in a container with water.

- Place a thermometer in the water and slowly heat the water.




6B430060


- Check the thermostat valve opening at the specified water temperatures. Replace if out of specification.



6B430070

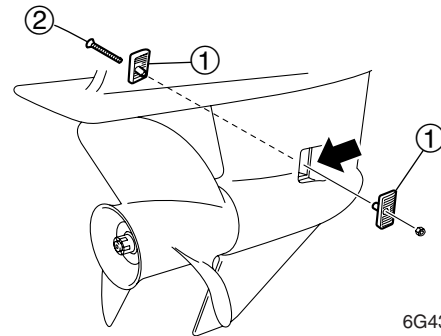
 Water temperature	Valve lift (a)
48–52°C (118.4–125.6°F)	0.05 mm (0.002 in) (valve begins to tilt)
above 60°C (140°F)	more than 3.0 mm (0.12 in)

- Install the new gaskets, thermostats and thermostat covers, and then tighten the cover bolts to specified torques.

	Thermostat cover bolt: 10 N·m (1.0 kgf·m, 7.4 ft·lb)
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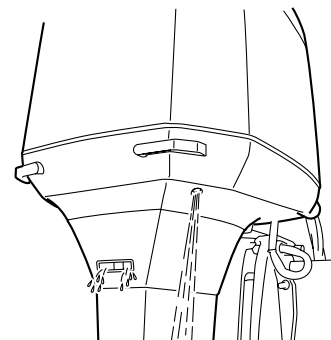
Checking the cooling water passage

- Check the cooling water inlet cover (1), screw (2) and cooling water inlet for clogging. Clean the water inlet cover and cooling water inlet if necessary.



6G430050

- Place the lower unit in water, and then start the engine.
- Check for water flow at the cooling water pilot hole. If there is no water flow, check the cooling water passage inside of the outboard motor.



6S310060

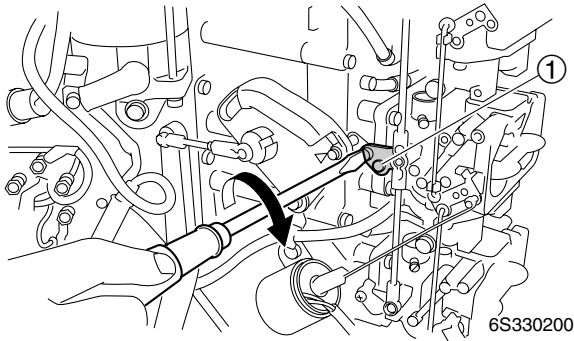


Control system

Synchronizing the carburetor

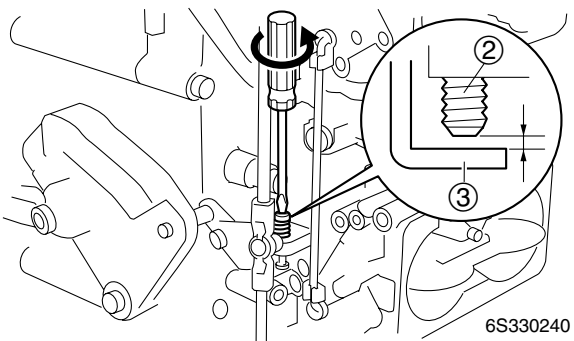
1. Remove the throttle cable and intake silencer.
2. Loosen the throttle lever tightening screw ① to clockwise on the middle carburetor.

NOTE: _____
The screw ① is left hand thread.



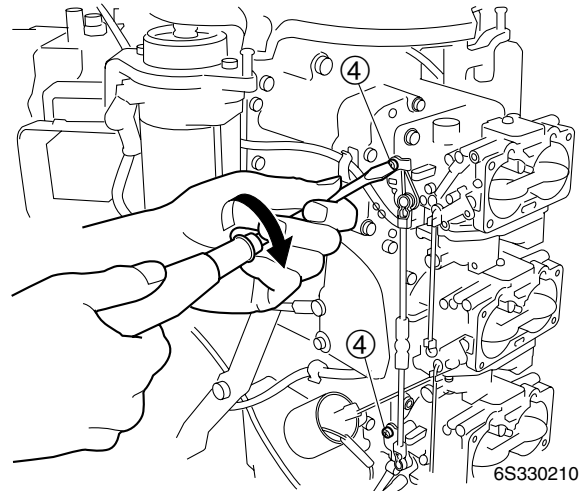
3. Turn out the throttle stop screw ② of the middle carburetor to make a clearance until the screw tip does not touch the stopper ③.

NOTE: _____
Make a note that how many times you turn out the throttle stop screw.



4. Loosen the throttle lever tightening screw ④ to clockwise on the upper and lower carburetors.

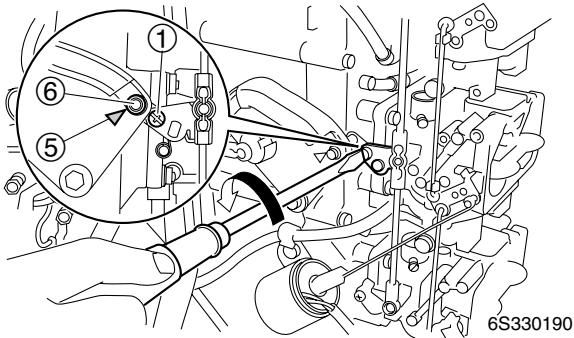
NOTE: _____
The screw ④ is left hand thread.



5. Make sure that the throttle valve is in the fully closed position.
6. Tighten the throttle lever tightening screws ④ to the counterclockwise on the upper and lower carburetors.

NOTE: _____
Set the throttle screw to its original position by turning it the same number of times as when you loosened it.

- Align the mark ⑤ on the accelerator cam with the center of the roller ⑥ on the middle carburetor and tighten the throttle lever tightening screw ①.



- Install the throttle cable and intake silencer.

NOTE:

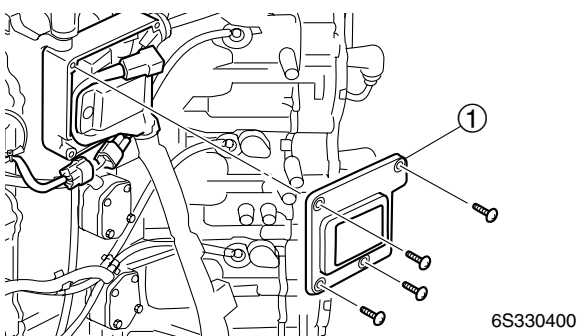
After synchronizing the carburetor, start the engine and check the engine idle speed to tighten the throttle stop screw.

Checking the throttle sensor

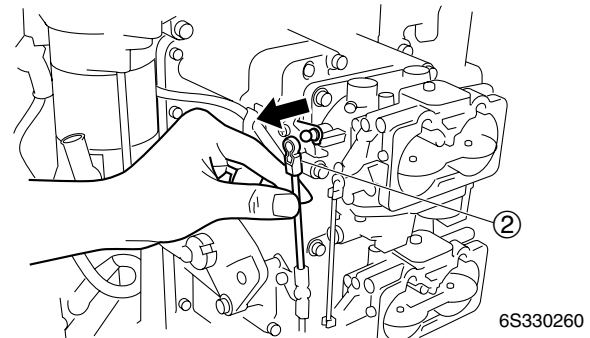
NOTE:

Do not loosen the throttle sensor screw except adjust or replace the carburetor.

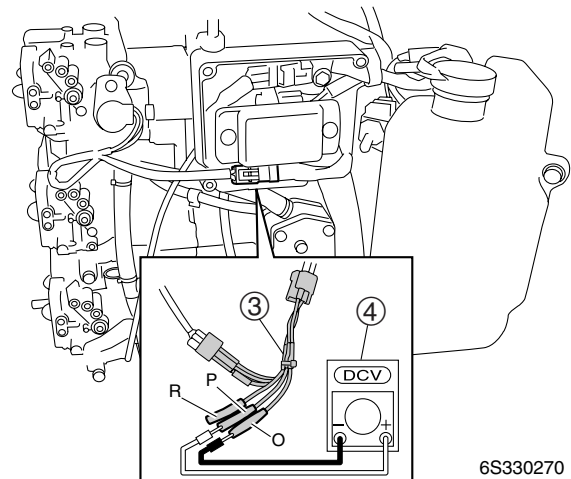
- Remove the hour meter cover ①.




- Remove the throttle link rod ② from the upper carburetor.





- Connect the test harness ③ to the throttle sensor coupler as shown.



- Turn the engine start switch to ON.
- Check the throttle sensor output voltage. Adjust the throttle sensor if out of specification. Refer to “Adjusting the throttle sensor” in chapter 4.

	Test harness (3 pins) ③: 90890-06857
---	---

	Digital circuit tester ④: 90890-03174
---	--

	Throttle sensor output voltage (with throttle valve fully closed): Pink (P) – Orange (O) 0.48 – 0.52 V
---	---

- Install the throttle link rod to the upper carburetor.



Checking the engine idle speed

NOTE: _____

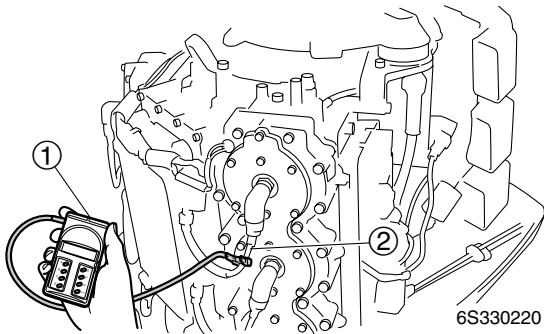
Before checking the engine idle speed, the pilot screws should be properly adjusted.

1. Attach the special service tool ① to the spark plug wire #1 ②.



Digital tachometer ①: 90890-06760

2. Start the engine and warm it up for 5 minutes, and then check the engine idle speed. Adjust if out of specification.



6S330220

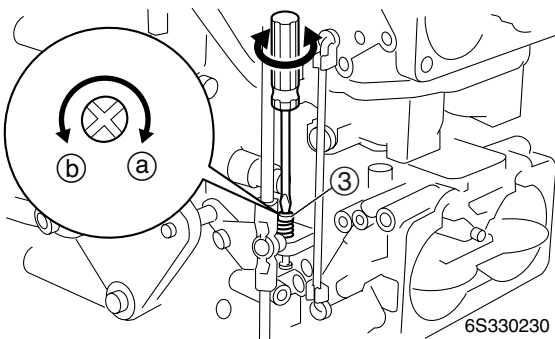


Engine idle speed:
675–725 r/min

NOTE: _____

Verify the stability of the engine idling speed.

3. Turn the throttle stop screw ③ in direction ① or ② until the specified engine idle speed is obtained.



6S330230

NOTE: _____

- To increase the idle speed, turn the throttle stop screw in direction ①.
- To decrease the idle speed, turn the throttle stop screw in direction ②.

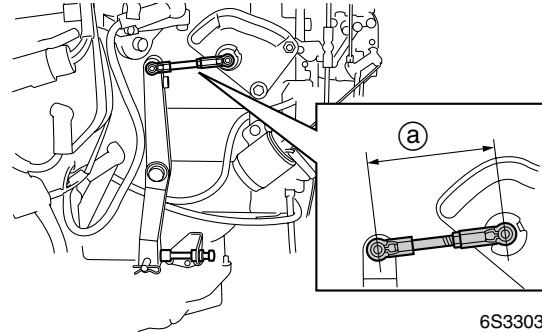
4. If the specified engine idle speed cannot be obtained, adjust the pilot screws.

NOTE: _____

When adjust the pilot screws, adjust it in the all of cylinders.

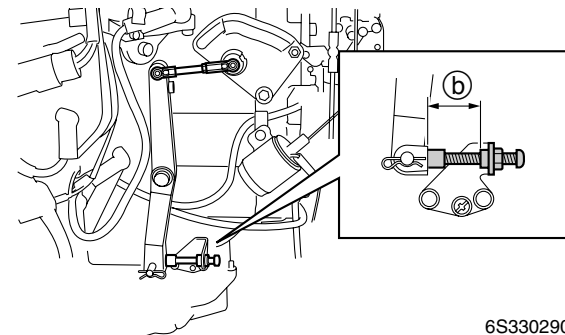
Checking the stopper and throttle link position

1. Measure the length of throttle link rod.



6S330300

2. Measure the length of stopper.



6S330290

3. Adjust the length of the stopper and throttle link rod if out of specification.



Length (reference):

① : 76 mm (2.99 in)

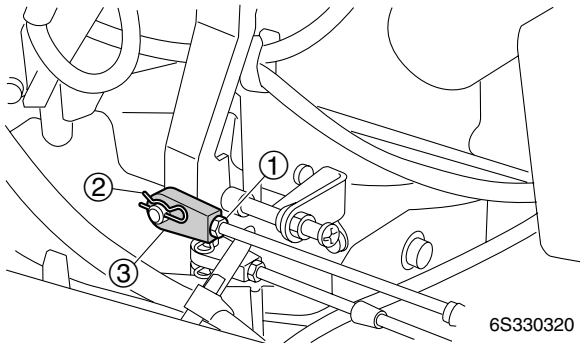
② : 31 mm (1.22 in)

Adjusting the throttle cable

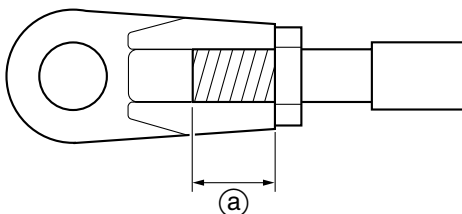
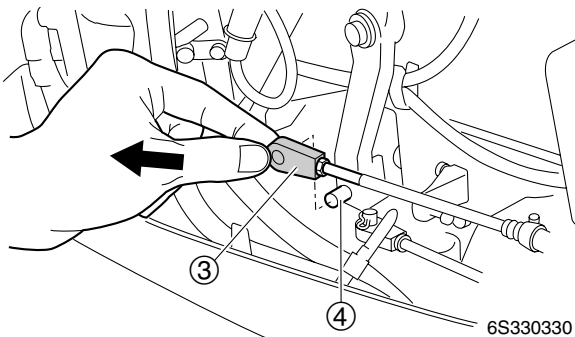
NOTE:

Before adjusting the throttle cable, the throttle stop screw should be properly adjusted.

1. Loosen the locknut ①, remove the clip ② and then remove the throttle cable joint ③.



2. Set the remote control lever to the fully closed position.
3. Adjust the position of the throttle cable joint ③ until its hole aligned with the set pin ④ on control lever.



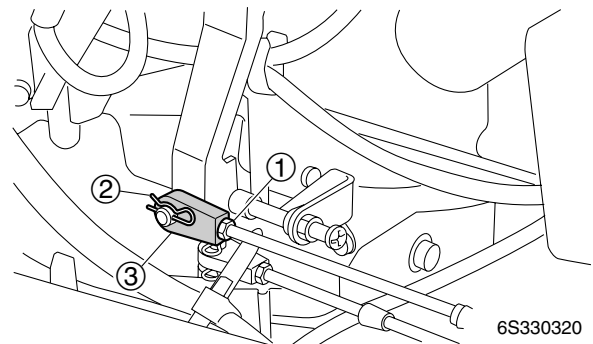
⚠ WARNING

The throttle cable joint must be screwed in a minimum of 8.0 mm (0.31 in) ①.

NOTE:

Pull the throttle cable towards the engine to remove any free play in the cable before adjusting the position of the throttle cable joint.

4. Connect the cable joint ③, install the clip ②, and then tighten the lock nut ①.

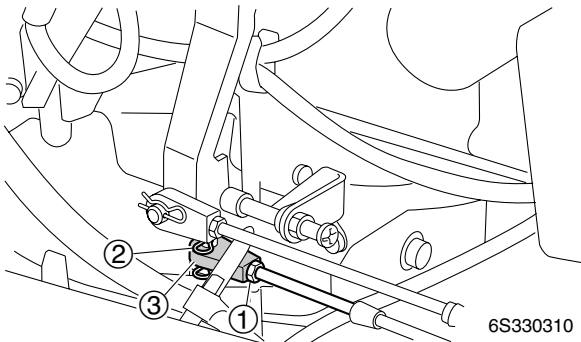


3

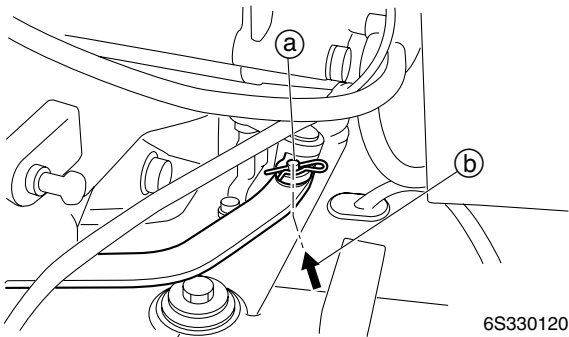


Checking the gear shift operation

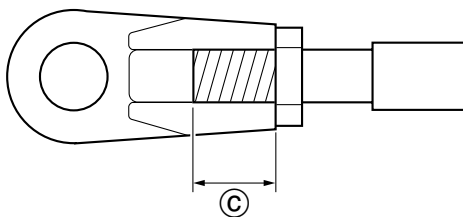
1. Check that the gear shift operates smoothly when shifting it from neutral to forward or reverse. Adjust the shift cable if necessary.
2. Set the gear shift to the neutral position.
3. Loosen the locknut ①, remove the clip ②, and then remove the shift cable joint ③.



4. Align the center of the set pin (a) on the shift lever with the alignment mark (b) on the bottom cowling.



5. Adjust the position of the shift cable joint until its hole is aligned with the set pin.

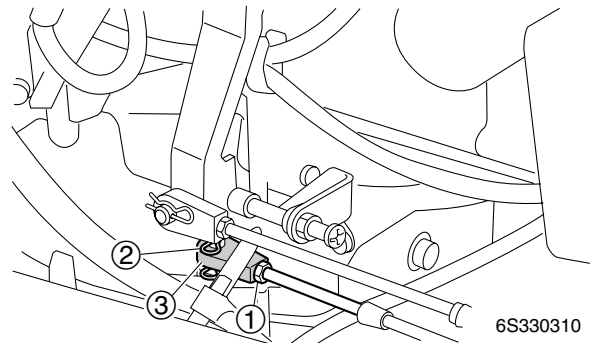


6S310050

⚠ WARNING

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

6. Install the shift cable joint ③, install the clip ②, and then tighten the locknut ①.



7. Check the gear shift for smooth operation and adjust the shift cable length, if necessary, repeat the steps 3-6.

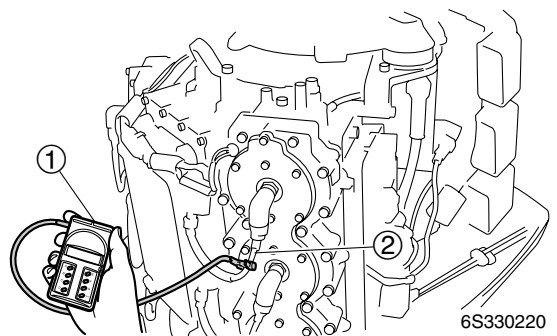
Checking the ignition timing

1. Start the engine and warm it up for 5 minutes.

NOTE:

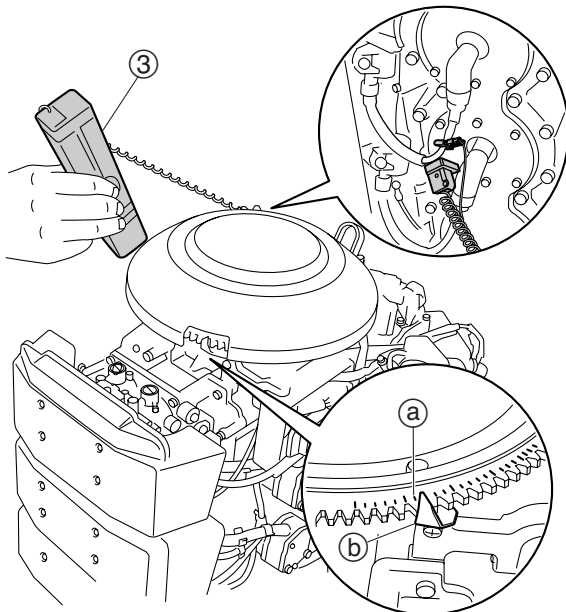
Turn off the engine when warmed it up completely.

2. Attach the special service tool ① to spark plug wire #1 ②, and then check the engine idle speed.



	Digital tachometer ①: 90890-06760
	Engine idle speed: 675–725 r/min
	Timing light ③: 90890-03141

3. Check that the ATDC 4° scale (a) on the flywheel magnet is aligned with the pointer (b) on the timing plate.



6S330340



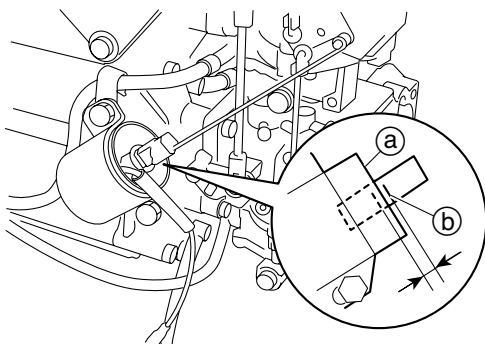
Ignition timing:
ATDC 2–6°

4. If the ignition timing is out of specification. Refer to “Adjusting the timing plate” P5-46 in chapter 5.

Checking the choke solenoid

1. Check that the choke solenoid face (a) is between the line (b) on the plunger. Adjust the position of the choke solenoid to loosen the bolt if necessary.

NOTE: _____
Make sure that the choke valves is fully open.

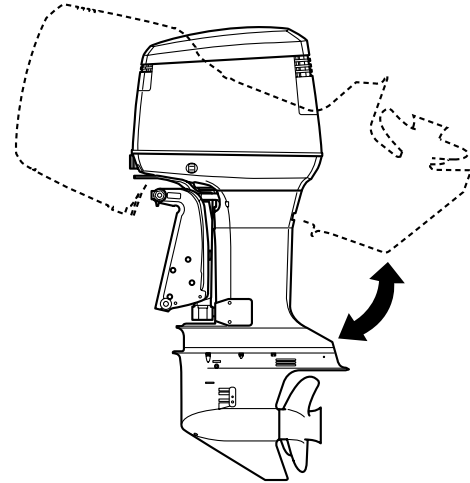


6S330370

Bracket

Checking the PTT operation

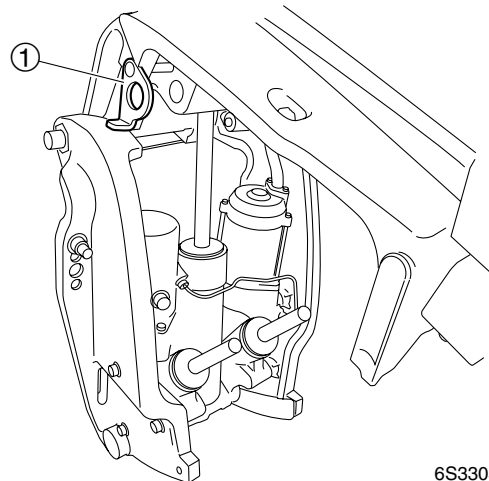
1. Fully tilt the outboard motor up and down a few times and check the entire trim and tilt range for smooth operation. Check the PTT fluid level if necessary.



NOTE: _____

Be sure to listen to the winding sound of the PTT motor for smooth operation.

2. Fully tilt the outboard motor up, and then support it with the tilt stop lever (1) to check the lock mechanism of the lever.

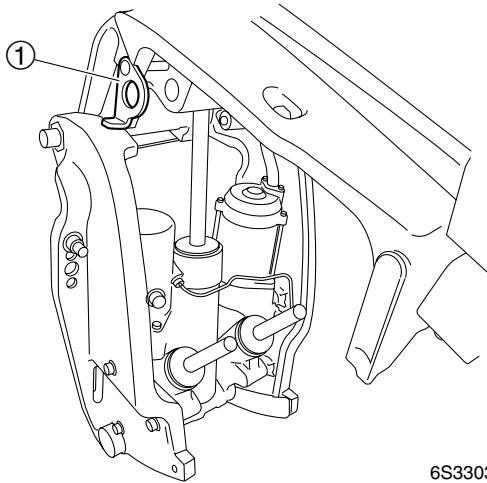


6S330380



Checking the PTT fluid level

1. Fully tilt the outboard motor up, and then support it with the tilt stop lever ①.

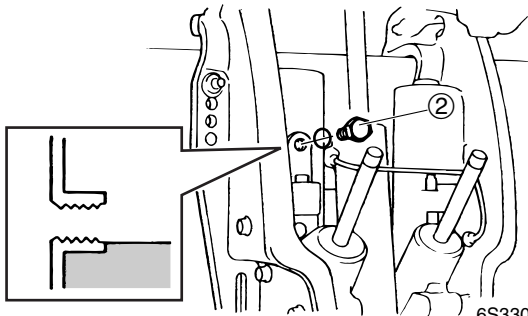


6S330380

⚠WARNING

After tilting up the outboard motor, be sure to support it with the tilt stop lever. Otherwise, the outboard motor could suddenly lower if the PTT unit should lose fluid pressure.

2. Remove the reservoir cap ②, and then check the fluid level in the reservoir.



6S330130

⚠WARNING

Make sure that the trim and tilt rams are fully extended when removing the reservoir cap, otherwise fluid can spurt out from the unit due to internal pressure.

NOTE:

If the fluid is at the correct level, the fluid should overflow out of the filler hole when the reservoir cap ② is removed.

3. If necessary, add sufficient fluid of the recommended type until it overflows out of the filler hole.



Recommended PTT fluid:
ATF Dexron II

4. Install the new O-ring reservoir cap ②, and then tighten it to the specified torque.

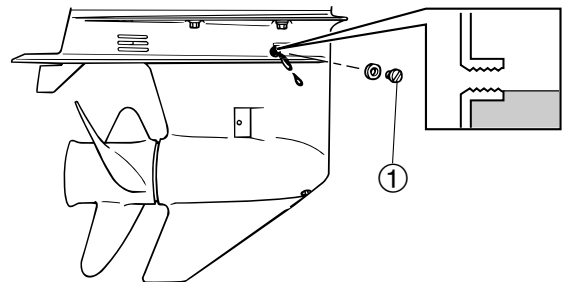


Reservoir cap ②:
7 N·m (0.7 kgf·m, 5.2 ft·lb)

Lower unit

Checking the gear oil level

1. Fully tilt the outboard motor down.
2. Remove the check screw ①, and then check the gear oil level in the lower case.



69D10055

NOTE:

If the fluid is at the correct level, the fluid should overflow out of the filler hole when the check screw is removed.

3. If necessary, add sufficient gear oil of the recommended type until it overflows out of the check hole.



Recommended gear oil:
Hypoid gear oil
API: GL-4
SAE: 90

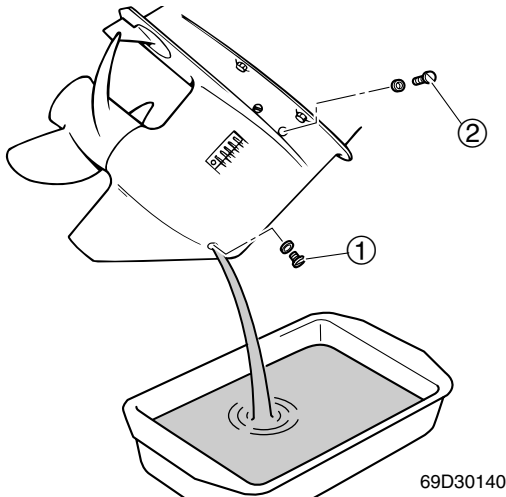
4. Install the new gasket check screw ①, and then tighten it to the specified torque.



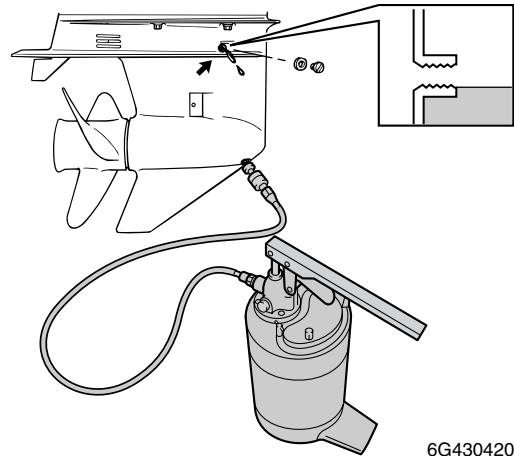
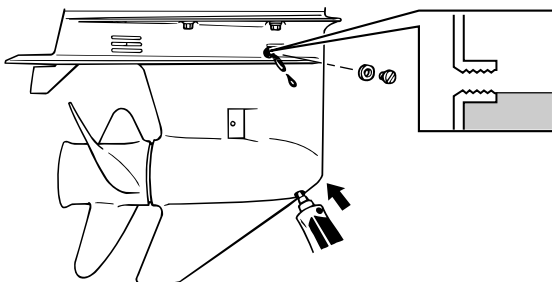
Check screw ①:
9 N·m (0.9 kgf·m, 6.6 ft·lb)

Changing the gear oil

1. Tilt the outboard motor so that the gear oil drain screw at the lowest point possible.
2. Place a drain pan under the drain screw ①, remove the drain screw, then the check screw ② and let the oil drain completely.



3. Check the oil for metal and discoloration, and its viscosity. Check the internal parts of the lower case if necessary.
4. Insert a gear oil tube or gear oil pump into the drain hole and slowly fill the gear oil until oil flows out of the check hole and no air bubbles are visible.



Recommended gear oil:

Hypoid gear oil

API: GL-4

SAE: 90

Gear oil quantity

Regular rotation model:

1150 cm³

(38.88 US oz, 40.56 Imp oz)

Counter rotation model:

1000 cm³

(33.81 US oz, 35.27 Imp oz)

5. Install the new gaskets, check screw and quickly install the drain screw, and then tighten them to the specified torque.



Check and drain screw:

9 N·m (0.9 kgf·m, 6.6 ft·lb)

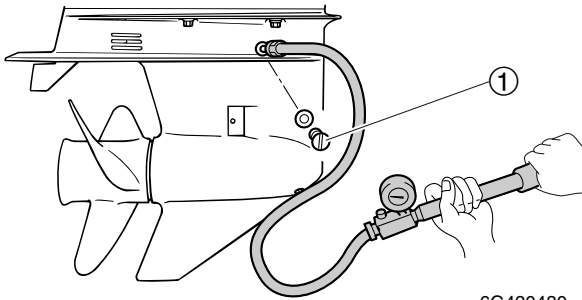


Checking the lower unit for air leakage

CAUTION: _____

Do not over pressurize the lower unit, otherwise the oil seals may be damaged.

1. Remove the check screw ①, and then install the special service tool.



6G430430



Leakage tester: 90890-06840

2. Apply the specified pressure to check that the pressure is maintained in the lower unit for at least 10 seconds.

NOTE: _____

Cover the check hole with a rag when removing the special service tool from the lower unit.



Lower unit holding pressure:
70 kPa (0.7 kgf/cm², 10 psi)

3. If the pressure drops below specification, check the drive shaft, propeller shaft oil seals, shift rod, and gasket of drain screw for damage.

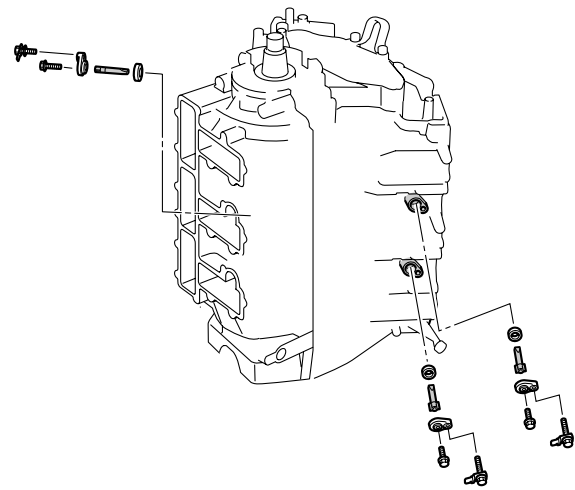
Checking the propeller

1. Check the propeller blades and splines for cracks, damage, or wear. Replace if necessary.

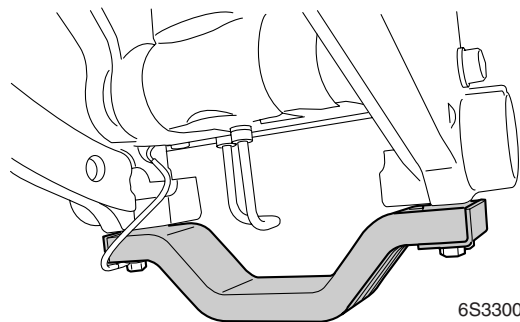
General

Checking the anode

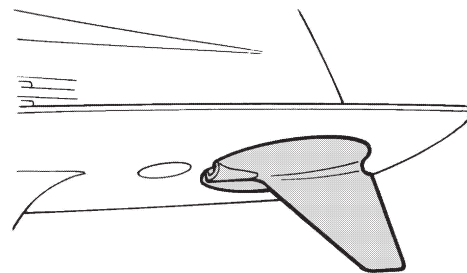
1. Check the anode and trim tab. Clean if there are scales, grease, or oil.



6S330140



6S330020



6G430450

CAUTION: _____

Do not oil, grease, or paint the anodes or the trim tab, otherwise they will be ineffective.

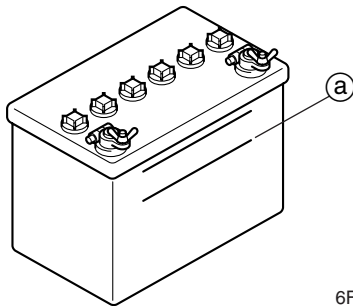
NOTE: _____

If it is necessary to disassemble the outboard motor to check an anode, refer to the applicable disassembly procedure in this manual.

2. Replace the anodes or trim tab if excessively eroded. Also check the ground lead together.

Checking the battery

1. Check the battery electrolyte level. If the level is at or below the minimum level mark (a), add distilled water until the level is between the maximum and minimum level marks.



6F630240

2. Check the specific gravity of the electrolyte. Fully charge the battery if below specification.

⚠ WARNING

Battery electrolyte is dangerous; it contains sulfuric acid which is poisonous and highly caustic.

- Avoid bodily contact with electrolyte as it can cause severe burns or permanent eye injury.
- Wear protective eye gear when handling or working near batteries.

Antidote (EXTERNAL):

- SKIN – Wash with water.
- EYES – Flush with water for 15 minutes and get immediate medical attention.

Antidote (INTERNAL):

- Drink large quantities of water or milk followed with milk of magnesia, beaten egg, or vegetable oil. Get immediate medical attention.
- Charge batteries in a well-ventilated area.
- Keep batteries away from fire, sparks or open flames (e.g., welding equipment, lighted cigarettes).
- DO NOT SMOKE when charging or handling batteries.

KEEP BATTERIES AND ELECTROLYTE OUT OF REACH OF CHILDREN.

NOTE:

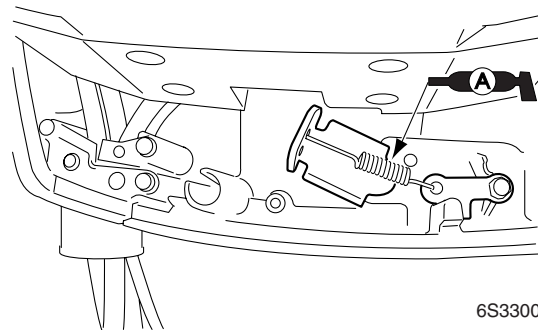
- Batteries vary per manufacturer. The procedures mentioned in this manual may not always apply, therefore, consult the instruction manual of the battery.
- Disconnect the negative battery cable first, then the positive battery cable.



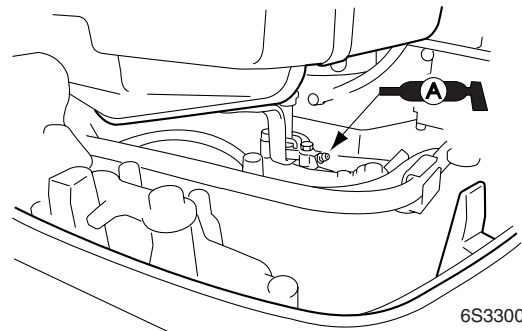
Electrolyte specific gravity:
1.280 at 20° C (68° F)

Lubricating the outboard motor

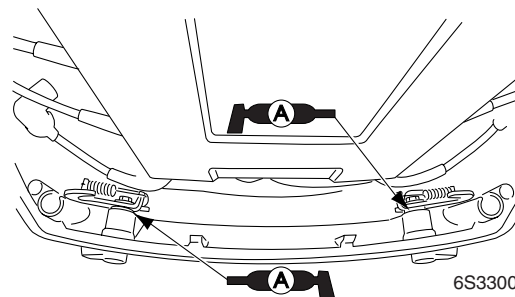
1. Apply water resistant grease to the areas shown.



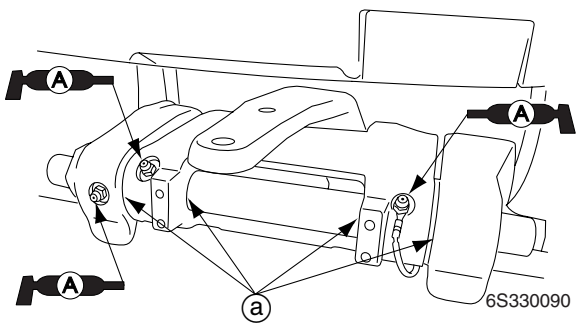
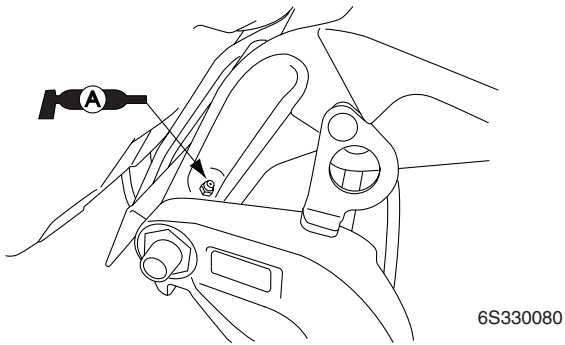
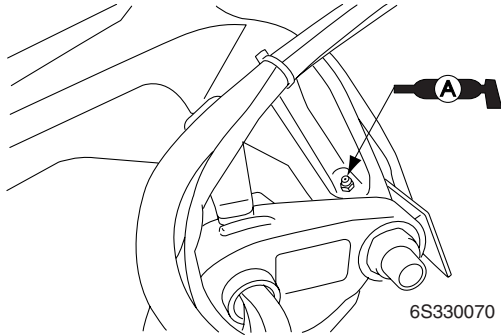
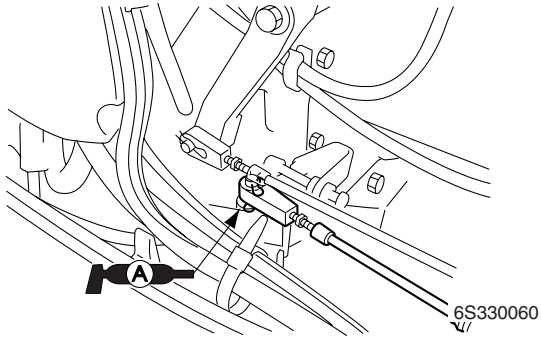
6S330030



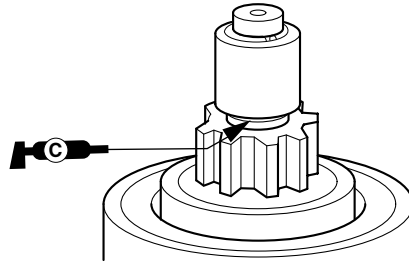
6S330040



6S330050

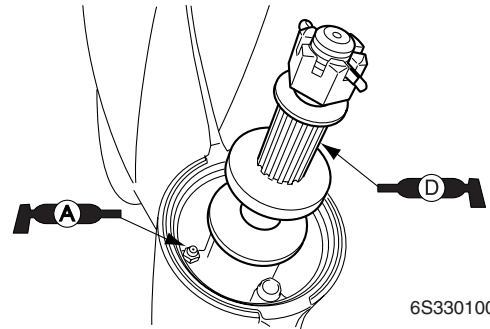


2. Apply low temperature resistant grease to the area shown.



6G430540

3. Apply corrosion resistant grease to the area shown.



6S330100

NOTE:

Apply grease to the grease nipple until it flows from the bushings (a).

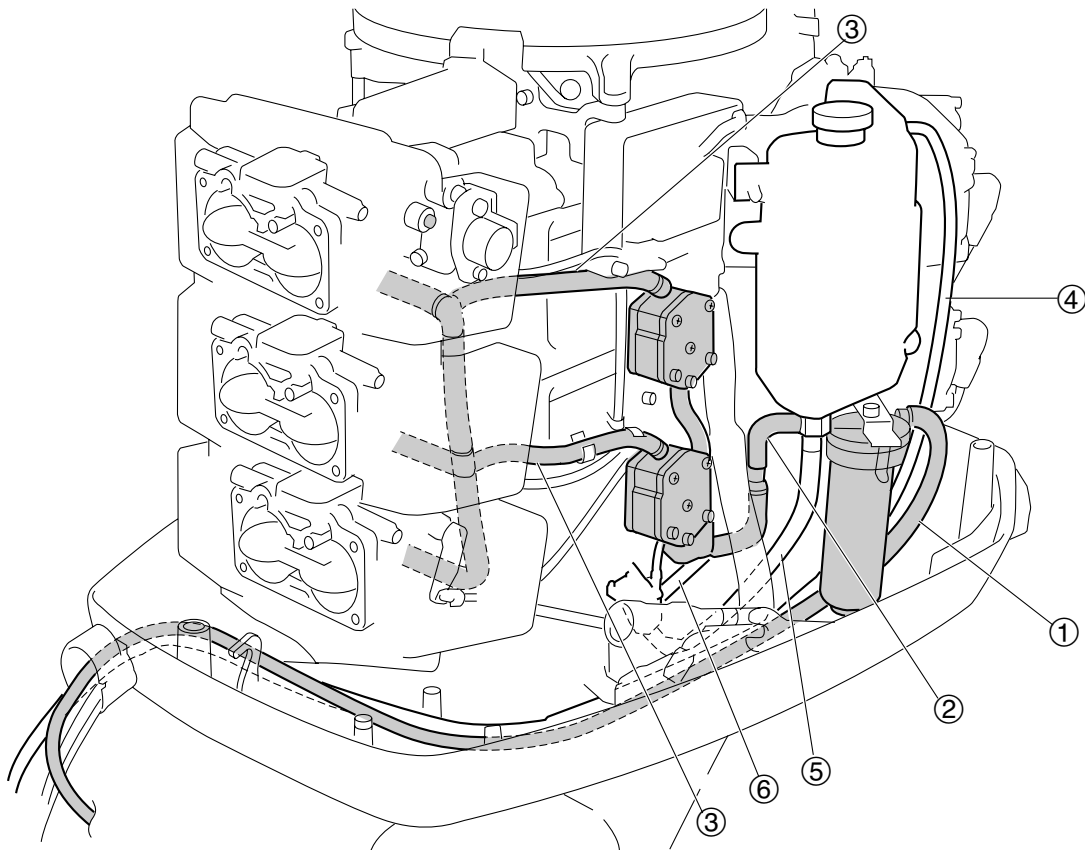
Fuel system

Hose routing	4-1
Fuel hose and breather hose	4-1
 Fuel line	 4-3
 Carburetor	 4-6
Disassembling the carburetor	4-10
Checking the carburetor	4-10
Assembling the carburetor	4-11
Adjusting the throttle sensor	4-12
 Fuel pump	 4-13
Checking the fuel pump	4-14
Disassembling the fuel pump	4-14
Assembling the fuel pump	4-15
 Oil injection system	 4-16
Checking the check valve	4-18
Checking the oil filter	4-18
Checking the oil tank	4-18
Assembling the oil tank	4-18
Installing the oil pump	4-18
Bleeding the oil pump	4-19



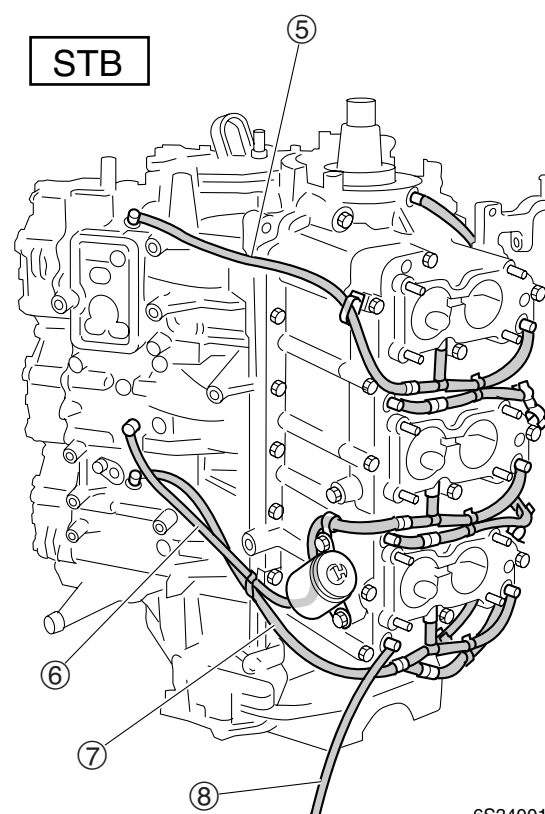
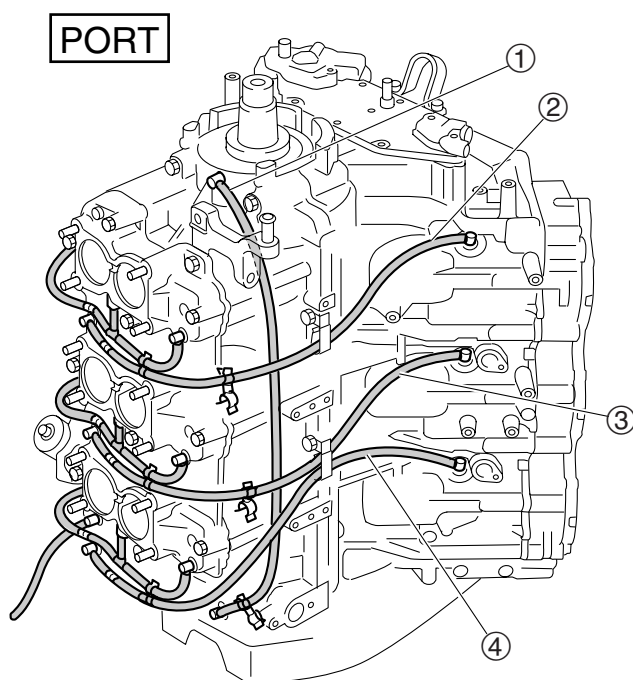
Hose routing

Fuel hose and breather hose



6S34001A

- ① Fuel hose (fuel tank-to-fuel filter)
- ② Fuel hose (fuel filter-to-fuel pumps)
- ③ Fuel hose (fuel pumps-to-carburetors)
- ④ Oil hose (remote oil tank-to-engine oil tank)
- ⑤ Oil hose (engine oil tank-to-oil injection pump)
- ⑥ Oil hose (oil injection pump-to-fuel hose)



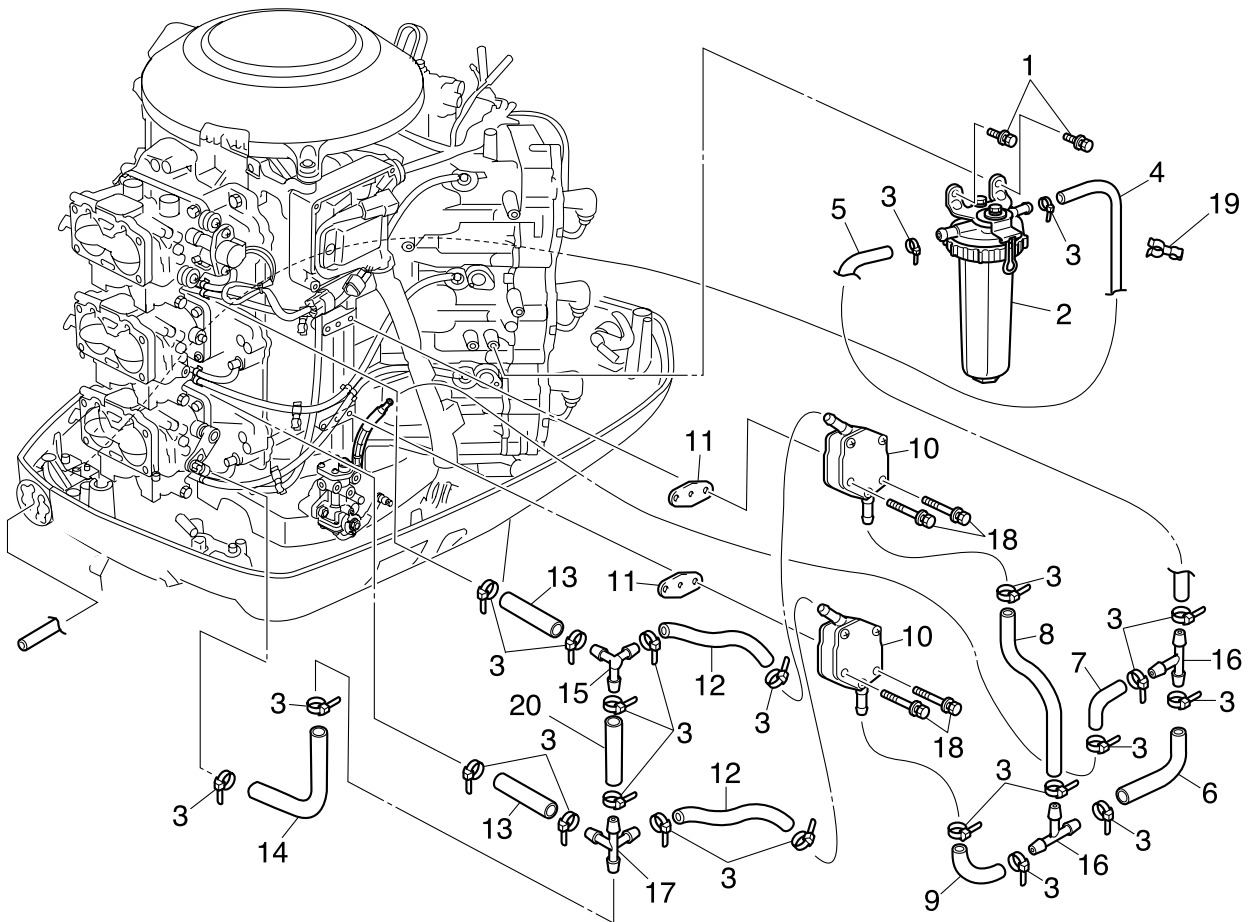
4

6S34001B

- ① Breather hose (upper-to-lower)
- ② Breather hose (manifold-to-cylinder body #2)
- ③ Breather hose (manifold-to-cylinder body #4)
- ④ Breather hose (manifold-to-cylinder body #6)
- ⑤ Breather hose (manifold-to-cylinder body #1)
- ⑥ Breather hose (manifold-to-cylinder body #3)
- ⑦ Breather hose (manifold-to-cylinder body #5)
- ⑧ Breather hose (manifold-to-intake silencer)



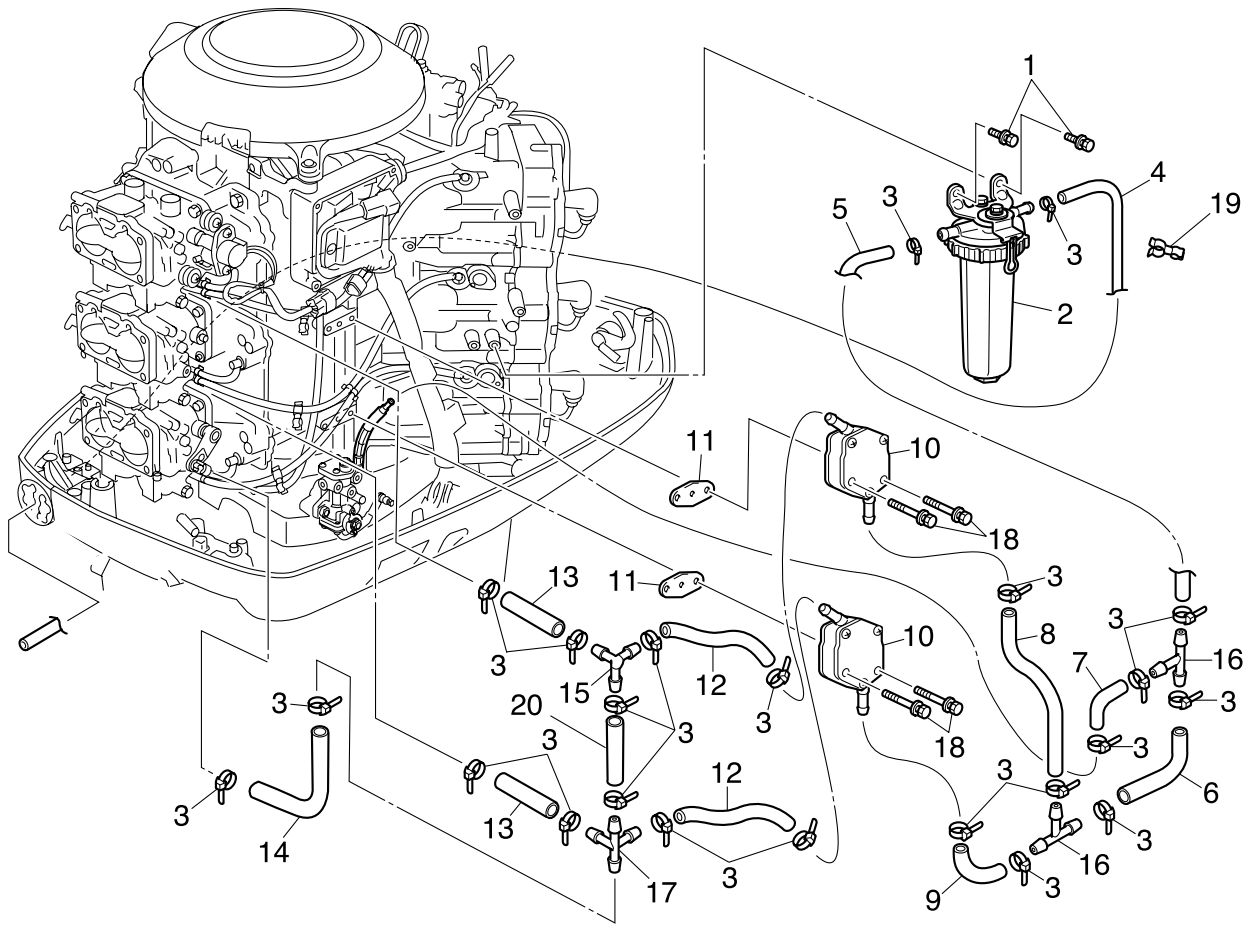
Fuel line



6S34020E

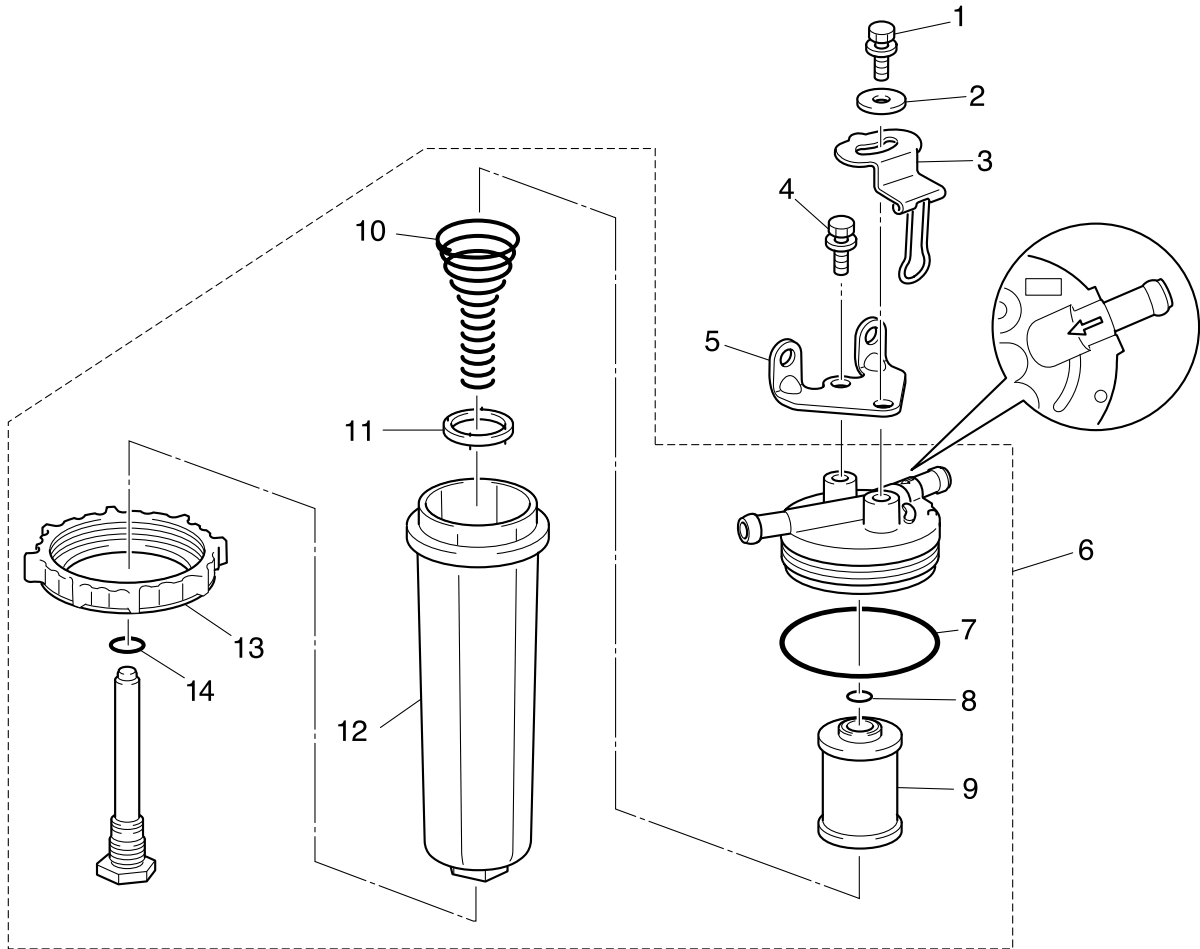
No.	Part name	Q'ty	Remarks
1	Bolt	2	M6 × 16 mm
2	Fuel filter assembly	1	
3	Lock tie	23	Not reusable
4	Fuel hose	1	
5	Fuel hose	1	
6	Fuel hose	1	
7	Oil hose	1	
8	Fuel hose	1	
9	Fuel hose	1	
10	Fuel pump assembly	2	
11	Gasket	2	Not reusable
12	Fuel hose	2	
13	Fuel hose	2	
14	Fuel hose	1	
15	Fuel joint	1	
16	Fuel joint	2	
17	Fuel joint	1	

4



6S34020E

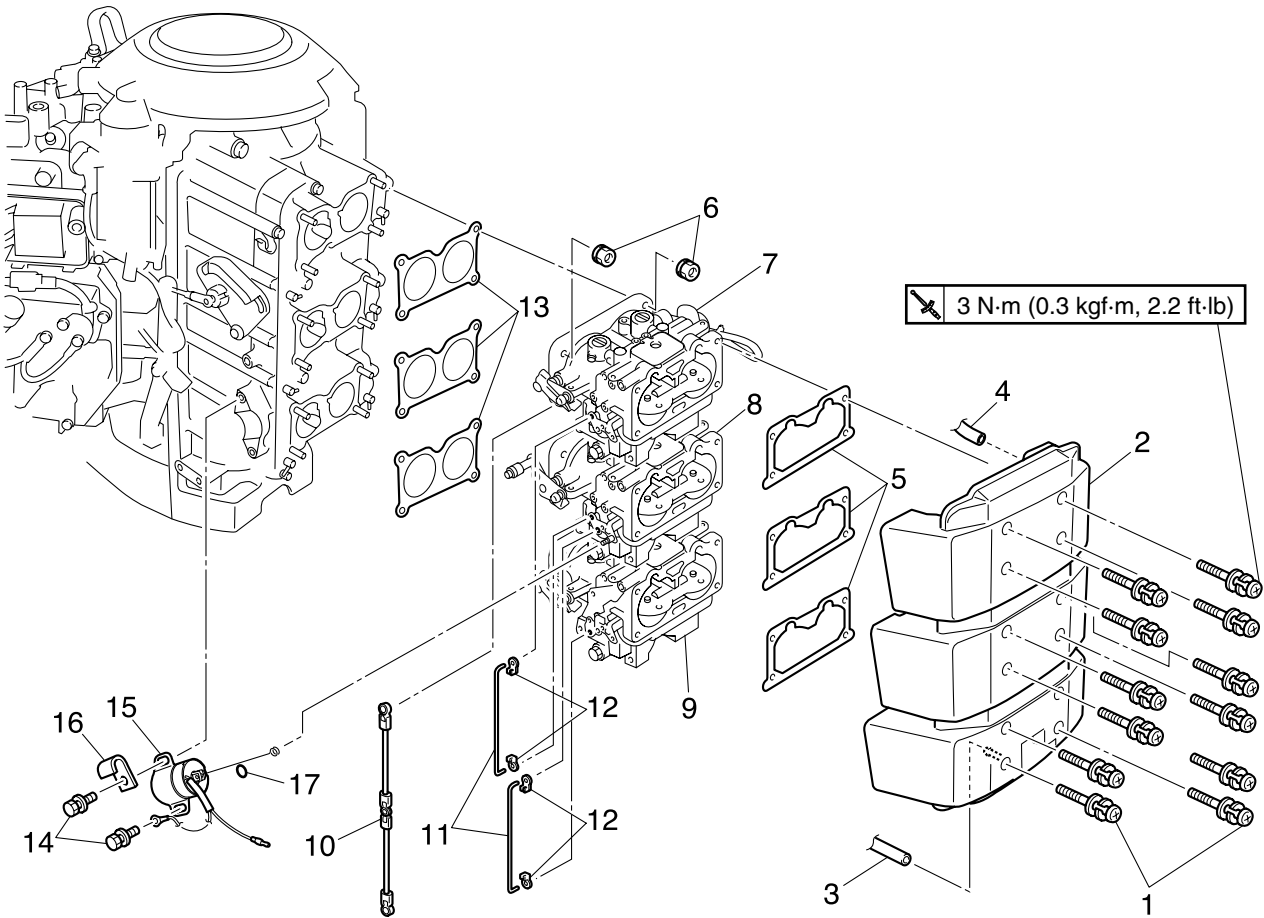
No.	Part name	Q'ty	Remarks
18	Bolt	4	M6 × 50 mm
19	Holder	3	
20	Hose	1	



6S34040E

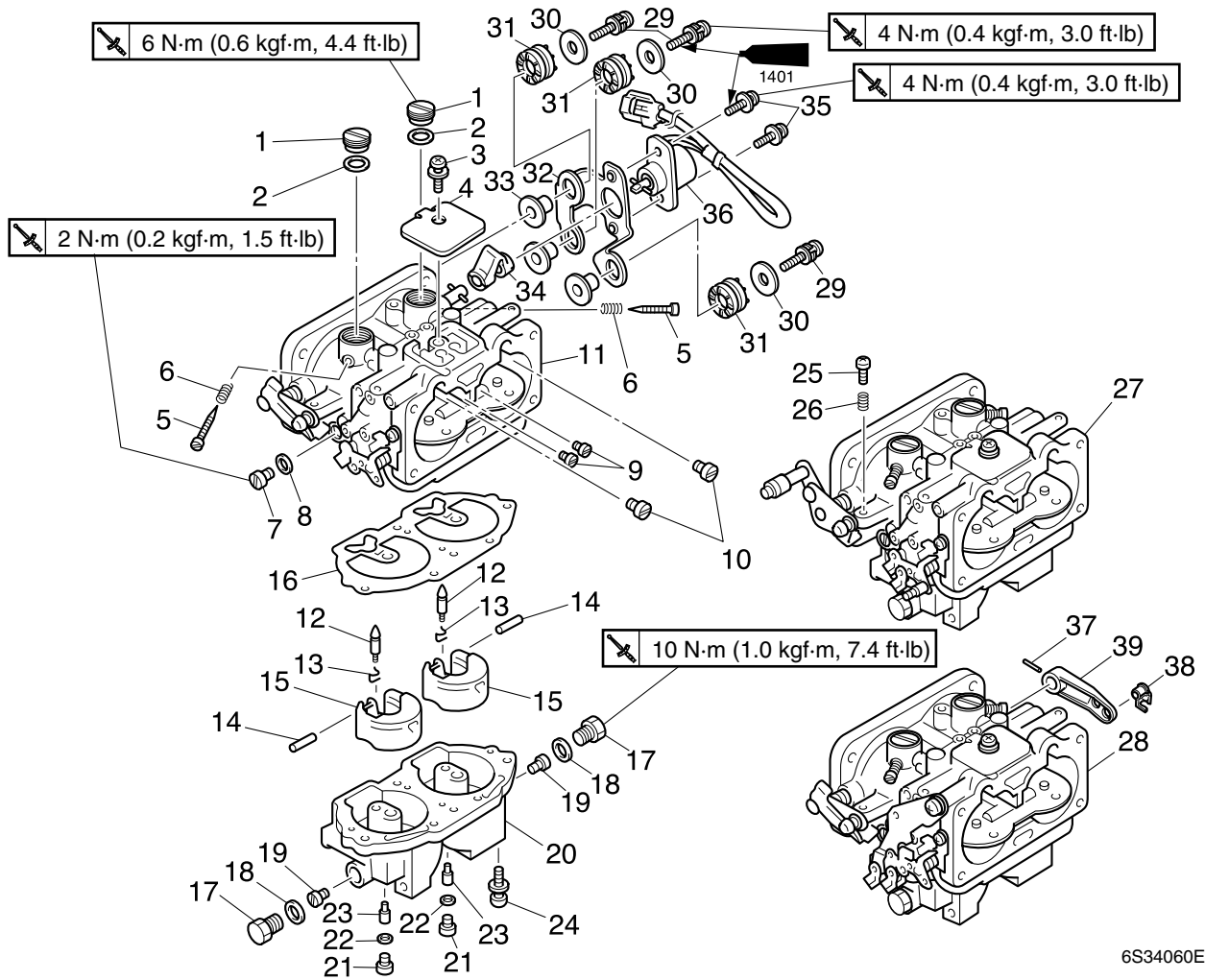
No.	Part name	Q'ty	Remarks
1	Bolt	1	M6 × 16 mm
2	Washer	1	
3	Holder	1	
4	Bolt	1	M6 × 14 mm
5	Bracket	1	
6	Fuel filter assembly	1	
7	O-ring	1	Not reusable
8	O-ring	1	Not reusable
9	Fuel filter element	1	
10	Spring	1	
11	Float	1	
12	Fuel filter cup	1	
13	Nut	1	
14	O-ring	1	Not reusable

Carburetor



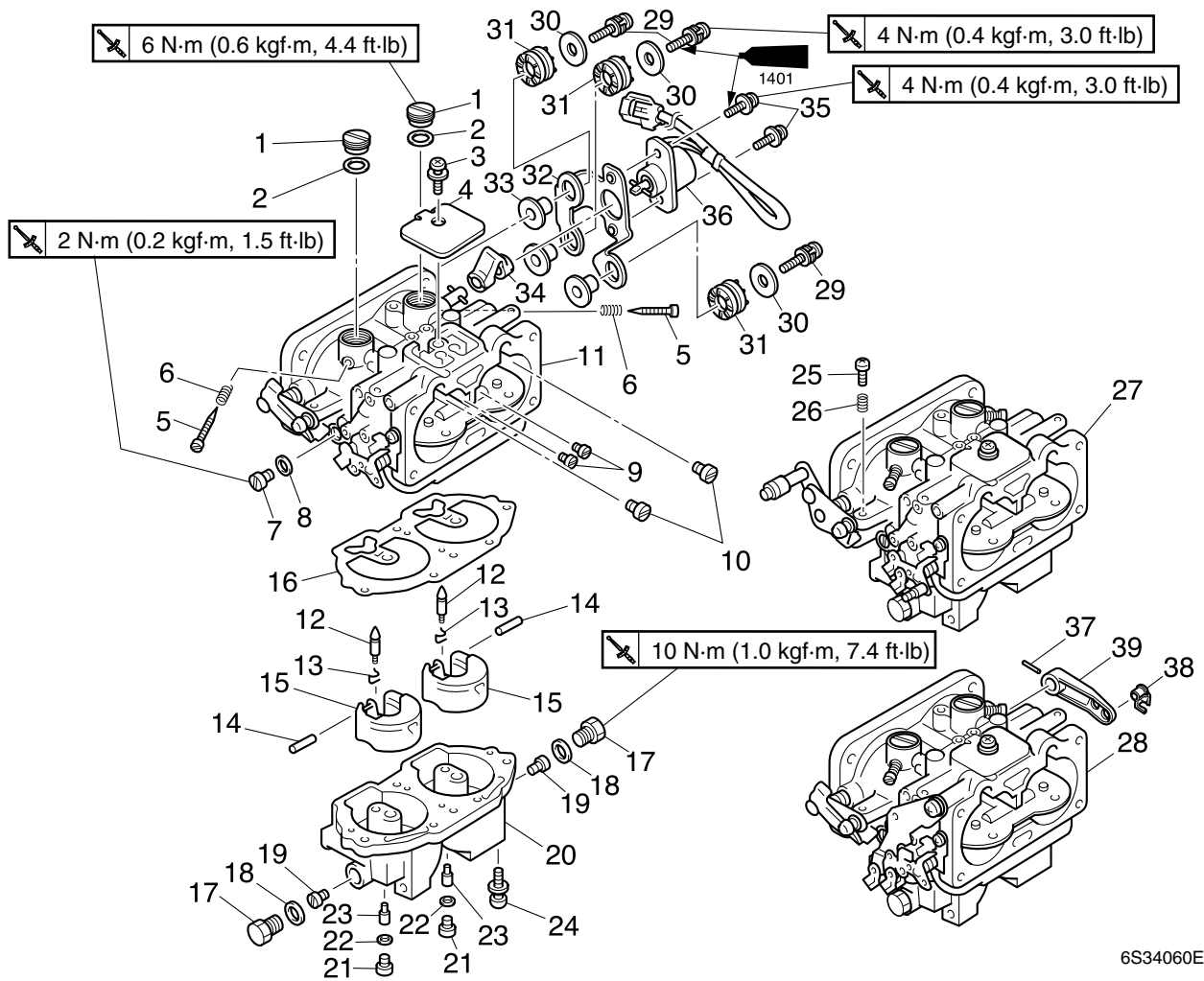
6S34050E

No.	Part name	Q'ty	Remarks
1	Screw	12	ø6 × 55 mm
2	Intake silencer	1	
3	Hose	1	
4	Hose	1	
5	Gasket	3	Not reusable
6	Nut	12	
7	Upper carburetor assembly	1	
8	Middle carburetor assembly	1	
9	Lower carburetor assembly	1	
10	Link rod	1	
11	Rod	2	
12	Joint	4	
13	Gasket	3	Not reusable
14	Bolt	2	M6 × 16 mm
15	Choke solenoid	1	
16	Clamp	1	
17	O-ring	1	Not reusable



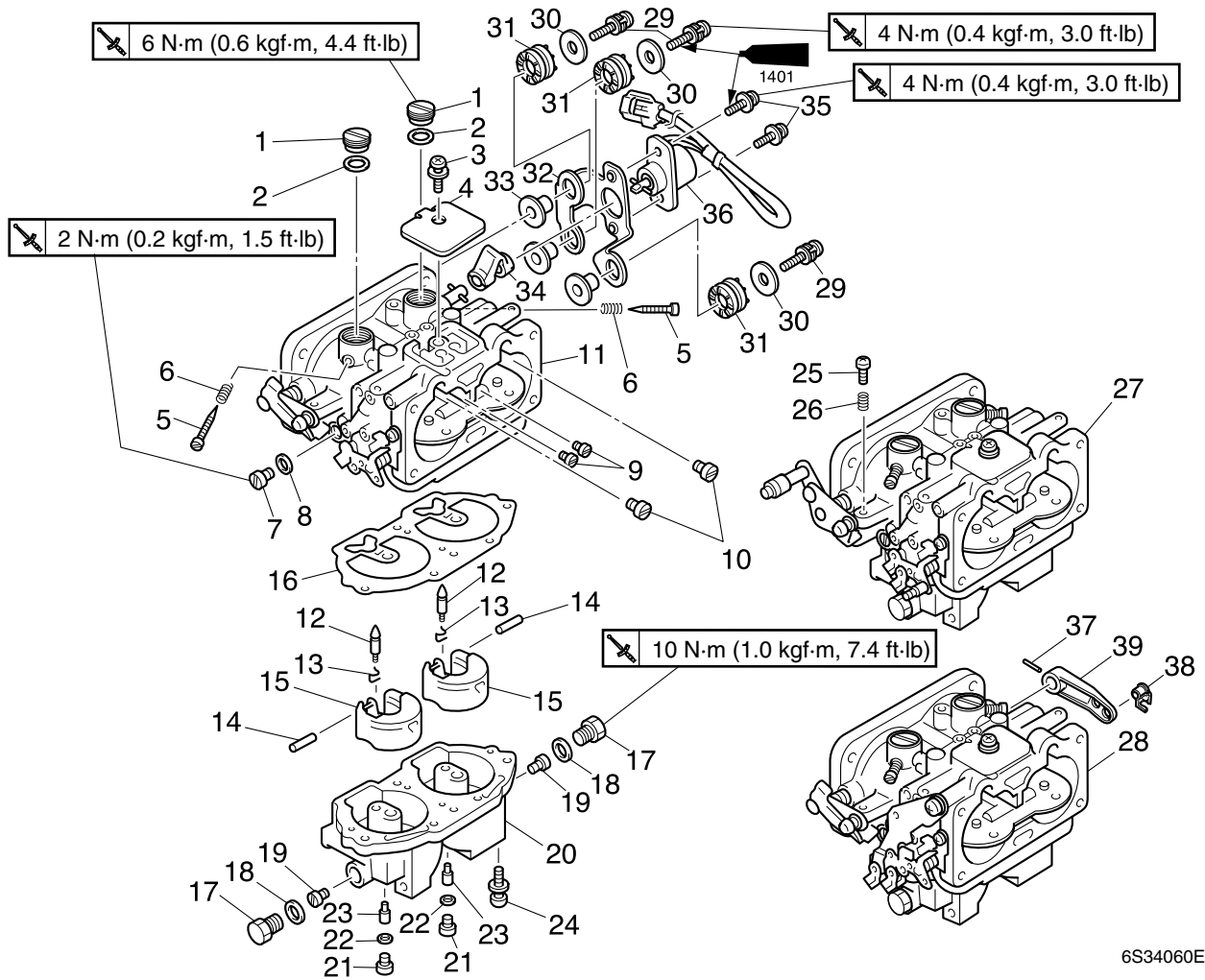
6S34060E

No.	Part name	Q'ty	Remarks
1	Plug	6	
2	Gasket	6	
3	Screw	3	
4	Plate	3	
5	Pilot screw	6	
6	Spring	6	
7	Screw	3	
8	Gasket	3	
9	Air bleed plug	6	
10	Pilot air jet	6	
11	Carburetor body	3	
12	Needle valve	6	
13	Clip	6	
14	Float pin	6	
15	Float	6	
16	Gasket	3	Not reusable
17	Drain plug	6	



4

No.	Part name	Q'ty	Remarks
18	Gasket	6	
19	Main jet	6	
20	Float chamber	3	
21	Plug	6	
22	Gasket	6	
23	Pilot jet	6	
24	Screw	12	ø5 × 16 mm
25	Throttle stop screw	1	
26	Spring	1	
27	Middle carburetor assembly	1	
28	Lower carburetor assembly	1	
29	Screw	3	ø5 × 25 mm
30	Washer	3	
31	Grommet	3	
32	Bracket	1	
33	Collar	3	
34	Joint	1	



6S34060E

No.	Part name	Q'ty	Remarks
35	Screw	2	ø5 × 10 mm
36	Throttle sensor	1	
37	Pin	1	
38	Joint	1	
39	Arm	1	

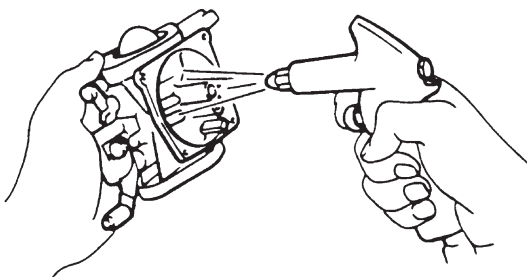
Disassembling the carburetor

NOTE:

- Before disassembling the carburetors, make sure to note the number of times the pilot screw is turned out from the seated position to its set position.
- Disassembled jets and other components should be sorted out and kept in order, so that they can be re-assembled in their original positions.

Checking the carburetor

1. Check the air and fuel passages and jets, for dirt and foreign matter. Clean the carburetor body with a petroleum based solvent if necessary.
2. Blow compressed air into all passages and jets.



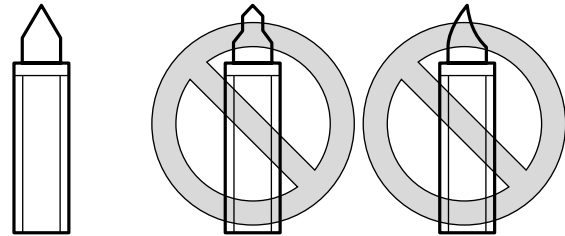
6D440025

CAUTION:

- Direct the compressed air downward, otherwise cleaning solvent may be blown into your eyes or small parts of the carburetor may be blown off.
- Do not use steel wire for cleaning the jets, otherwise the jet diameters may be enlarged, which may seriously affect performance.

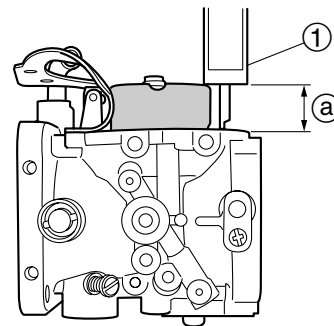
3. Check the main jet, pilot jet, and main nozzle for dirt or residue. Clean if necessary.

4. Check the pilot screw and needle valve for bends or wear. Replace the pilot screw and needle valve if necessary.

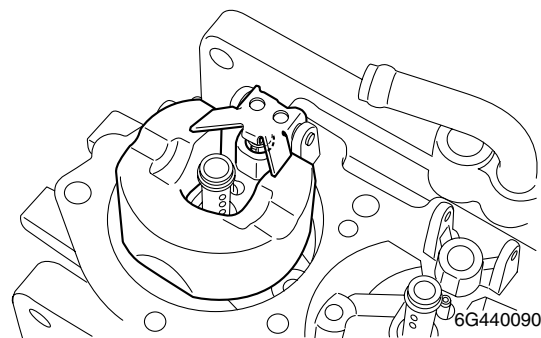


6B440040

5. Check the float for deterioration. Replace the float if necessary.
6. Measure the float height (a). Replace the float and needle valve as a set, if out of specification.



6G440080



6G440090

NOTE:

When measure the float height, the float should not be compressing.



Digital caliper (1): 90890-06704

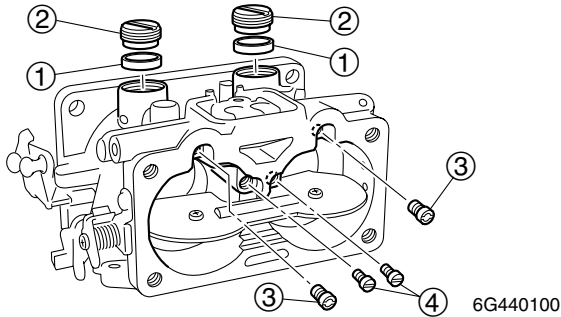


Float height (a) (without gasket):
15.5–16.5 mm (0.61–0.65 in)

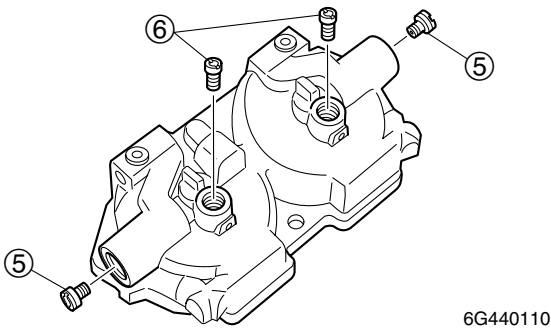


Assembling the carburetor

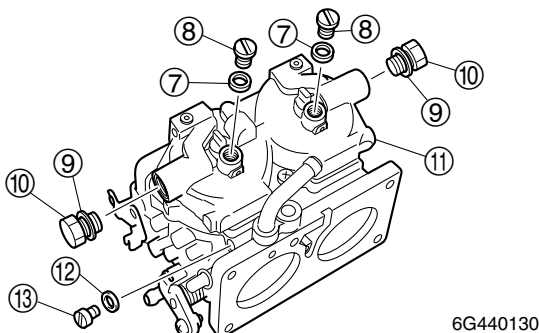
1. Install the gaskets ①, plugs ②, pilot air jets ③, and air bleed plugs ④ onto the carburetor body.



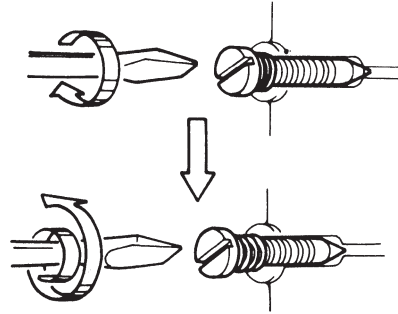
2. Install a new gasket, and then install the needle valves, floats and float pins onto the carburetor body. Check the float for smooth operation, after install them.
3. Install the main jets ⑤ and pilot jets ⑥ onto the float chamber.



4. Install the gaskets ⑦, plugs ⑧, gaskets ⑨ and plugs ⑩ onto the float chamber ⑪.
5. Install the float chamber ⑪ onto the carburetor body and install the gaskets ⑫ and plugs ⑬ onto the carburetor body.



6. Install the pilot screw, and then turn in until it is lightly seated, and then turn out by the specified number of turns.



NOTE:

When disassemble the carburetor, be sure to set the pilot screw by the specified times.



Pilot screw turns out:

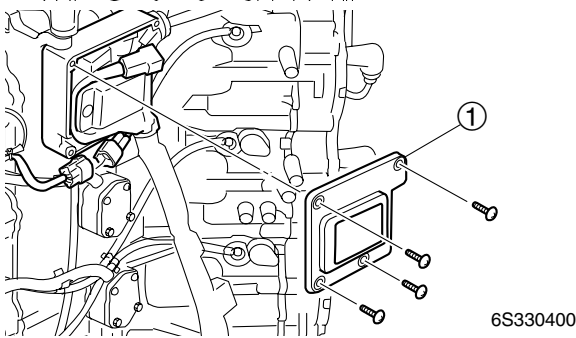
- 7/8 : [SU, SM, SL]*
- 1 : [PU]
- 3/4 : [PM]
- 1 3/8 : [PL]

- *PU : Port upper
- PM : Port middle
- PL : Port lower
- SU : Starboard upper
- SM : Starboard middle
- SL : Starboard lower

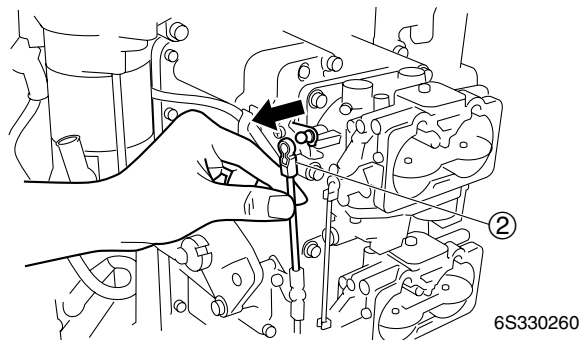
7. Install the carburetor assembly.

Adjusting the throttle sensor

1. Remove the hour meter cover ① and intake silencer cover.

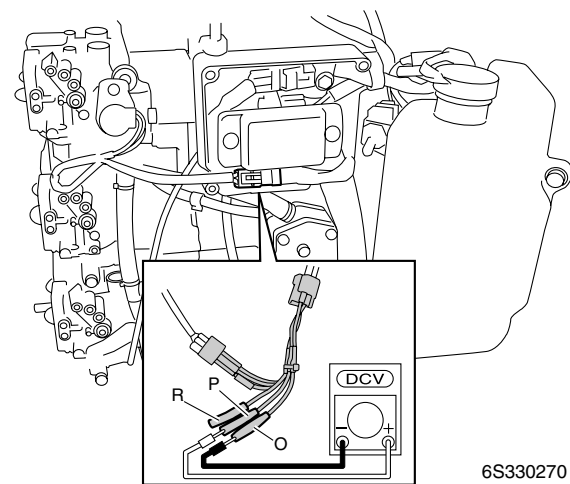



2. Remove the throttle link rod ② from the upper carburetor.



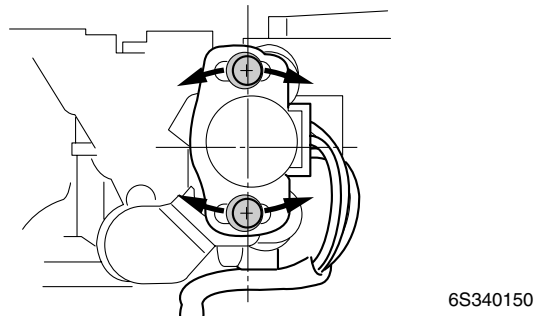
3. Check the throttle valve to fully closed position.


4. Connect the test harness to the throttle sensor.



 Test harness (3 pins): 90890-06857

5. Turn the engine start switch to ON.
6. Loosen the throttle sensor screws.
7. Adjust the position of the throttle sensor until the specified output voltage is obtained.



 Throttle sensor output voltage (with throttle valve fully closed):
Pink (P) – Orange (O)
0.48 – 0.52 V

8. Tighten the throttle sensor screws.

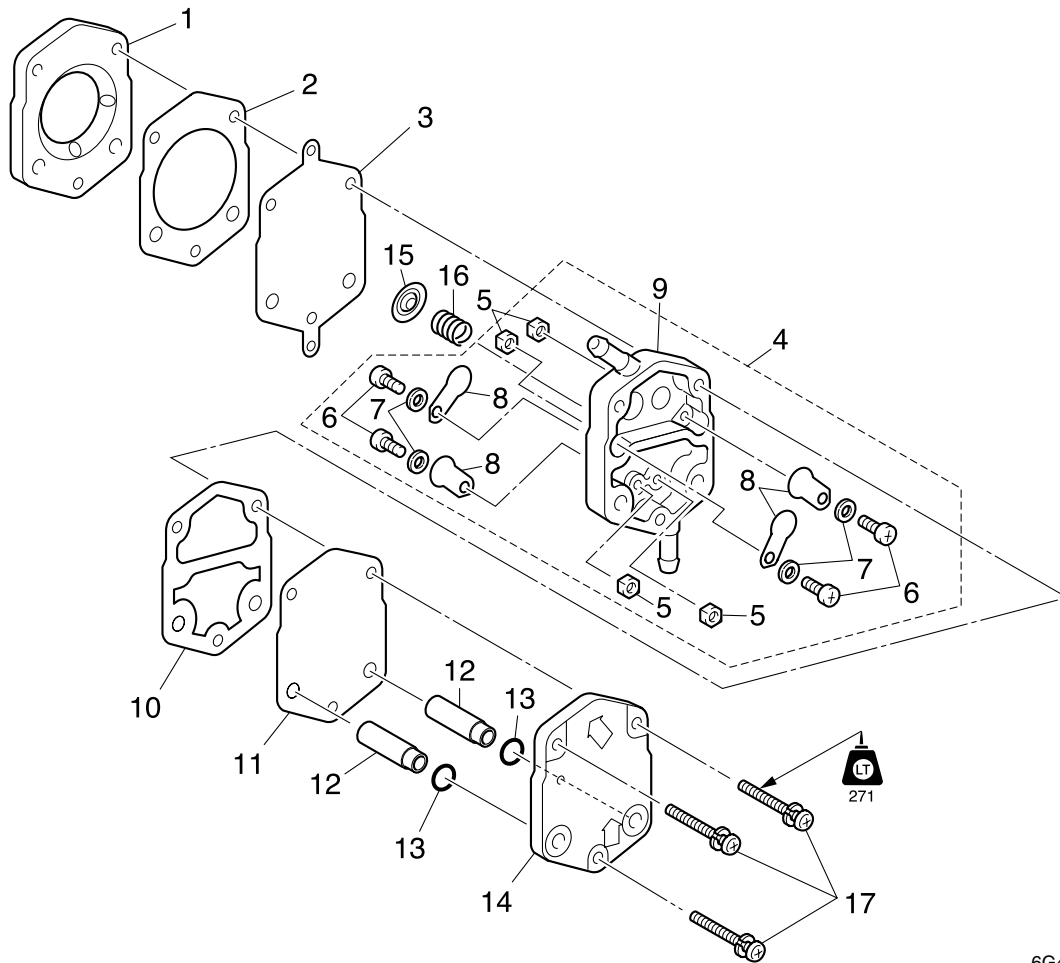
 Throttle sensor screw:
4 N·m (0.4 kgf·m, 3.0 ft·lb)

9. Disconnect the test harness and install the throttle link rod, and then install the hour meter cover and intake silencer cover.

NOTE: _____
Be sure to check the engine idle speed, after adjusting the throttle sensor.



Fuel pump

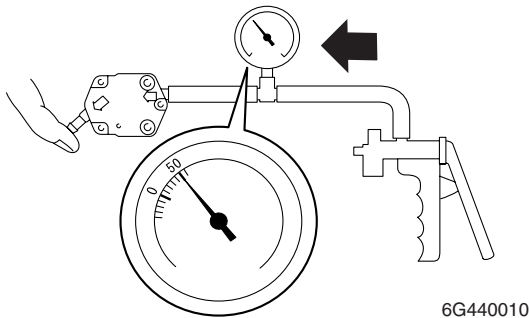


6G44030E


No.	Part name	Q'ty	Remarks
1	Base	2	
2	Gasket	2	Not reusable
3	Diaphragm	2	
4	Body assembly	2	
5	Nut	8	
6	Screw	8	ø5 × 28 mm
7	Washer	8	
8	Check valve	8	
9	Body	2	
10	Gasket	2	Not reusable
11	Diaphragm	2	
12	Collar	4	
13	O-ring	4	Not reusable
14	Cover	2	
15	Plate	2	
16	Spring	2	
17	Screw	6	ø5 × 35 mm


Checking the fuel pump

1. Place a drain pan under the fuel hose connections, and then disconnect the fuel hoses from the fuel pumps.
2. Connect the special service tool to the fuel pump inlet.
3. Cover the fuel pump outlet with a finger, and then apply the specified positive pressure. Check that there is no air leakage.

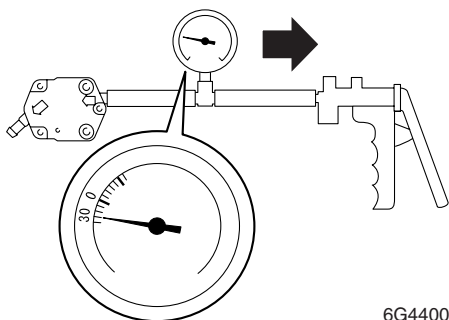


6G440010


 Vacuum/pressure pump gauge set:
90890-06756

 Specified pressure:
50 kPa (0.5 kgf/cm², 7.3 psi)

4. Apply the specified negative pressure and check that there is no air leakage.

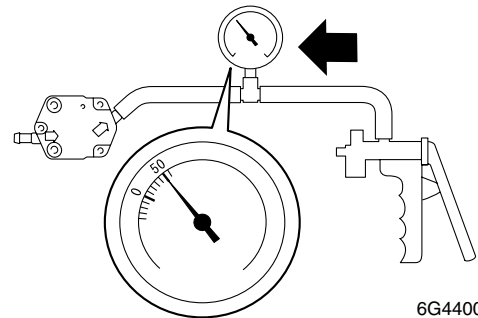


6G440020


 Specified pressure:
30 kPa (0.3 kgf/cm², 4.4 psi)

5. Connect the special service tool to the fuel pump outlet.

6. Apply the specified positive pressure and check that there is no air leakage. Disassemble the fuel pump if necessary.

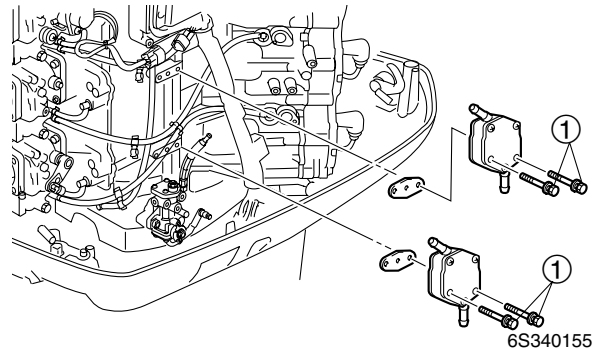


6G440030

 Specified pressure:
50 kPa (0.5 kgf/cm², 7.3 psi)

Disassembling the fuel pump

1. Disconnect the inlet and outlet hose from the fuel pumps.
2. Remove the 2 bolts ① securing the pumps to the crankcase.



6S340155

3. Remove the 3 screws securing the pump together. Refer to exploded diagram P4-13.

NOTE: _____
Take care to let the spring fly out or lose the plate.

4. Check the diaphragms for tears or damage. Replace the diaphragms if necessary.
5. Check the valves for bends or damage. Replace the valve if necessary. Also, check the fuel pump bodies and springs for damage. Replace the fuel pump bodies and springs if necessary.
6. Clean the fuel pump bodies.

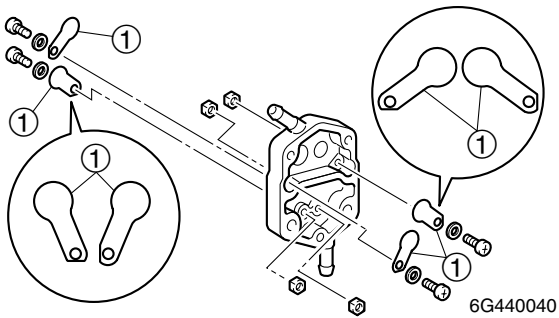


Assembling the fuel pump

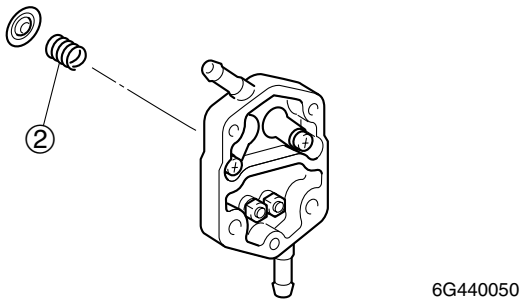
NOTE: _____
 Clean the parts and soak the valves and the diaphragms in gasoline before assembly to obtain prompt operation of the fuel pumps when starting the engine.

NOTE: _____
 Make sure that the gaskets and diaphragms are kept in place through the assembly process.

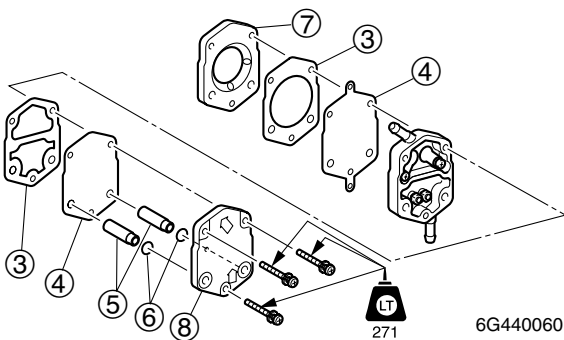
1. Install the check valves ① onto the fuel pump body.



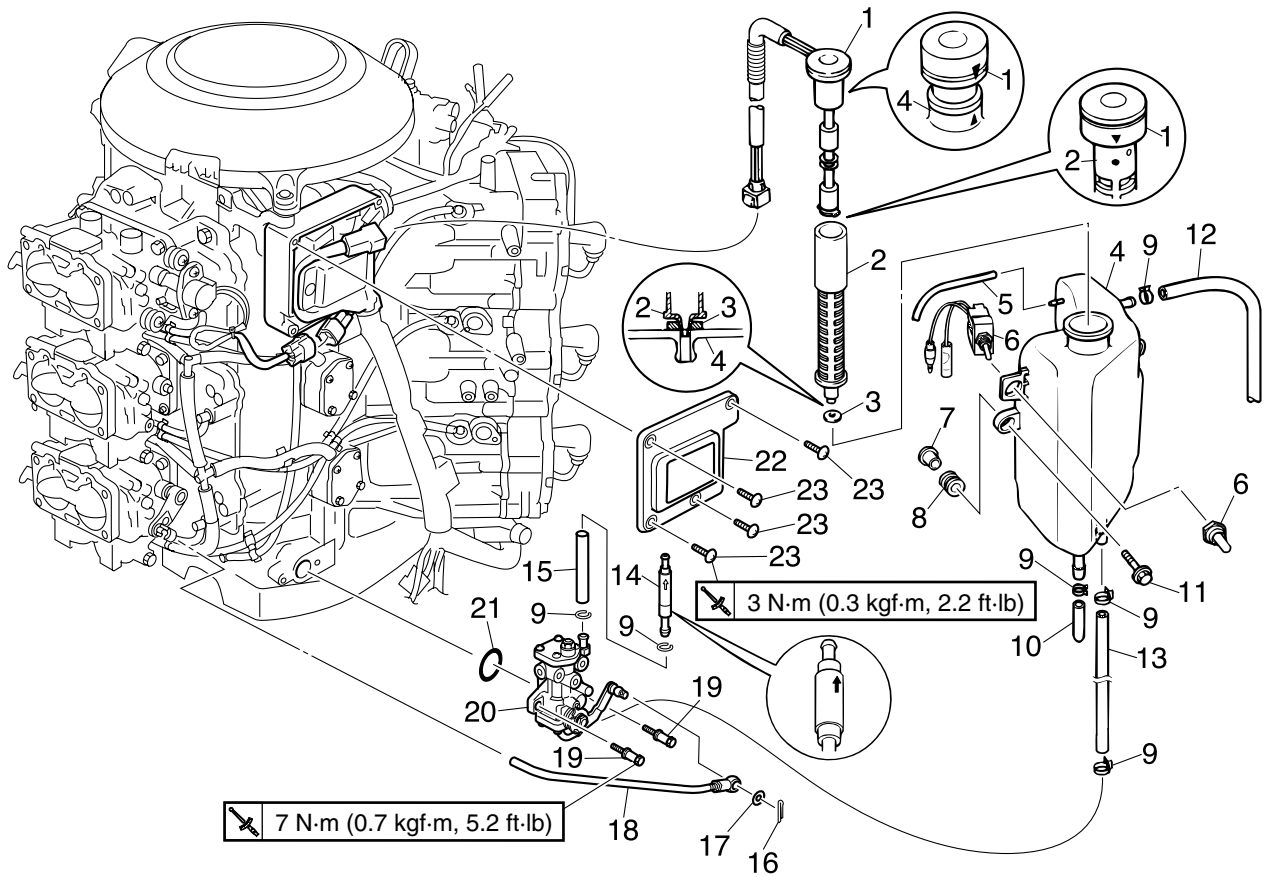
2. Install the spring ②.



3. Install the new gaskets ③, diaphragms ④, collars ⑤, O-rings ⑥, base ⑦ and cover ⑧ on to the fuel pump body.

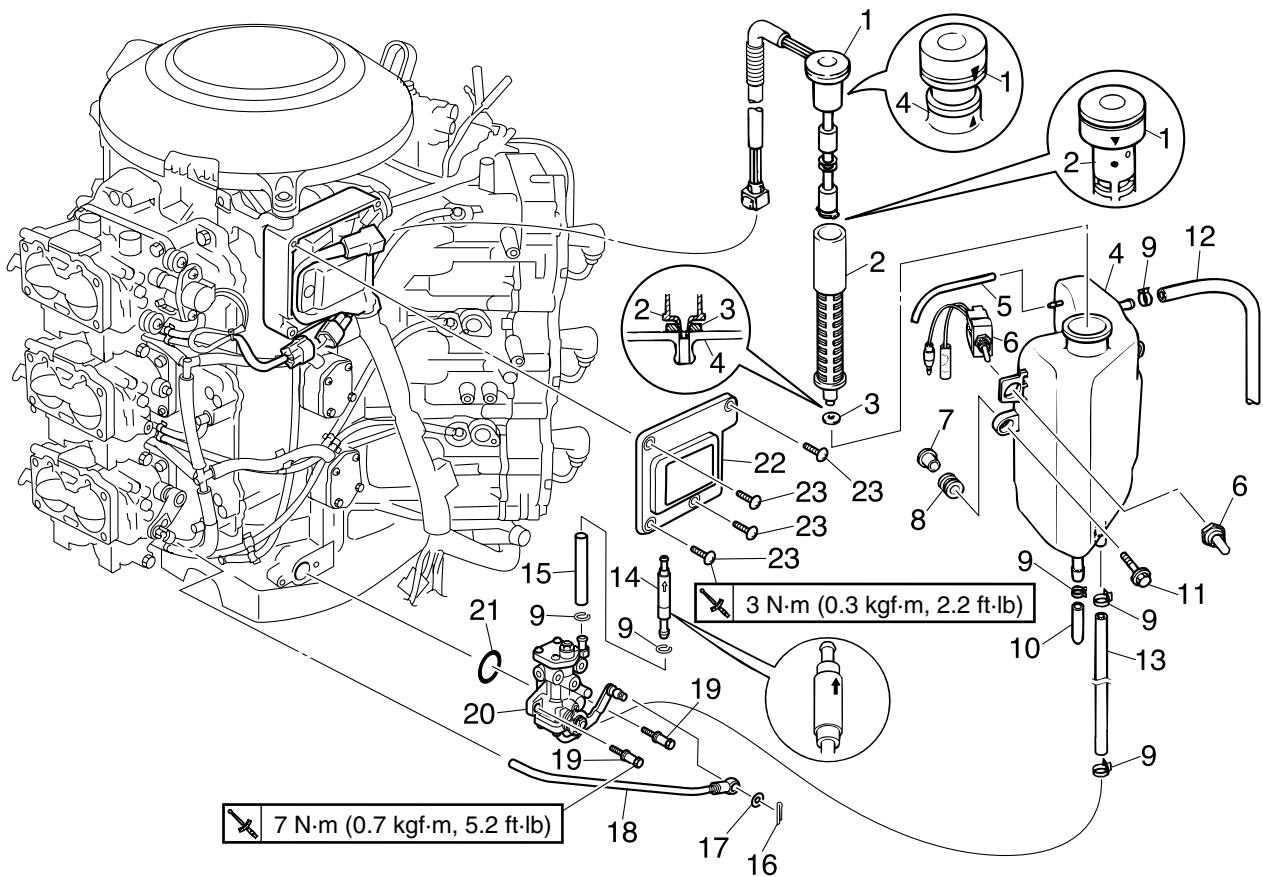


Oil injection system



6S34110E

No.	Part name	Q'ty	Remarks
1	Oil level sensor	1	
2	Oil filter	1	
3	Washer	1	
4	Oil tank	1	
5	Air vent hose	1	
6	Emergency switch	1	
7	Collar	3	
8	Grommet	3	
9	Lock tie	6	Not reusable
10	Water trap	1	
11	Bolt	3	M6 × 30 mm
12	Oil hose	1	
13	Oil hose	1	
14	Check valve	1	
15	Oil hose	1	
16	Cotter pin	1	
17	Plastic washer	1	

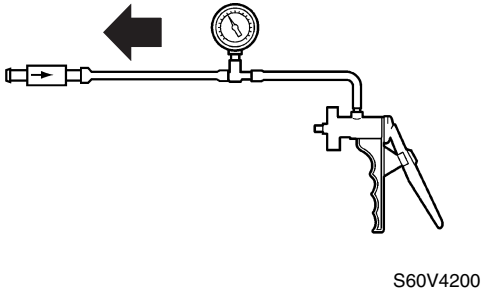


6S34110E

No.	Part name	Q'ty	Remarks
18	Oil pump link rod	1	
19	Bolt	2	M6 × 20 mm
20	Oil pump	1	
21	O-ring	1	Not reusable
22	Cover	1	
23	Screw	4	ø5 × 20 mm

Checking the check valve

1. Connect the special service tool to the check valve.
2. Apply positive pressure to the check valve port. Replace if necessary.



Vacuum/pressure pump gauge set:
90890-06756

NOTE:

Check that no air leakage from the opposite end of the check valve.

Checking the oil filter

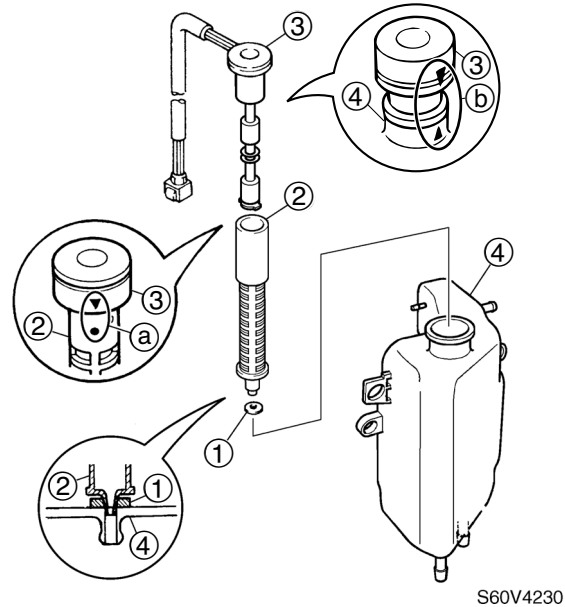
1. Check the oil filter for dirt, residue, or cracks. Clean or replace if necessary.

Checking the oil tank

1. Check the oil tank for cracks, leaks, or damage. Replace if necessary.

Assembling the oil tank

1. Install the washer (1), oil filter (2), and oil level sensor (3) into the oil tank (4).

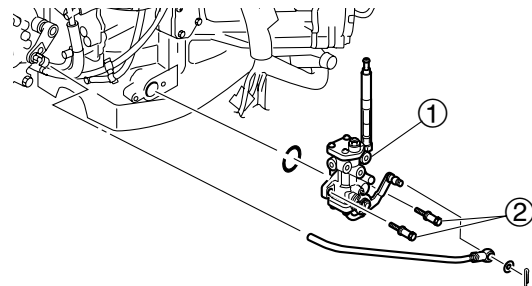


NOTE:

- Align the alignment marks (a) on the oil filter (2) and oil level sensor (3).
- Align the alignment marks (b) on the oil level sensor (3) and oil tank (4).

Installing the oil pump

1. Connect the oil hose to the oil pump.
2. Install the oil pump (1), and then tighten the bolts (2) to the specified torque.



6S340040



Oil pump bolt:
7 N·m (0.7 kgf·m, 5.2 ft·lb)

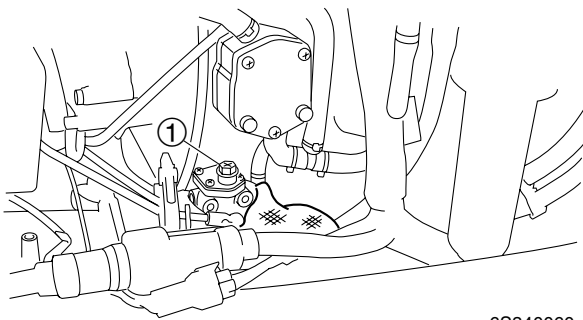


Bleeding the oil pump

CAUTION:

- Make sure that the engine oil is filled in the engine oil tank.
- If the engine oil is not in the engine oil tank, fill the engine oil tank.

1. Place rags around the air bleed screw ① to catch any oil that might spill.

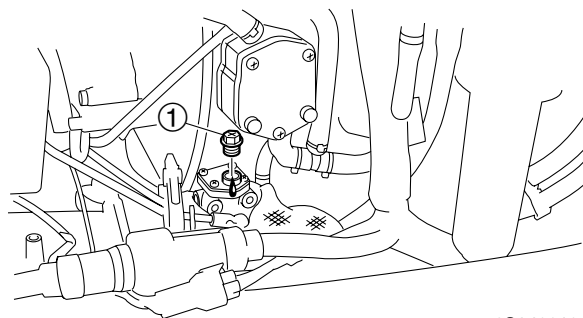


6S340060

2. Fill the engine oil tank with engine oil.

	Recommended engine oil: YAMALUBE 2-stroke outboard motor oil
--	--

3. Loosen the air bleed screw ① and make sure that both the oil and air bubbles flow out.



6S340010

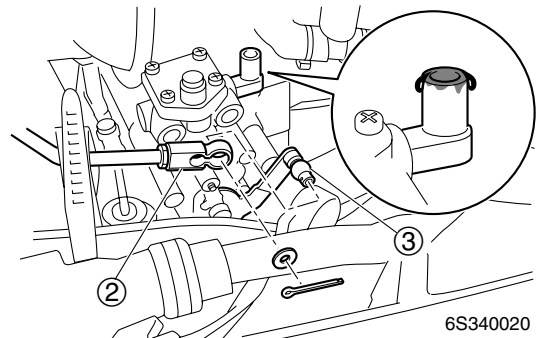
NOTE:

Remove the air bleed screw to bleed the air bubbles completely.

4. When there are no air bubbles left, tighten the air bleed screw.
5. Disconnect the oil pump link rod joint ② from the oil pump lever.
6. Disconnect the oil hose (translucent) and start the engine.
7. Make sure that the engine oil is come out of the outlet of oil pump. After that, connect the oil hose (translucent).

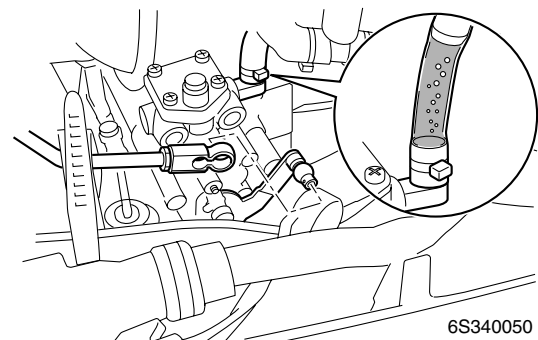
CAUTION:

When start the engine while bleeding the air bubbles, be sure to use the premix fuel.



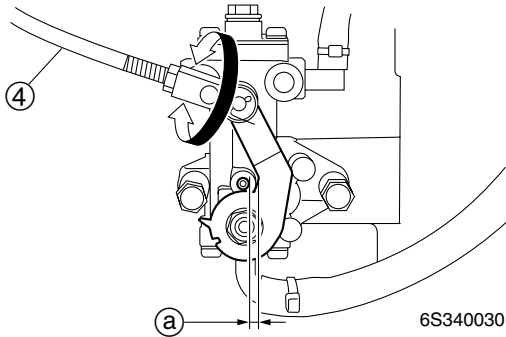
6S340020


8. When the oil pump lever ③ at the full open position, connect the oil hose and start the engine for 5–10 minutes.
9. Check that the air bubbles flows into the oil hose (translucent). If the air bubbles still leaves into the oil hose, repeat the steps 1–6.



6S340050

10. Connect the oil pump link rod ④ to the oil pump lever. Check the oil pump lever clearance ① between the oil pump lever and stopper.



 Oil pump lever clearance ①:
1 mm (0.039 in)

11. If the oil pump lever clearance is out of specification, remove the oil pump link rod and adjust the length until the specified clearance.

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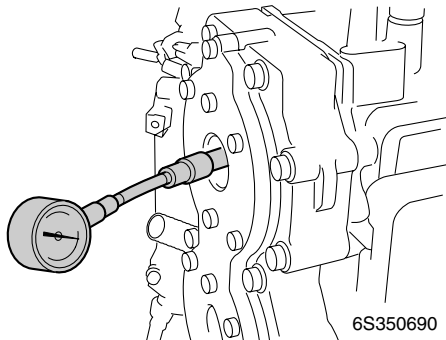
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Power unit

Checking the compression pressure

1. Start the engine, warm it up for 5 minutes, and then turn it off.
2. Remove the lock plate from the engine stop lanyard switch on the remote control box or switch panel.
3. Remove the all spark plug caps and all spark plugs, and then install the special service tools into a spark plug hole.



6S350690

5. If the compression pressure is below specification and the compression pressure for each cylinder is unbalanced, add a small amount of engine oil to the cylinders, and then check the compression pressure again.

NOTE:

- If the compression pressure increases, check the pistons and piston rings for wear. Replace if necessary.
- If the compression pressure does not increase, check the cylinder head gasket, and cylinder head. Replace if necessary.

CAUTION:

Before removing the spark plugs, blow compressed air in the spark plug well to clear out any dirt or dust that may fall into the cylinder.



Compression gauge:
90890-03160

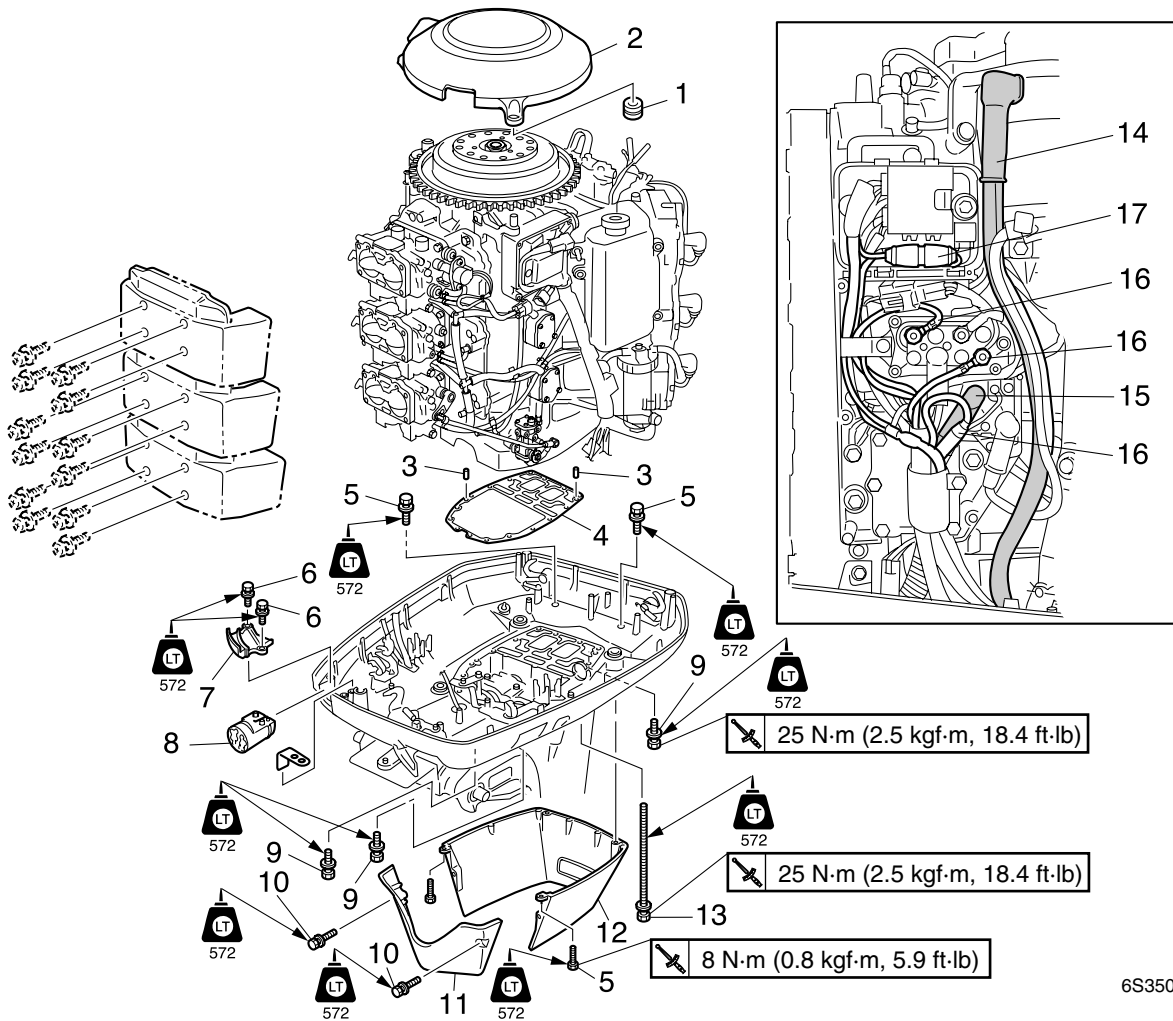
4. Fully open the throttle, and then crank the engine until the reading on the compression gauge stabilizes.

NOTE:

Disconnect the choke solenoid blue lead from the wireharness.

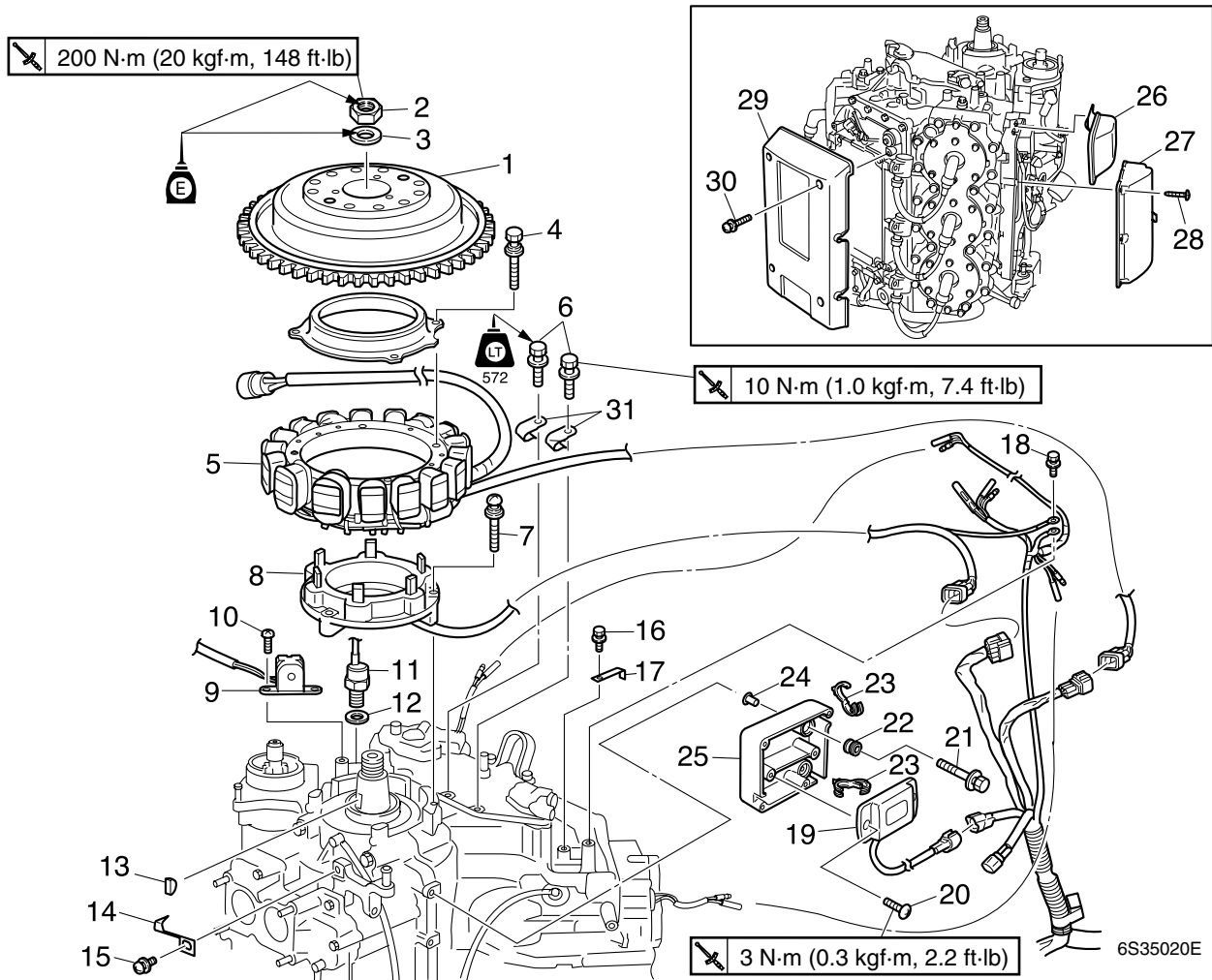


Minimum compression pressure
(reference data):
430 kPa (4.3 kgf/cm², 61 psi)

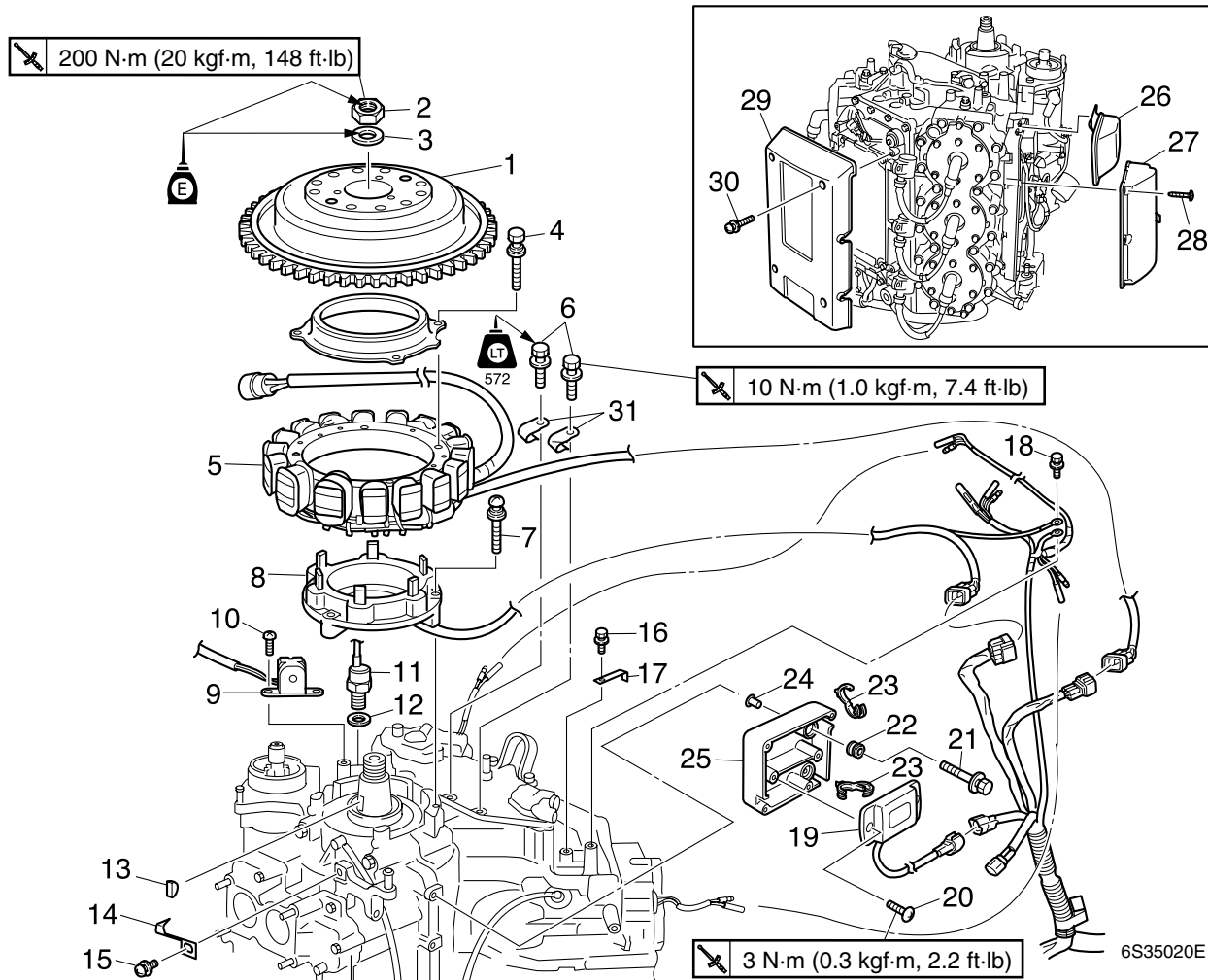


6S35010E

No.	Part name	Q'ty	Remarks
1	Grommet	3	
2	Flywheel cover	1	
3	Dowel	2	
4	Gasket	1	Not reusable
5	Bolt	4	M6 × 20 mm
6	Bolt	3	M6 × 16 mm
7	Retaining plate	1	
8	Grommet	1	
9	Bolt	6	M8 × 30 mm
10	Bolt	2	M6 × 30 mm
11	Apron	1	
12	Apron	1	
13	Bolt	8	M8 × 135 mm
14	Negative battery cable	1	
15	Positive battery cable	1	
16	PTT motor lead	3	
17	Fuse holder	1	

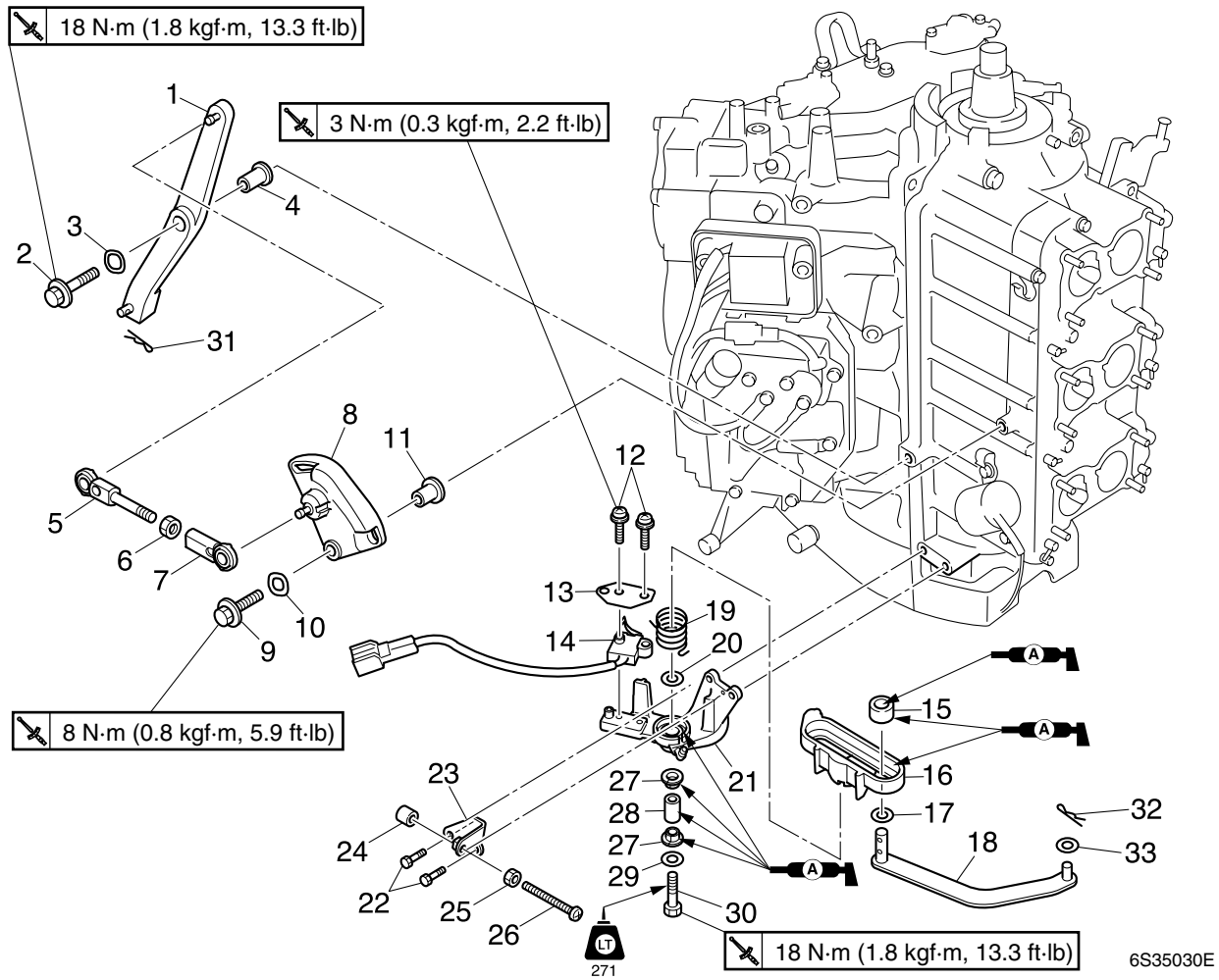


No.	Part name	Q'ty	Remarks
1	Flywheel magnet	1	
2	Nut	1	
3	Washer	1	
4	Bolt	4	M6 × 35 mm
5	Stator assembly	1	
6	Bolt	2	M6 × 20 mm
7	Screw	3	ø5 × 30 mm
8	Pulser coil assembly	1	
9	Crank position sensor	1	
10	Screw	2	ø5 × 12 mm
11	Thermo sensor	1	
12	Washer	1	
13	Woodruff key	1	
14	Timing plate	1	
15	Screw	1	ø5 × 10 mm
16	Bolt	1	M6 × 12 mm
17	Holder	1	

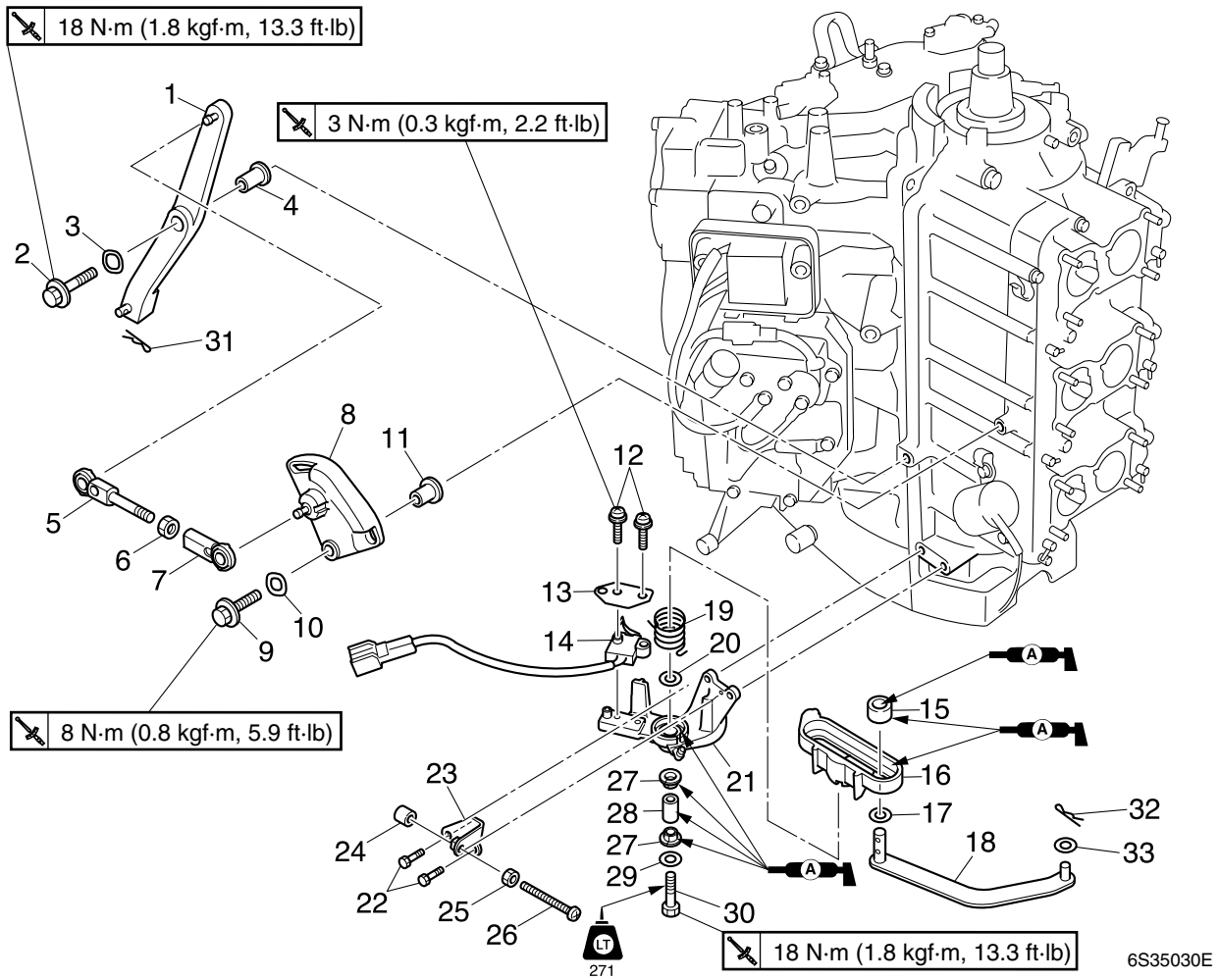


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No.	Part name	Q'ty	Remarks
18	Bolt	1	M6 × 16 mm
19	Hour meter	1	
20	Screw	2	ø5 × 20 mm
21	Bolt	4	M6 × 30 mm
22	Grommet	4	
23	Clamp	2	
24	Collar	4	
25	Case	1	
26	Cover	1	
27	Cover	1	
28	Screw	6	ø5 × 20 mm
29	Cover	1	
30	Screw	4	M6 × 25 mm
31	Clamp	2	

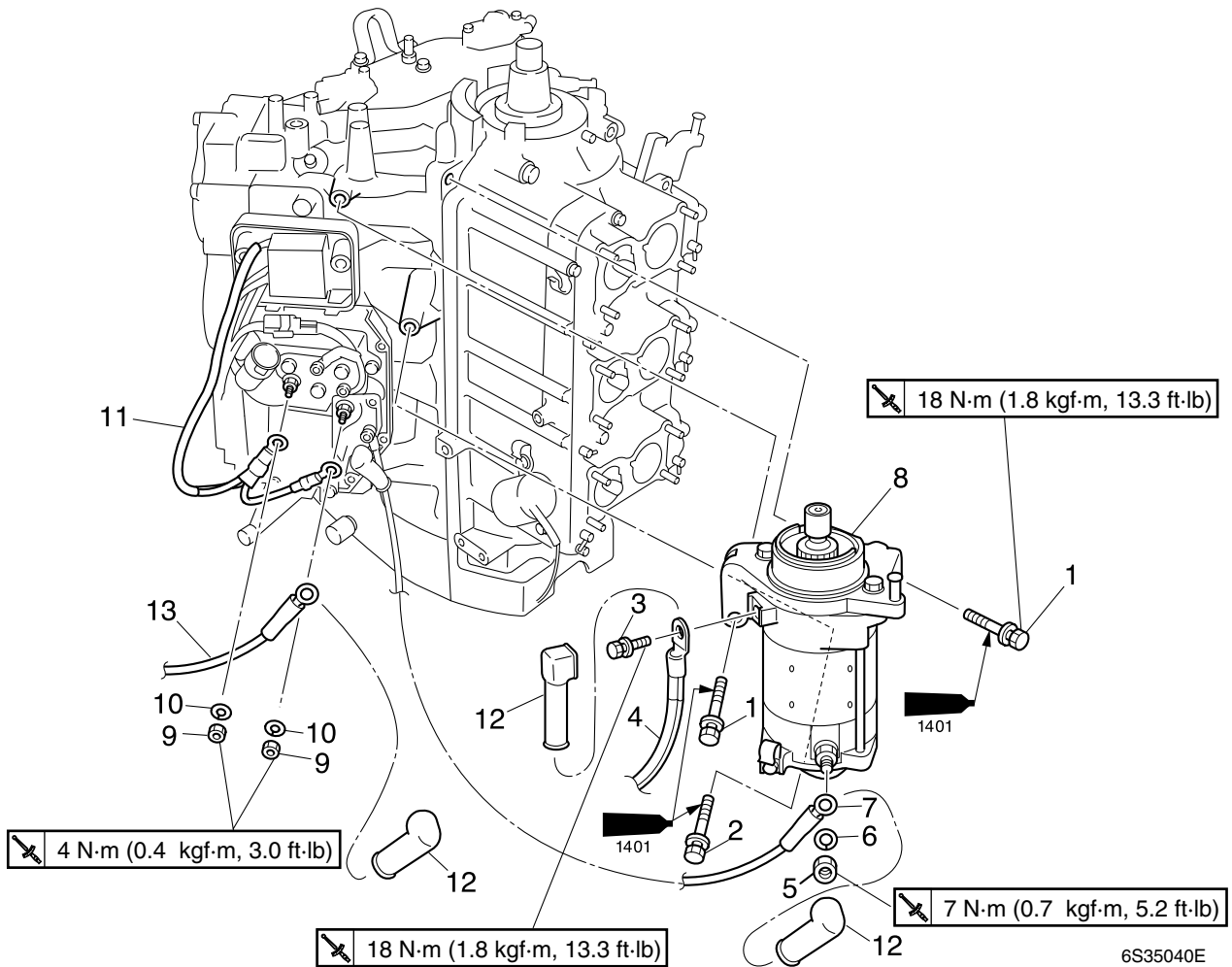


No.	Part name	Q'ty	Remarks
1	Control lever	1	
2	Bolt	1	M8 × 40 mm
3	Wave washer	1	
4	Collar	1	
5	Throttle link rod	1	
6	Lock nut	1	
7	Joint	1	
8	Accelerator cam	1	
9	Bolt	1	M6 × 25 mm
10	Wave washer	1	
11	Collar	1	
12	Screw	2	ø4 × 16 mm
13	Plate	1	
14	Shift cut switch	1	
15	Bushing	1	
16	Bracket	1	
17	Washer	1	



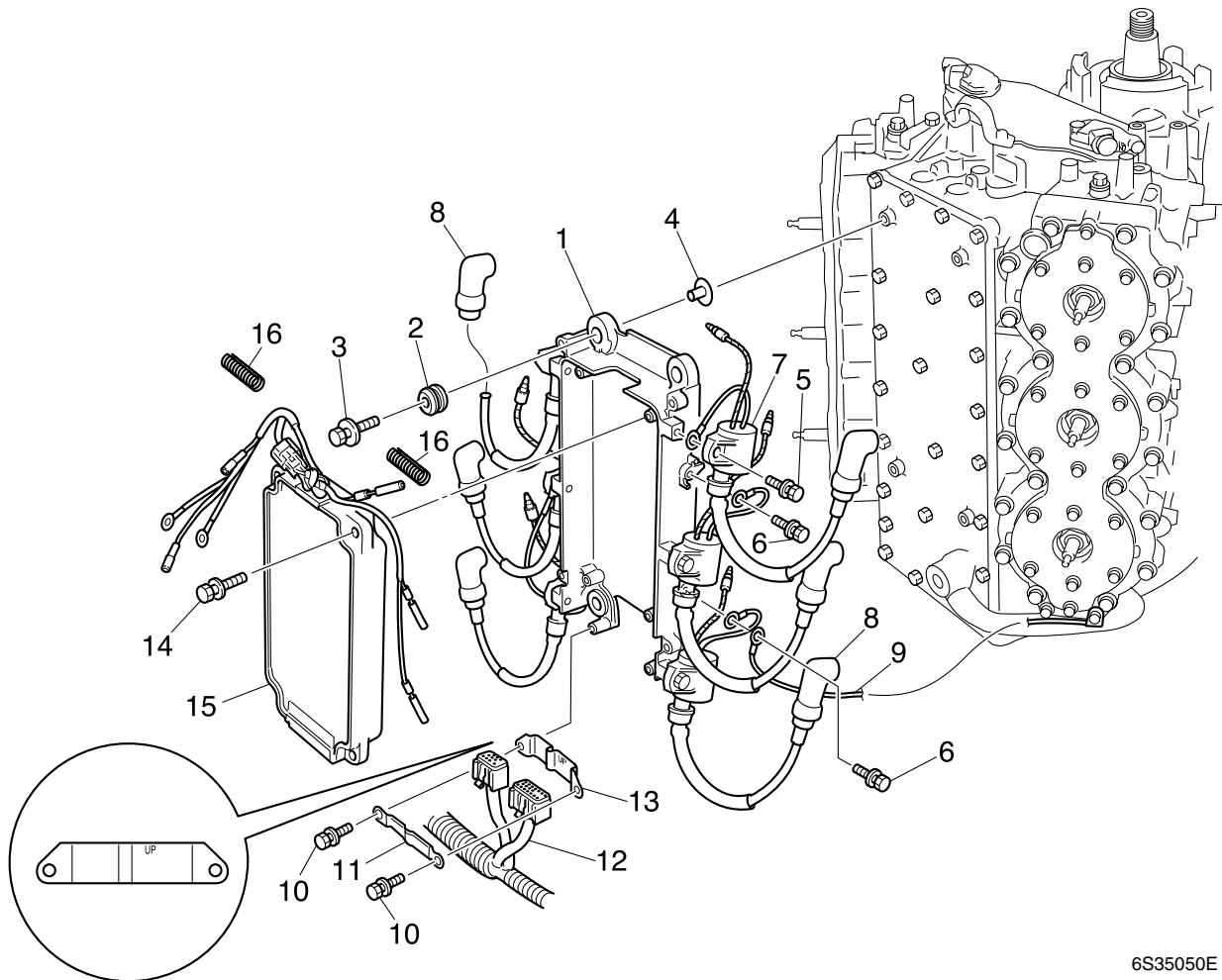
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No.	Part name	Q'ty	Remarks
18	Lever	1	
19	Spring	1	
20	Washer	1	
21	Bracket	1	
22	Bolt	2	M6 × 20 mm
23	Stay	1	
24	Cap	1	
25	Lock nut	1	
26	Screw	1	ø6 × 50 mm
27	Bush	2	
28	Collar	1	
29	Washer	1	
30	Bolt	1	M8 × 35 mm
31	Clip	1	
32	Clip	1	
33	Plastic washer	1	



6S35040E

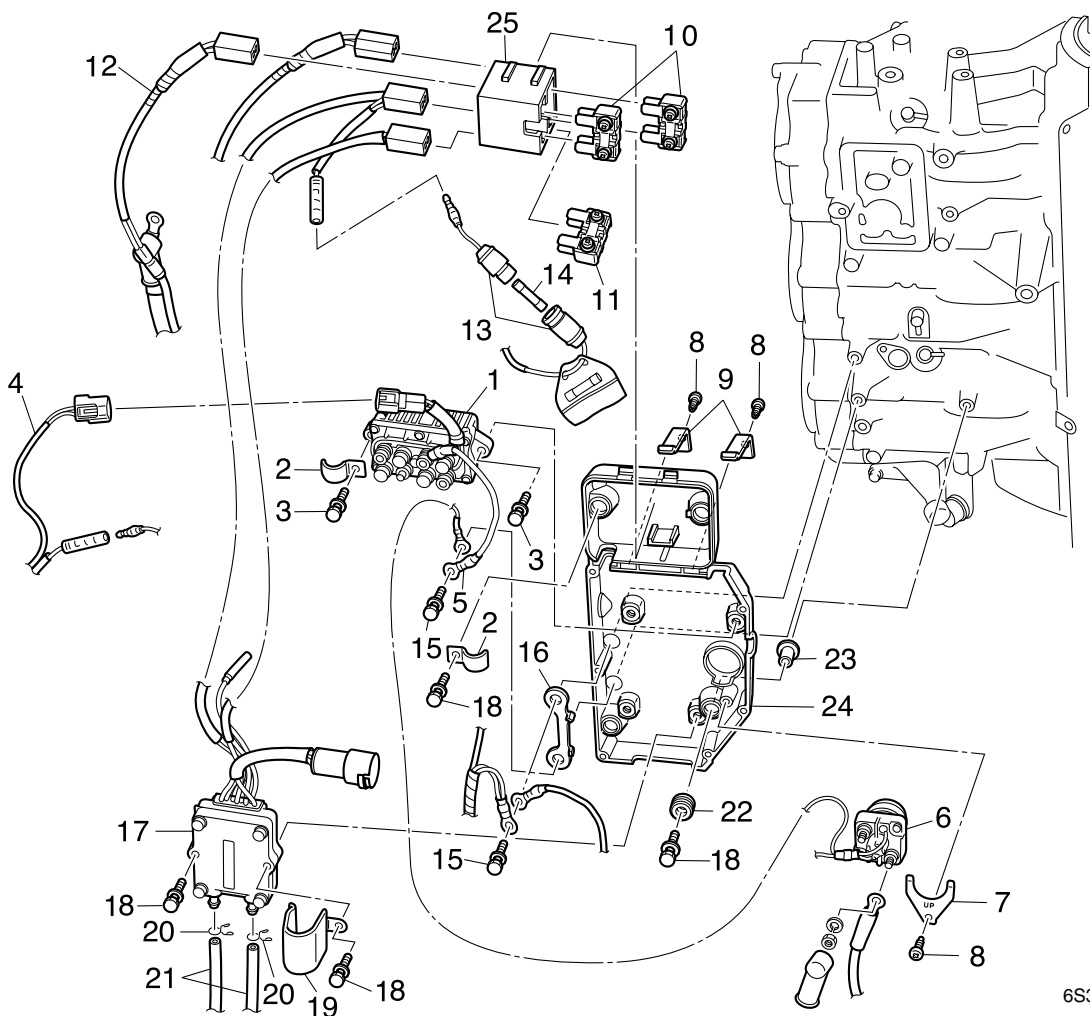
No.	Part name	Q'ty	Remarks
1	Bolt	2	M8 × 45 mm
2	Bolt	1	M8 × 35 mm
3	Bolt	1	M8 × 16 mm
4	Negative battery cable	1	
5	Nut	1	
6	Spring washer	1	
7	Positive battery lead	1	
8	Starter motor	1	
9	Nut	2	
10	Spring washer	2	
11	Positive battery lead	1	
12	Cap	3	
13	Positive battery cable	1	



5

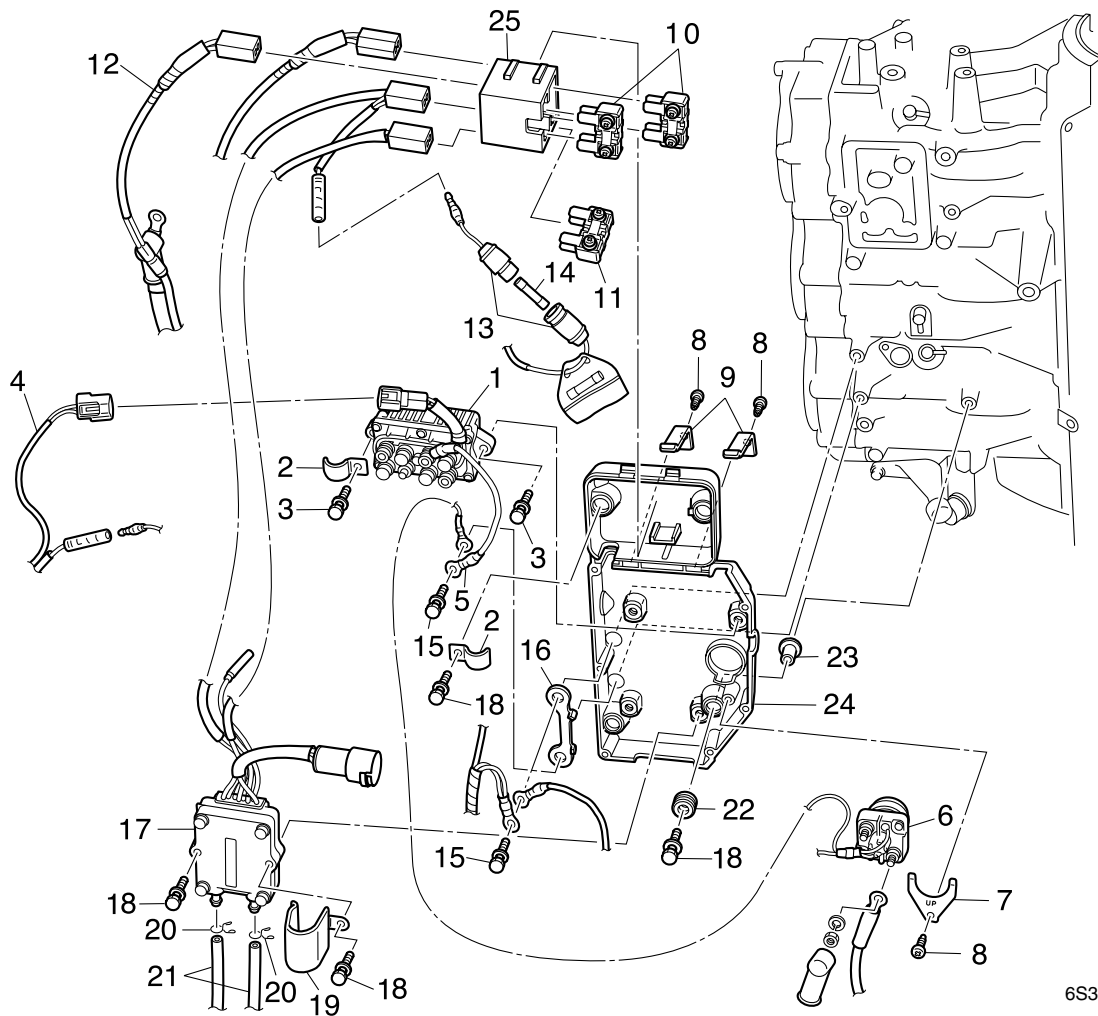
6S35050E

No.	Part name	Q'ty	Remarks
1	Case	1	
2	Grommet	4	
3	Bolt	4	M6 × 28 mm
4	Collar	4	
5	Bolt	6	M6 × 20 mm
6	Bolt	4	M6 × 14 mm
7	Ignition coil	6	
8	Plug cap	6	
9	Ground lead	1	
10	Bolt	2	M6 × 16 mm
11	Plate	1	
12	Wire harness	1	
13	Holder	1	
14	Bolt	4	M6 × 24 mm
15	CDI unit	1	
16	Tube	2	



6S35060E

No.	Part name	Q'ty	Remarks
1	PTT relay	1	
2	Clamp	2	
3	Bolt	2	M6 × 30 mm
4	Wireharness	1	
5	Ground lead	1	
6	Starter relay	1	
7	Holder	1	
8	Screw	3	ø5 × 12 mm
9	Stay	2	
10	Fuse	2	80A
11	Spare fuse	1	80A
12	Positive battery lead	1	
13	Fuse holder	1	
14	Fuse	1	20A
15	Bolt	2	M6 × 14 mm
16	Joint connector	1	
17	Rectifier Regulator	1	



6S35060E

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No.	Part name	Q'ty	Remarks
18	Bolt	6	M6 × 30 mm
19	Clamp	1	
20	Clip	2	
21	Hose	2	
22	Grommet	4	
23	Collar	4	
24	Case	1	

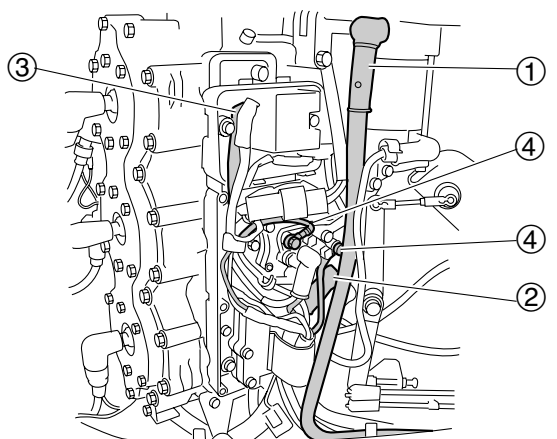


Removing the power unit

NOTE:

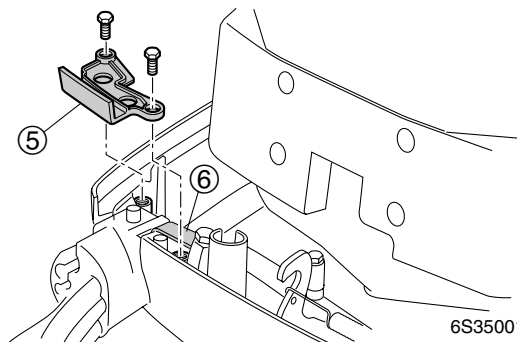
It is recommended to loosen the flywheel magnet nut before removing the power unit to improve working efficiency.

1. Remove the junction box cover, and then disconnect the negative battery cable ①, positive battery cable ②, positive battery lead ③ and PTT motor lead ④.



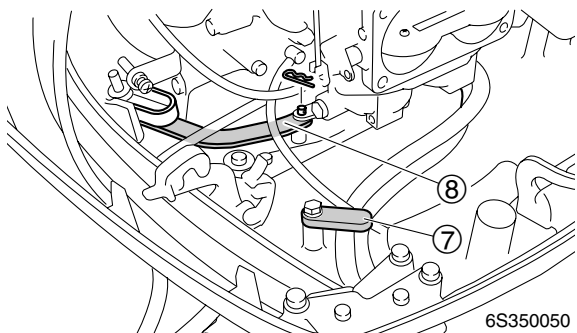
6S350020

2. Remove the retaining plate ⑤ and plate ⑥.



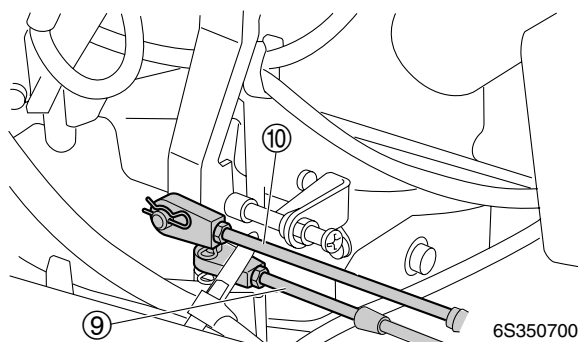
6S350010

3. Loosen the cable holder ⑦ and remove the shift lever ⑧.



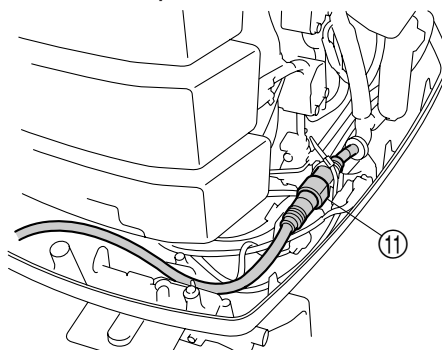
6S350050

4. Set the remote control lever in the neutral position, and then disconnect the shift cable ⑨, throttle cable ⑩.



6S350700

5. Disconnect the main coupler ⑪ and PTT switch coupler.

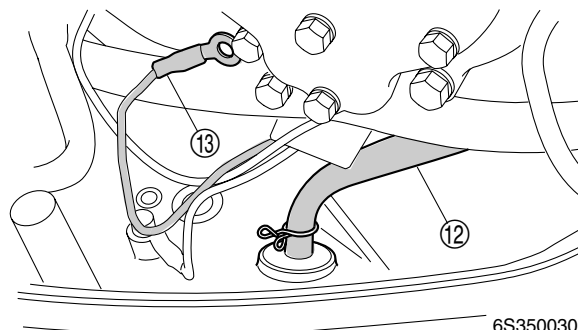


6S350040

6. Remove the flywheel cover and the intake silencer.

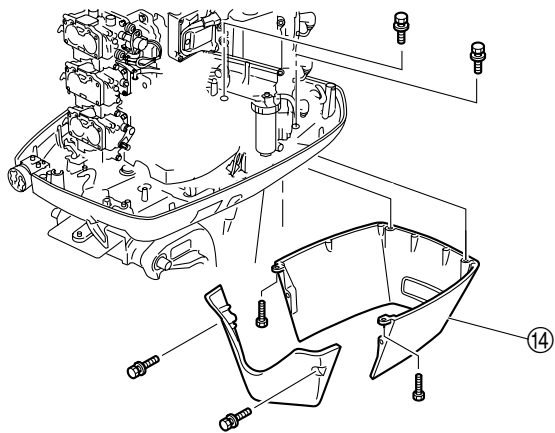
7. Disconnect the fuel hose and oil hose.

8. Disconnect cooling the water pilot hose ⑫ and ground lead ⑬.



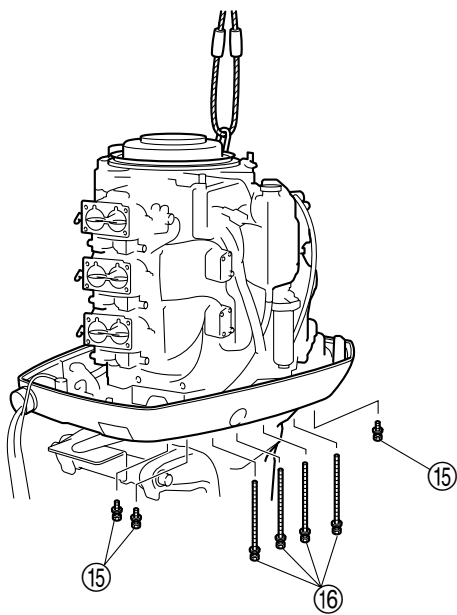
6S350030

9. Remove the apron (14).



6S350280

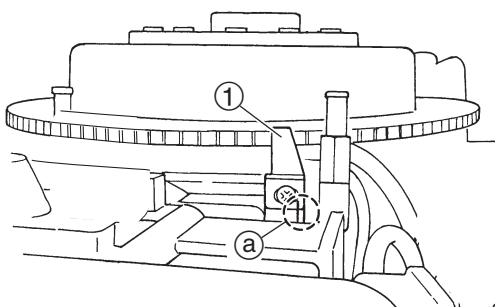
10. Remove the power unit by removing the bolts (15) and (16).



6S350060

Removing the flywheel magnet

1. Remove the timing plate (1).

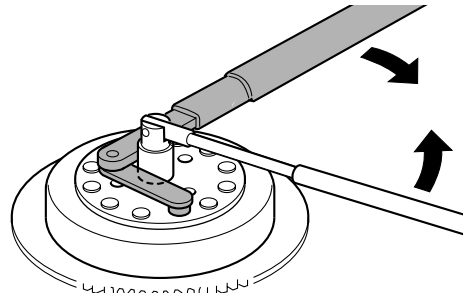


S60V5410

NOTE:

Make an alignment mark (a) at the installation point of the timing plate, and then remove the timing plate (1).

2. Loosen the flywheel magnet nut.



6F650200

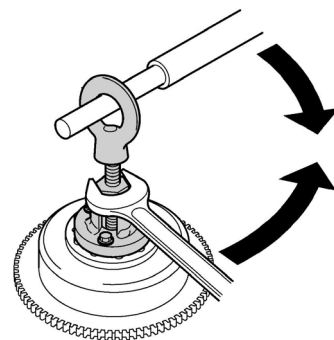
CAUTION:

Apply force in the direction of the arrows shown. While working, do not allow the flywheel holder to slip off the flywheel.

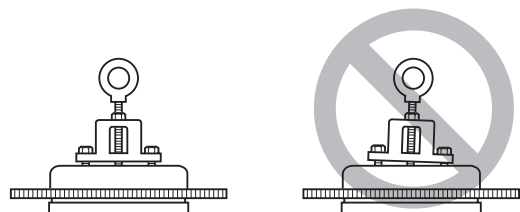


Flywheel holder: 90890-06522

3. Remove the flywheel magnet.



6B450090





CAUTION:

To prevent damage to the engine or tools, screw in the flywheel puller set bolts evenly and completely so that the flywheel puller is parallel to the flywheel magnet.

NOTE:

Apply force to the crankshaft end until the flywheel magnet comes off the tapered portion of the crankshaft.

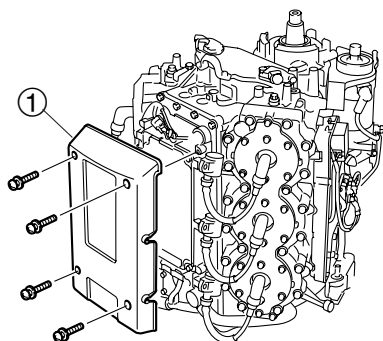


Flywheel puller: 90890-06521

4. Remove the Woodruff key.

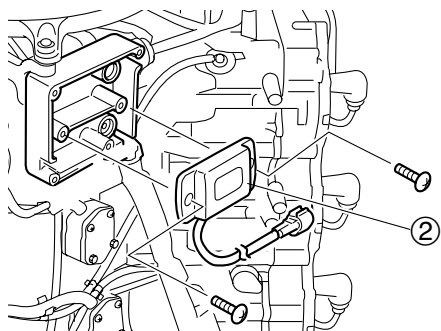
Removing the electrical component

1. Remove the cover ①.



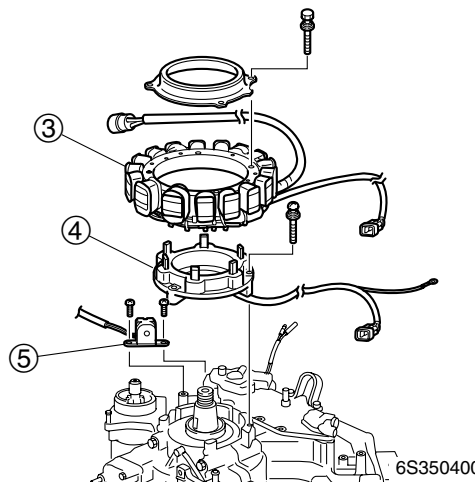
6S350470

2. Remove the hour meter ②.



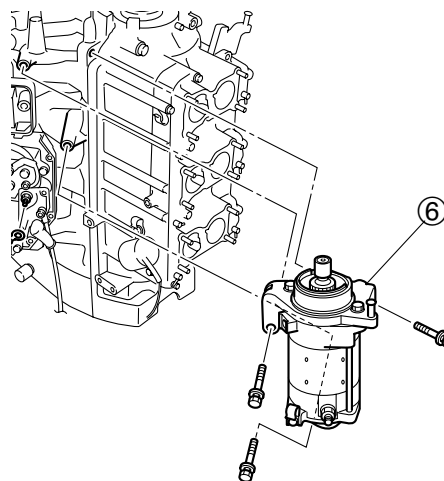
6S350410

3. Remove the stator assembly ③ pulser coil assembly ④ and crank position sensor ⑤.



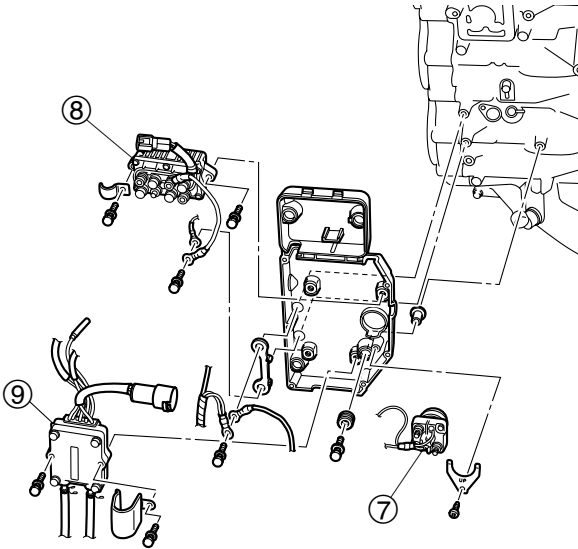
6S350400

4. Remove the starter motor ⑥.



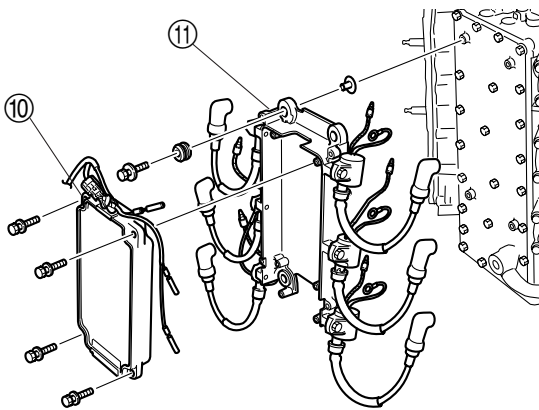
6S350390

5. Remove the starter relay (7), the PTT relay assembly (8), and rectifier regulator (9) onto the power unit.



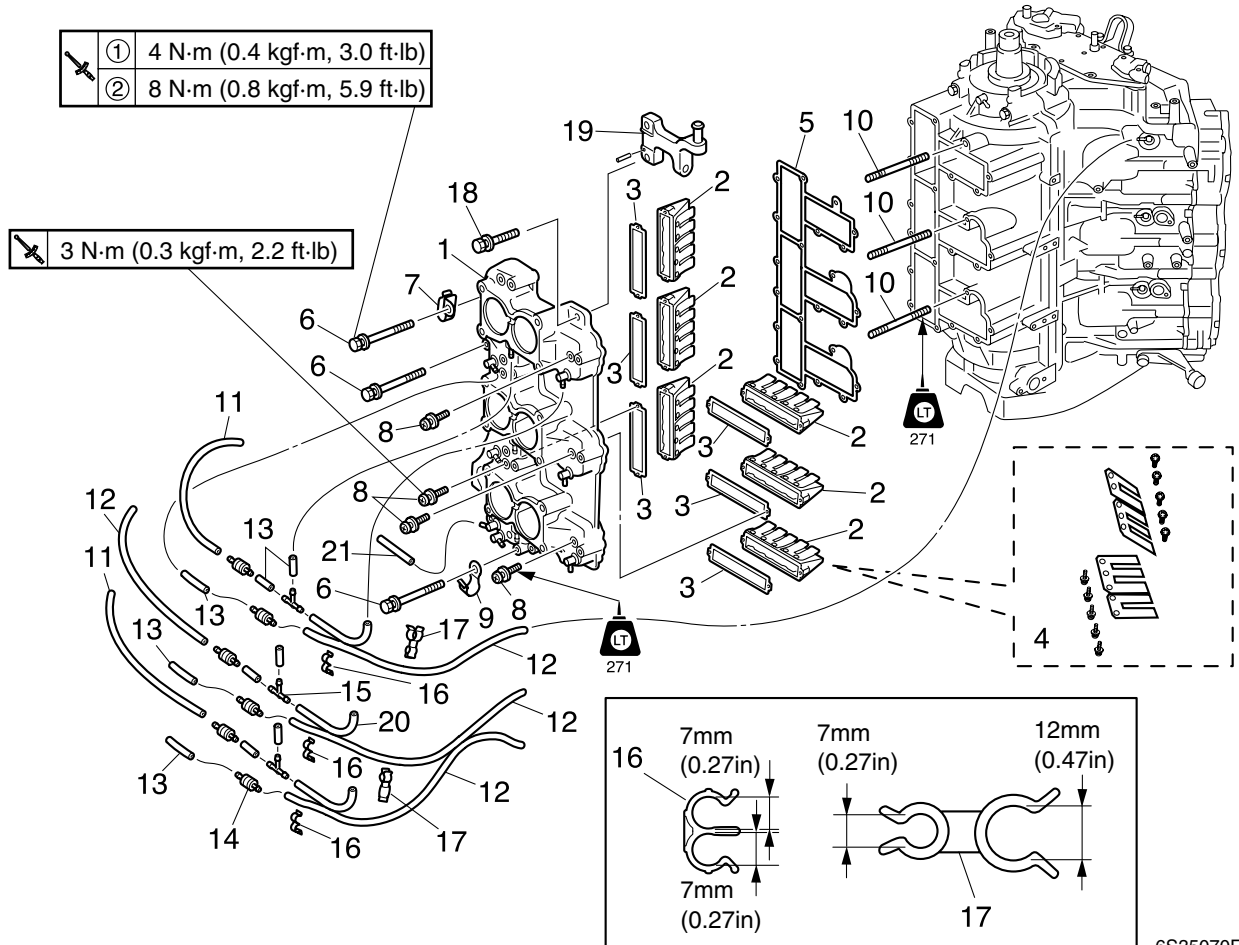
6S350525

6. Disconnect the ignition coil leads, and then remove the CDI unit (10) and case (11).



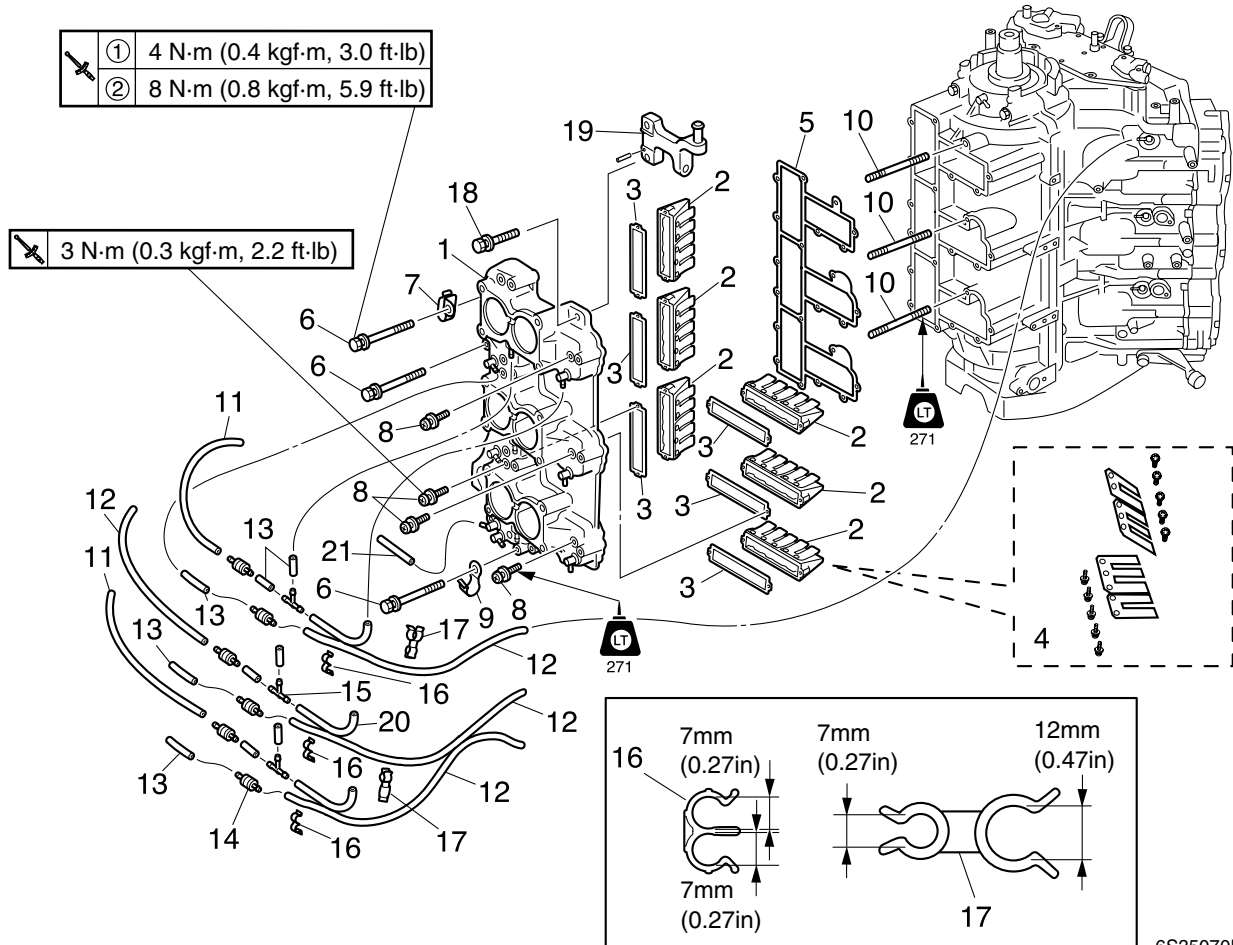
6S350420

Intake manifold



6S35070E

No.	Part name	Q'ty	Remarks
1	Intake manifold	1	
2	Reed valve assembly	6	
3	Gasket	6	Not reusable
4	Reed valve set	6	
5	Gasket	1	Not reusable
6	Bolt	19	M6 × 25 mm
7	Clamp	1	
8	Screw	12	∅5 × 16 mm
9	Clamp	1	
10	Stud bolt	3	
11	Hose	2	
12	Hose	4	
13	Hose	9	
14	Check valve	6	
15	Joint	3	
16	Clamp	3	
17	Clamp	2	



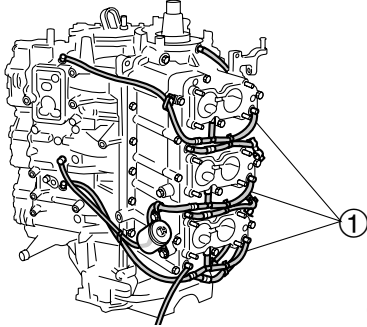
6S35070E

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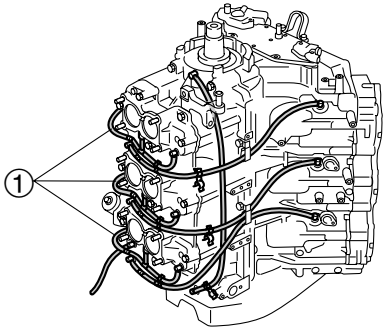
No.	Part name	Q'ty	Remarks
18	Bolt	1	M6 × 20 mm
19	Bracket	1	
20	Hose	3	
21	Hose	1	

Removing the intake manifold

1. Remove the carburetor assemblies and the fuel hoses.
2. Disconnect the hoses ①.



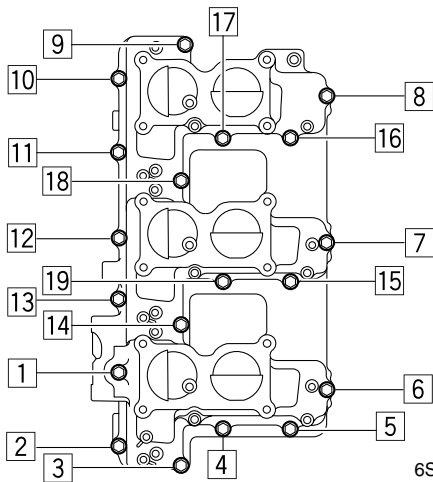
6S350730



6S350740

NOTE: _____
 Mark the hoses connecting position, before disconnect.

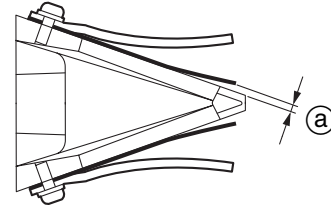
3. Remove the intake manifold bolts in the sequence shown.



6S350140

Checking the reed valve

1. Check the reed valves for bends ①. Replace the reed valves if above specification.

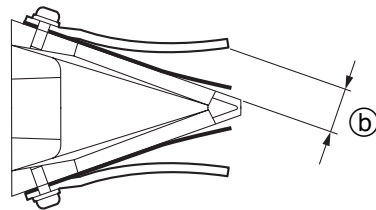


S60V5530



Valve bend limit ①:
 0.2 mm (0.0079 in)

2. Measure the reed valve stopper height ②. Replace the reed valve stopper if out of specification.

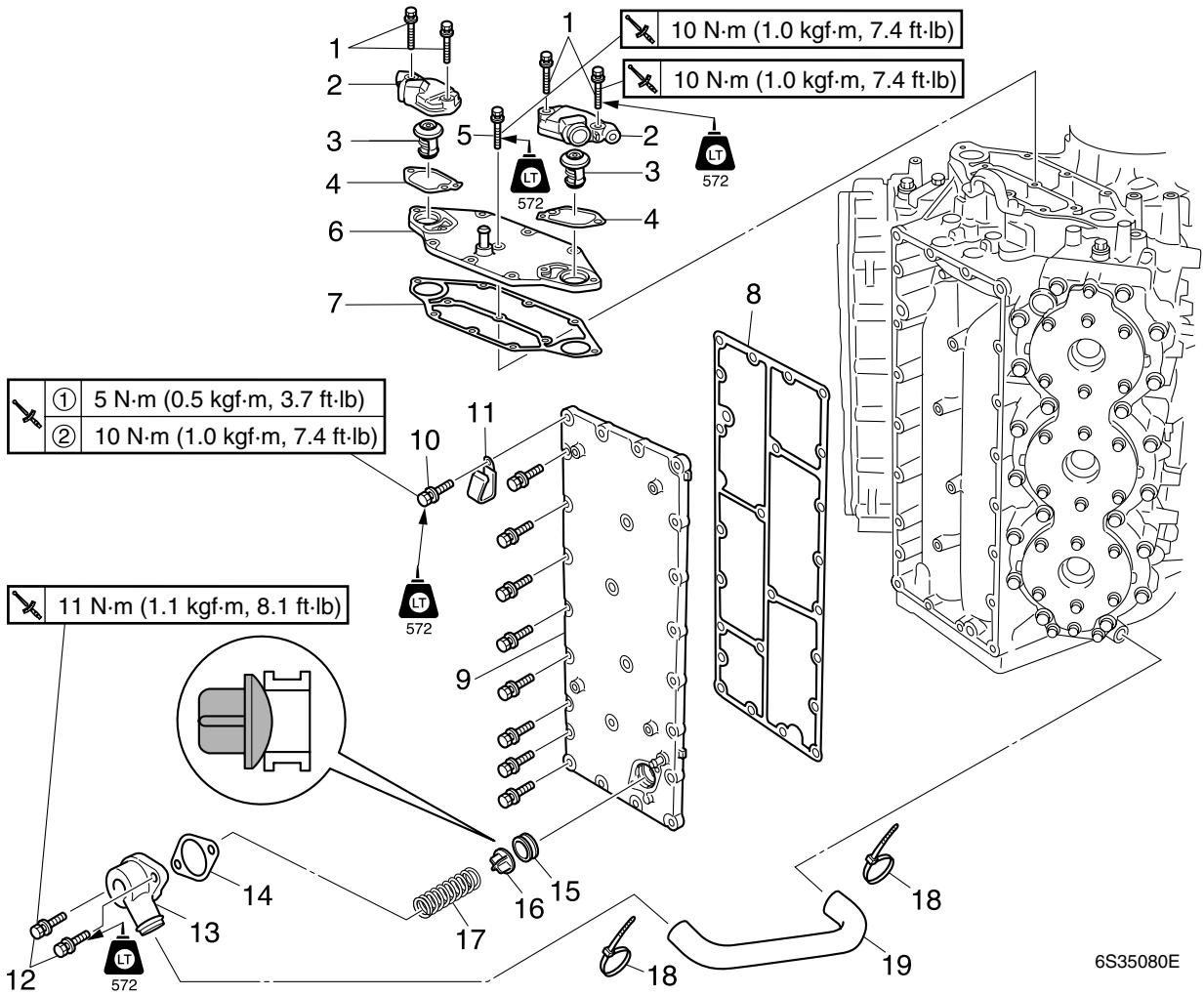


S60V5540



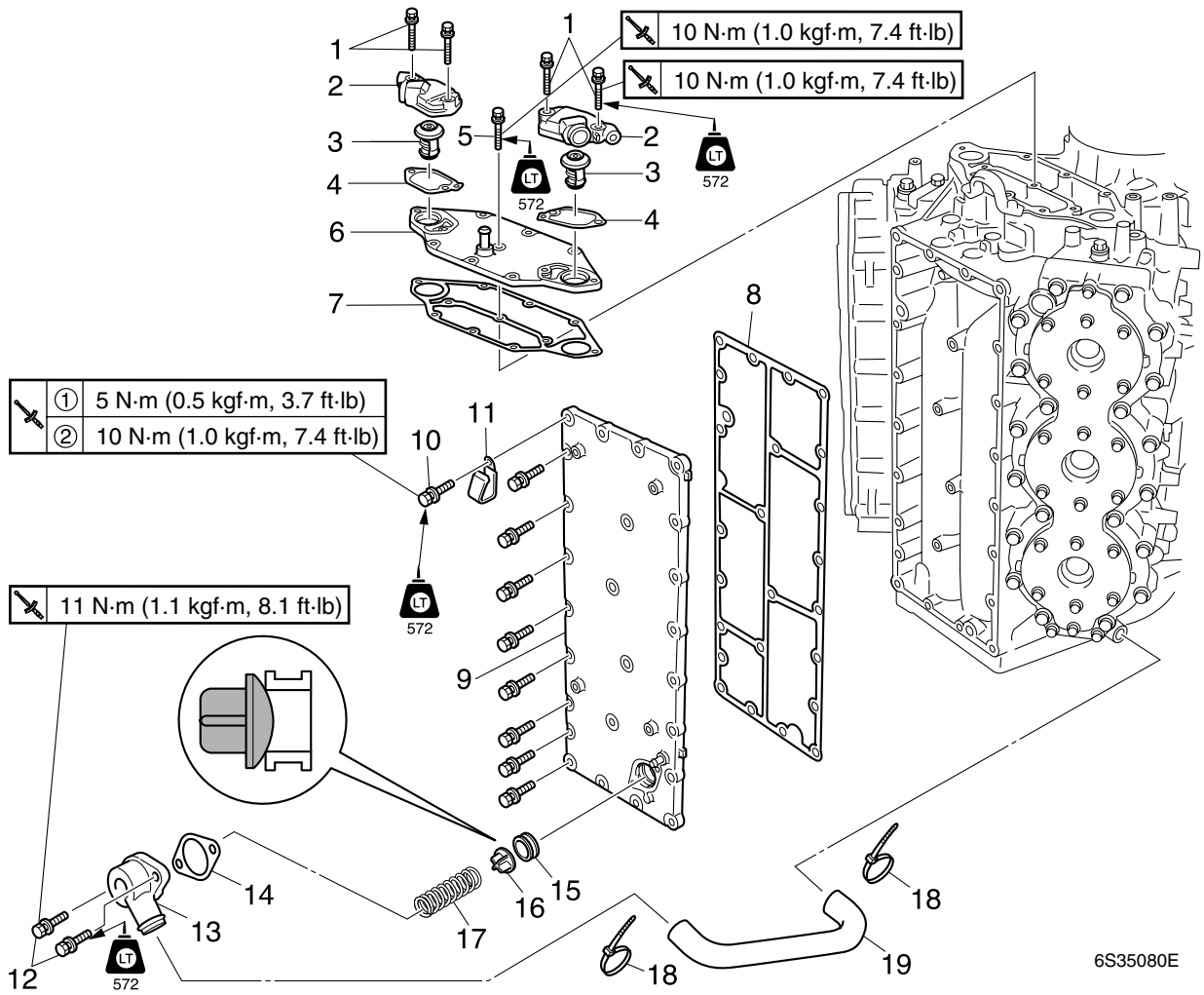
Valve stopper height ②:
 8.7–9.3 mm (0.34–0.36 in)

Exhaust cover



6S35080E

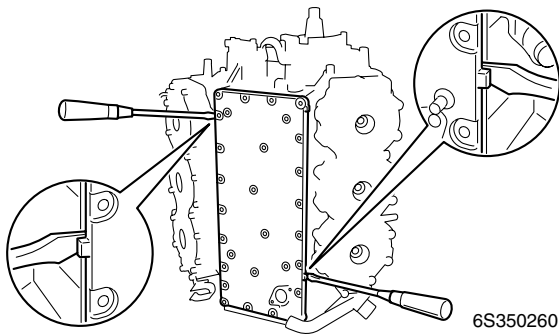
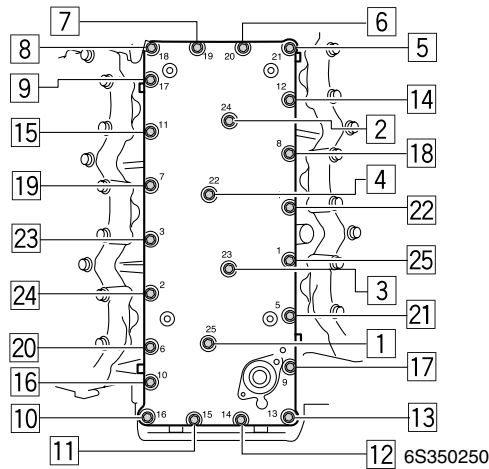
No.	Part name	Q'ty	Remarks
1	Bolt	4	M6 × 35 mm
2	Cover	2	
3	Thermostat	2	
4	Gasket	2	Not reusable
5	Bolt	7	M6 × 20 mm
6	Cover	1	
7	Gasket	1	Not reusable
8	Gasket	1	Not reusable
9	Exhaust cover	1	
10	Bolt	25	M6 × 30 mm
11	Clamp	1	
12	Bolt	2	M6 × 20 mm
13	Cover	1	
14	Gasket	1	Not reusable
15	Grommet	1	
16	PCV	1	
17	Spring	1	



No.	Part name	Q'ty	Remarks
18	Lock tie	2	Not reusable
19	Hose	1	

Removing the exhaust cover

1. Remove the exhaust cover bolts in the sequence shown.



Checking the exhaust cover

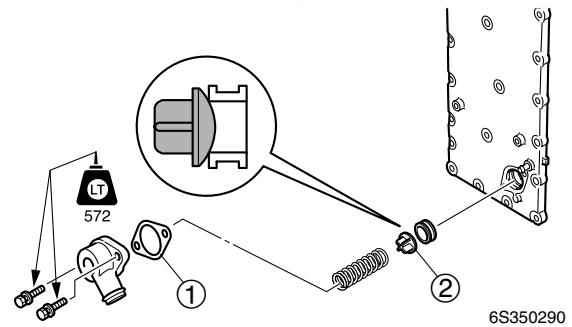
1. Check the exhaust cover for distortion or corrosion. Replace the exhaust cover if necessary.


Checking the PCV

1. Remove the pressure control valve.
2. Check the pressure control valve for wear or deformation. Replace the control valve if necessary.
3. Check the grommet for deformation. Replace the grommet if necessary.
4. Check the spring for fatigue or deformation. Replace the spring if necessary.

Installing the PCV

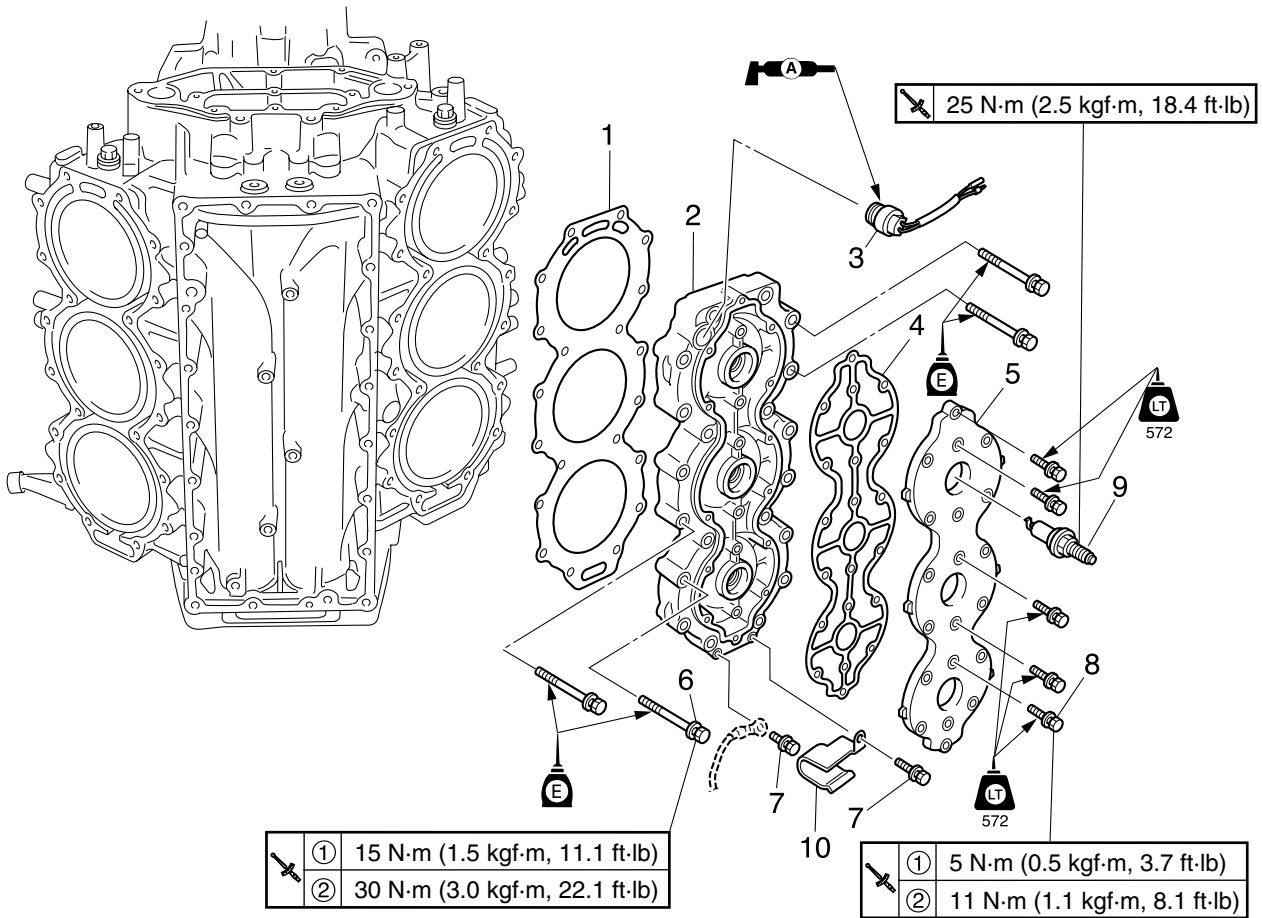
1. Install a new gasket ① and the pressure control valve ② with its rounded side facing towards the exhaust cover, and then tighten the bolts to the specified torque.



 PCV cover bolt:
11 N·m (1.1 kgf·m, 8.1 ft·lb)

5

Cylinder head

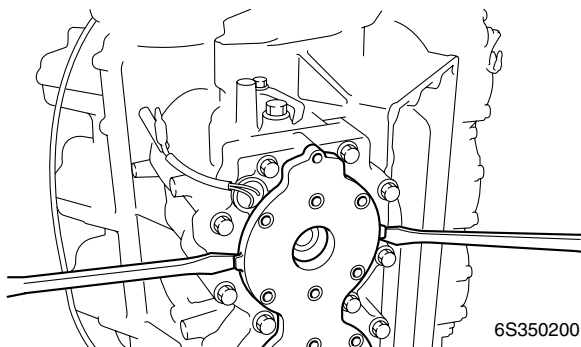
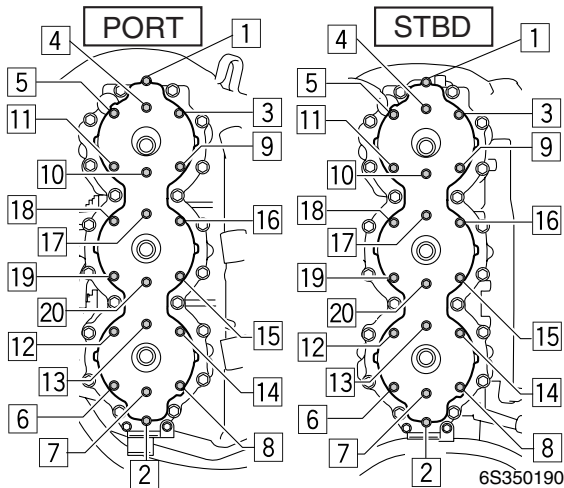


6S35090E

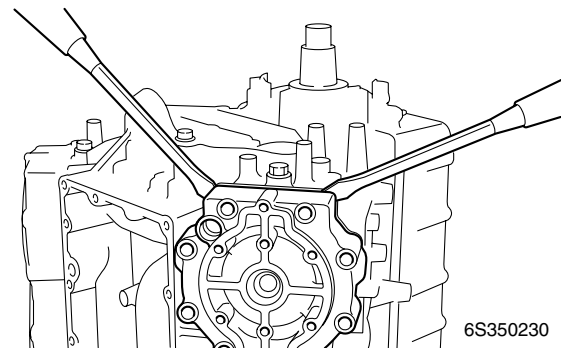
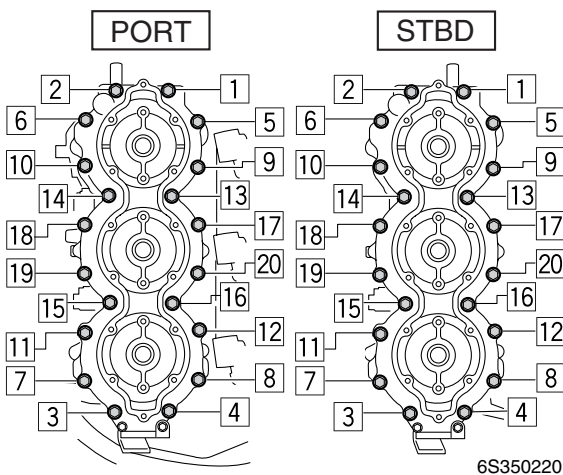
No.	Part name	Q'ty	Remarks
1	Gasket	2	Not reusable
2	Cylinder head	2	
3	Thermo switch	2	
4	Gasket	2	
5	Cylinder head cover	2	
6	Bolt	40	M8 × 60 mm
7	Bolt	4	M6 × 12 mm
8	Bolt	40	M6 × 25 mm
9	Spark plug	6	
10	Clamp	2	

Removing the cylinder head

1. Remove the spark plugs.
2. Remove the cylinder head cover bolts in the sequence shown.



3. Remove the thermoswitch.
4. Remove the cylinder head bolts in the sequence shown.



CAUTION:

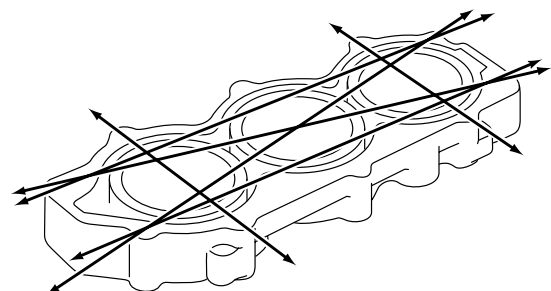
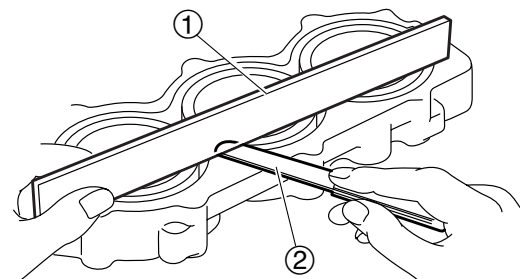
Do not scratch or damage the mating surfaces of the cylinder head and cylinder block.

NOTE:

Insert a flat-head screw driver between the pry tabs to pry off the cylinder heads.

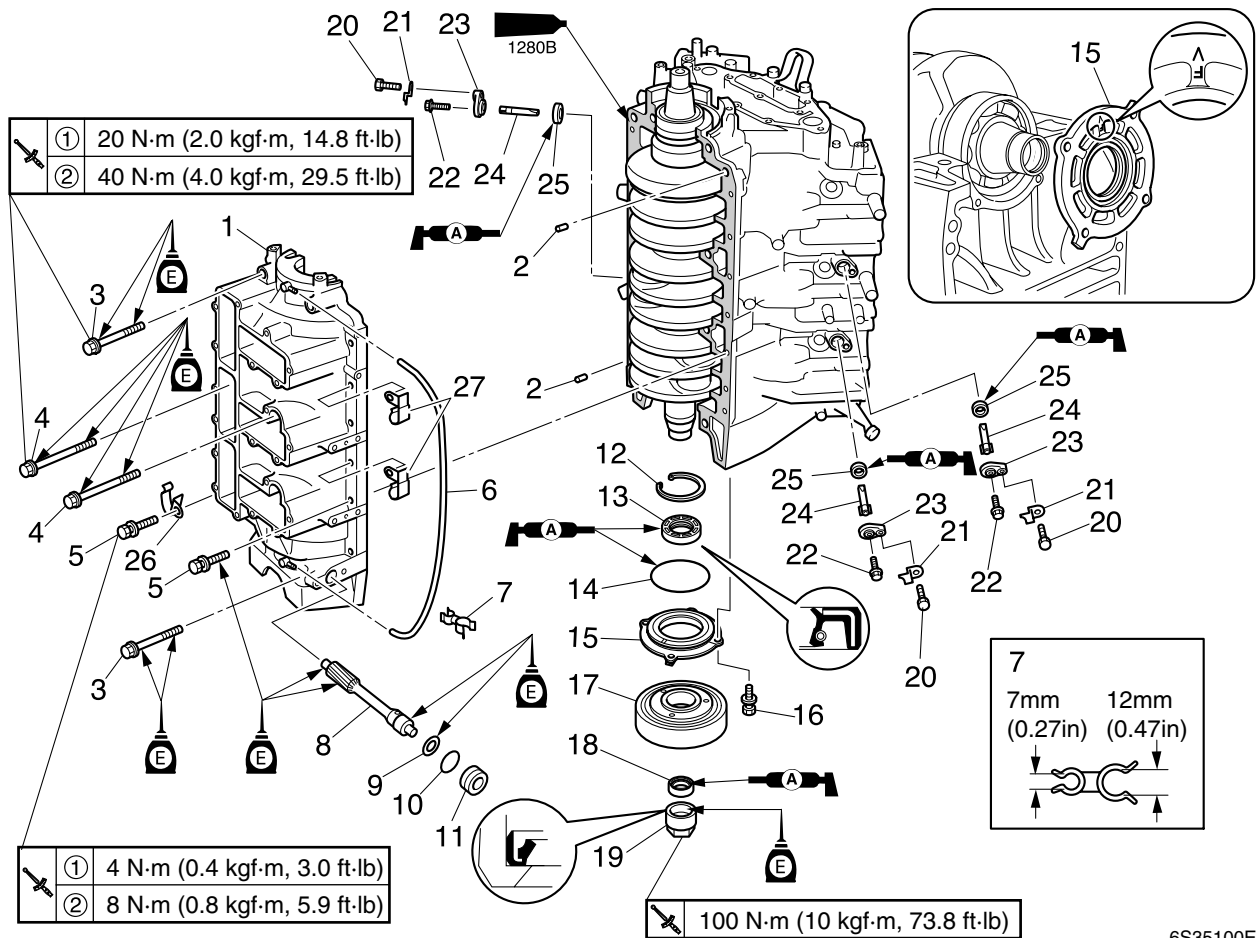
Checking the cylinder head

1. Eliminate carbon deposits from the combustion chambers and check for deterioration.
2. Check the cylinder head warpage using a straightedge ① and thickness gauge ② in 4 directions as shown. Replace the cylinder head if above specification.



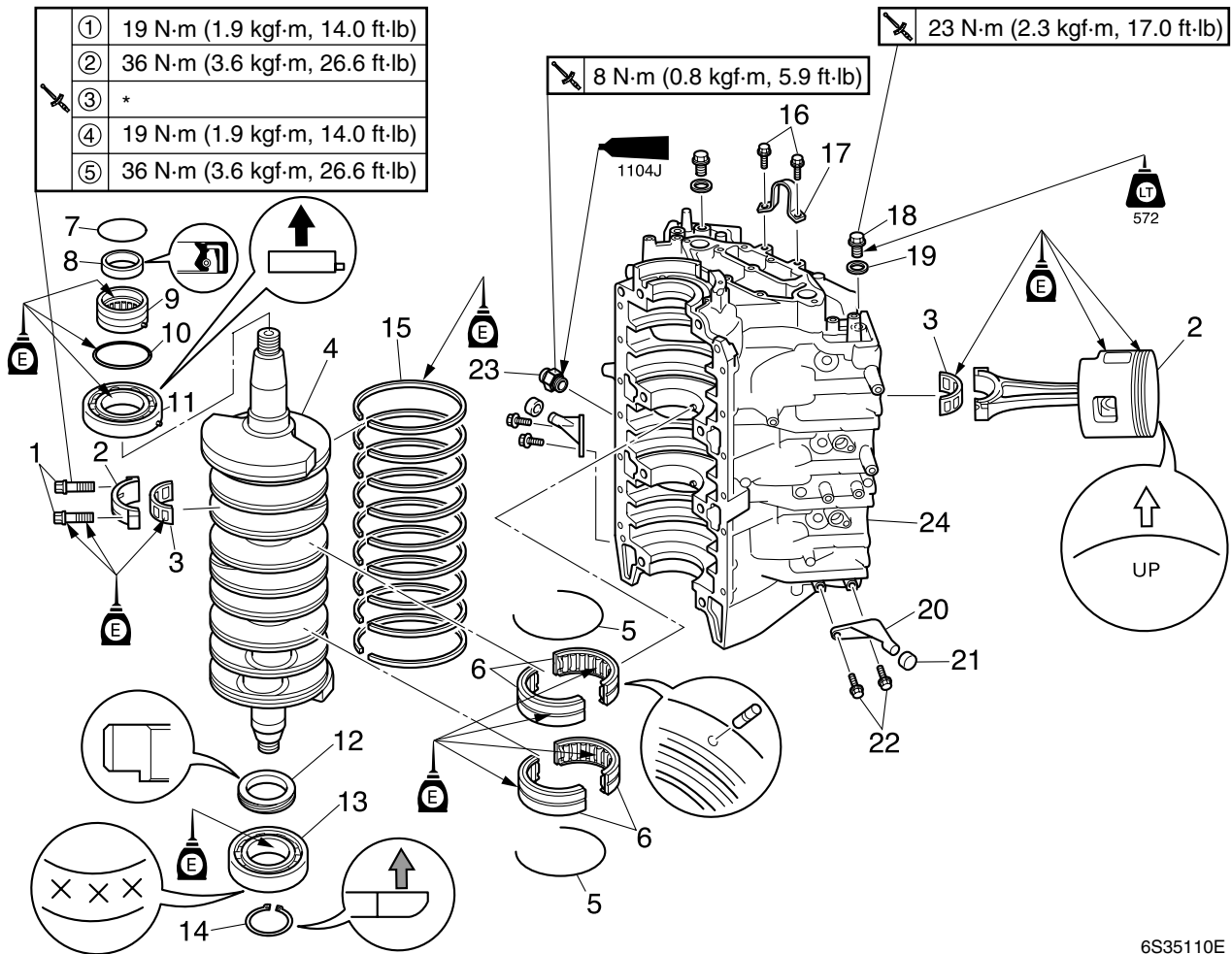
Cylinder head warpage limit:
0.10 mm (0.0039 in)

Crankcase



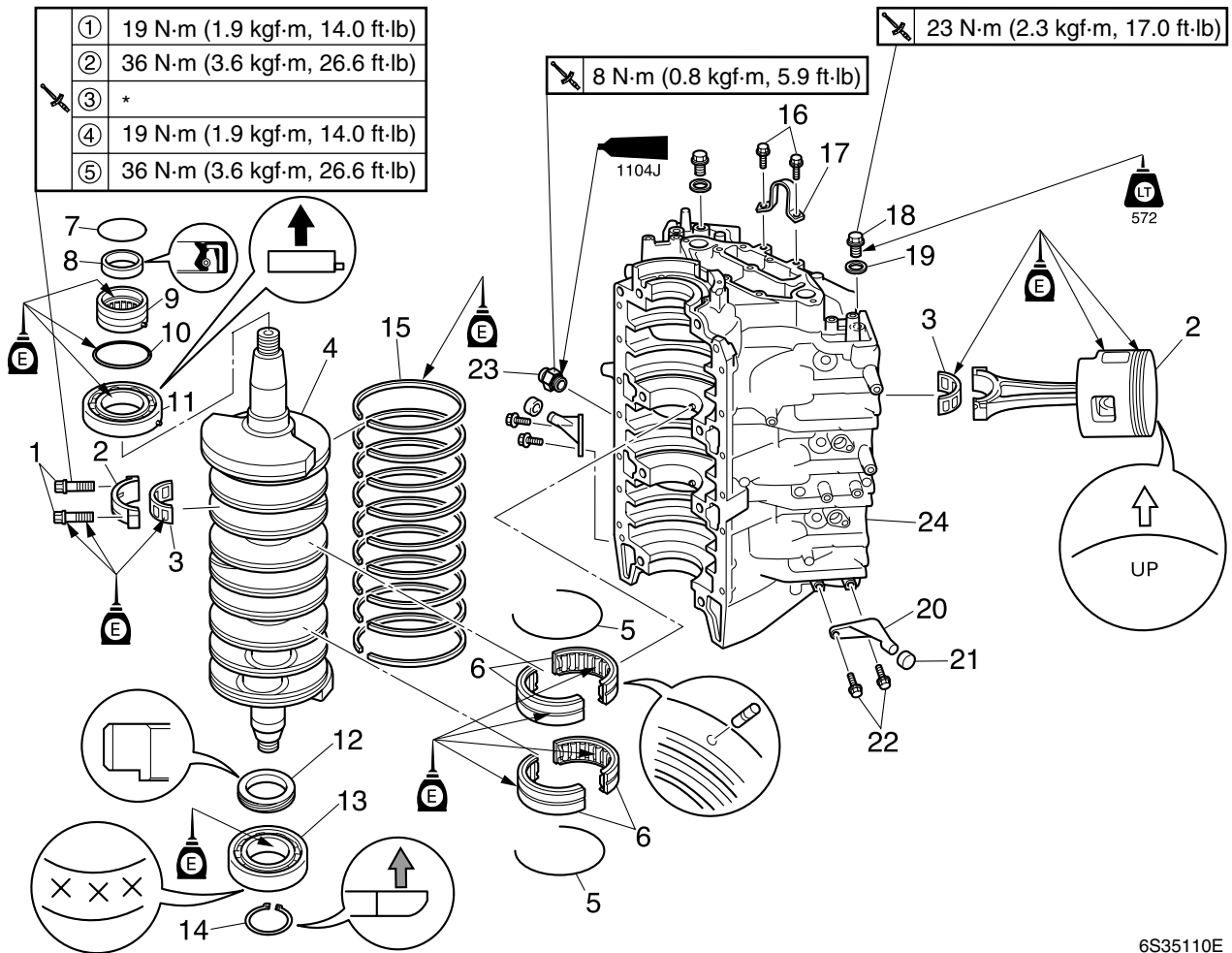
6S35100E

No.	Part name	Q'ty	Remarks
1	Crankcase	1	
2	Dowel	2	
3	Bolt	4	M10 × 70 mm
4	Bolt	4	M10 × 90 mm
5	Bolt	14	M6 × 30 mm
6	Hose	1	
7	Clamp	1	
8	Oil pump driven gear	1	
9	Washer	1	
10	O-ring	1	Not reusable
11	Grommet	1	
12	Circlip	1	
13	Oil seal	1	Not reusable
14	O-ring	1	Not reusable
15	Housing	1	
16	Bolt	4	M6 × 20 mm
17	Crankshaft balancer	1	



6S35110E

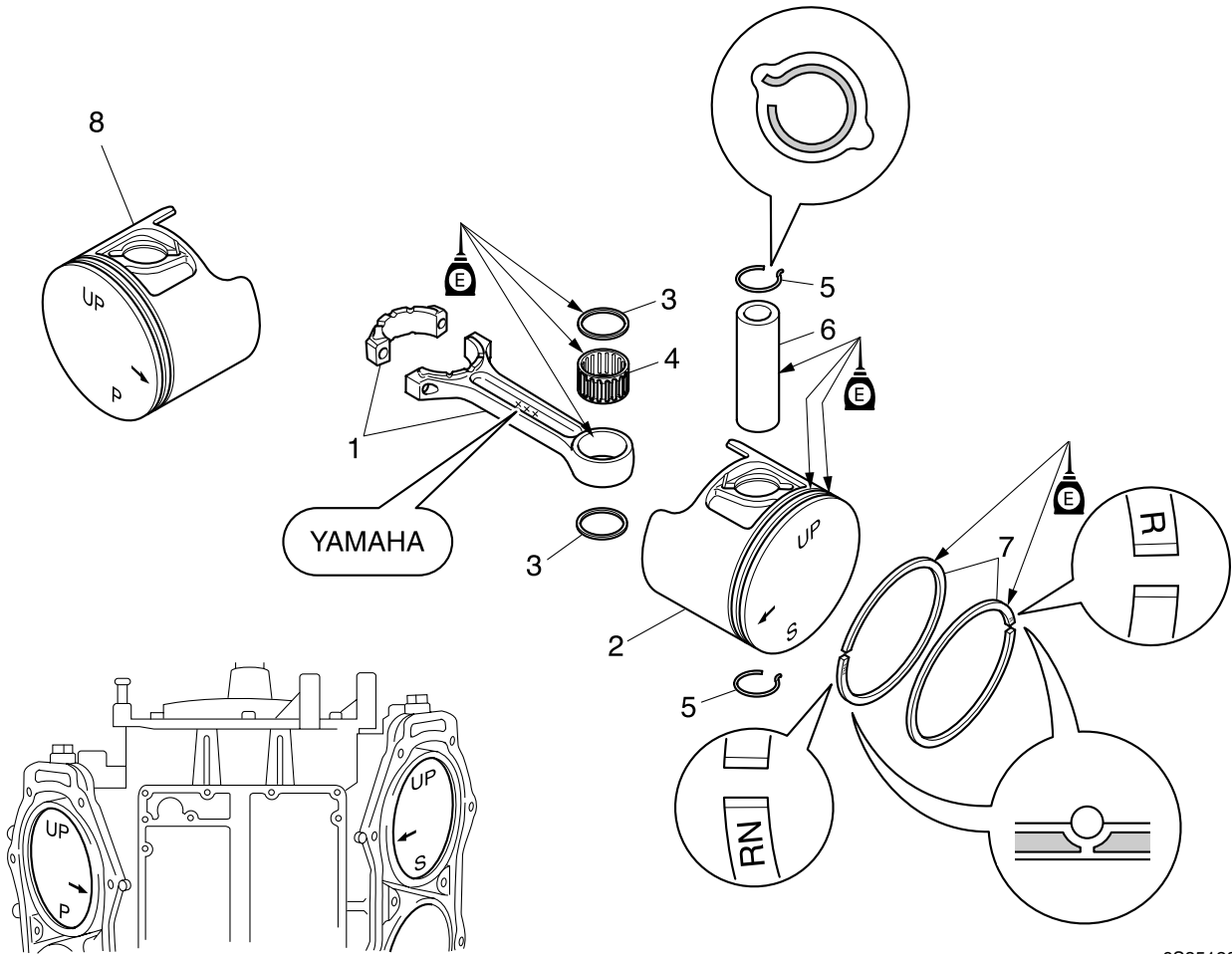
No.	Part name	Q'ty	Remarks
1	Bolt	12	
2	Piston and connecting rod assembly	6	
3	Roller bearing	6set	
4	Crankshaft	1	
5	Circlip	2	
6	Main bearing	2set	
7	O-ring	1	Not reusable
8	Oil seal	1	Not reusable
9	Roller bearing	1	
10	Stopper ring	1	Not reusable
11	Ball bearing	1	
12	Oil pump drive gear	1	Not reusable
13	Ball bearing	1	Not reusable
14	Circlip	1	
15	Seal ring	9	
16	Bolt	2	M8 × 20 mm
17	Engine hanger	1	



6S35110E

No.	Part name	Q'ty	Remarks
18	Plug	2	
19	Gasket	2	Not reusable
20	Stopper	2	
21	Cap	2	
22	Bolt	4	M6 × 20 mm
23	Joint	1	
24	Cylinder block	1	

*: Loosen completely

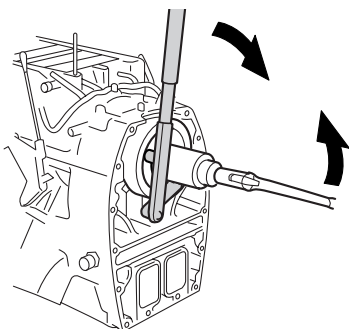


6S35120E

No.	Part name	Q'ty	Remarks
1	Connecting rod	6	
2	Piston (Starboard side)	3	
3	Washer	12	
4	Needle bearing	6	
5	Clip	12	Not reusable
6	Piston pin	6	
7	Piston ring set	6	
8	Piston (Port side)	3	

Removing the crankcase

1. Remove the crankshaft balancer nut.



S60V5640

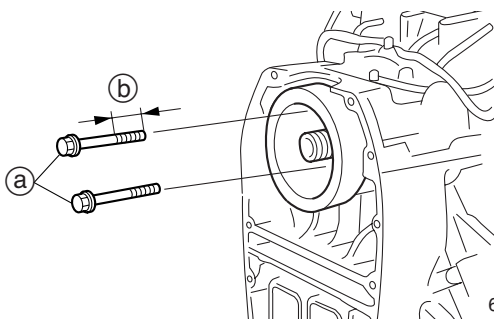
CAUTION:

Apply force in the direction arrows shown, to prevent the flywheel holder from slipping off easily.



Flywheel holder:
90890-06522

2. Remove the crankshaft balancer



6S350460

CAUTION:

To prevent damage to the engine or tools, screw in the specified bolts evenly to the crankshaft balancer.

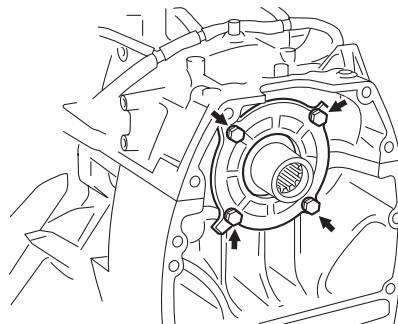
NOTE:

- Apply force to the bolts (a) until the crankshaft balancer comes off the tapered portion of the crankshaft.
- Use bolts (a) with the specified measurements.



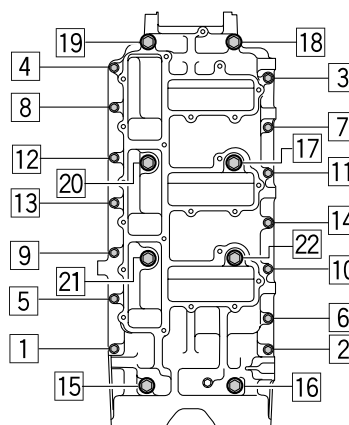
Specified bolts (a) : M8 × 60 mm
Thread size (b) : 25 mm or more

3. Remove the oil seal housing bolts.

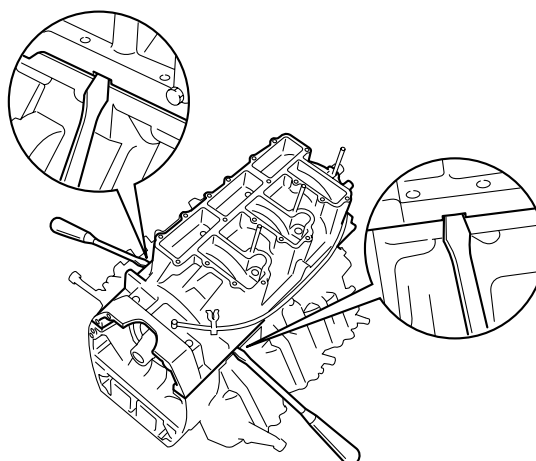


S60V5690

4. Remove the crankcase bolts in the sequence shown.



6S350090



6S350070

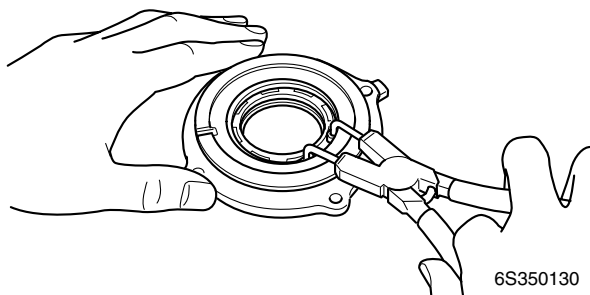
NOTE:

Insert a flat-head screw driver between the pry tabs to pry off the crankcase.

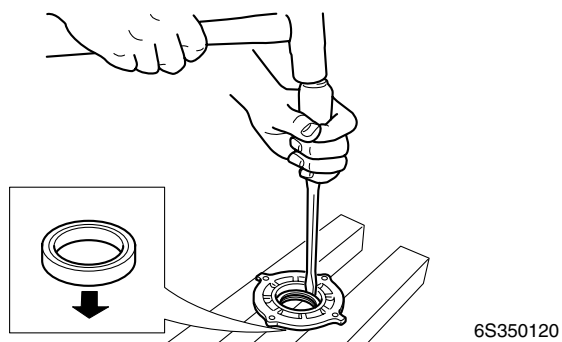


Disassembling the oil seal housing

1. Remove the circlip from oil seal housing.

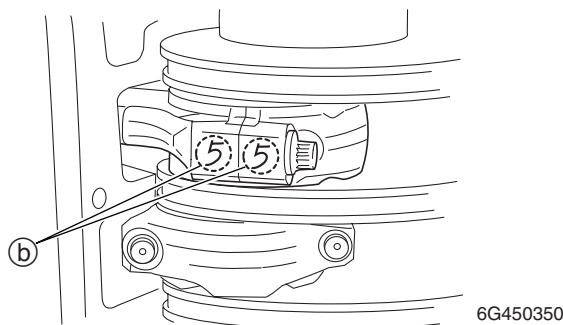
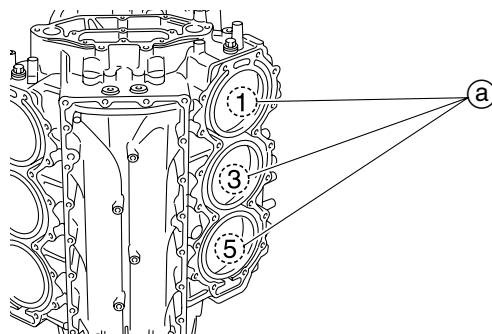


2. Remove the oil seals from oil seal housing.



Removing the piston, connecting rod assembly and crankshaft assembly

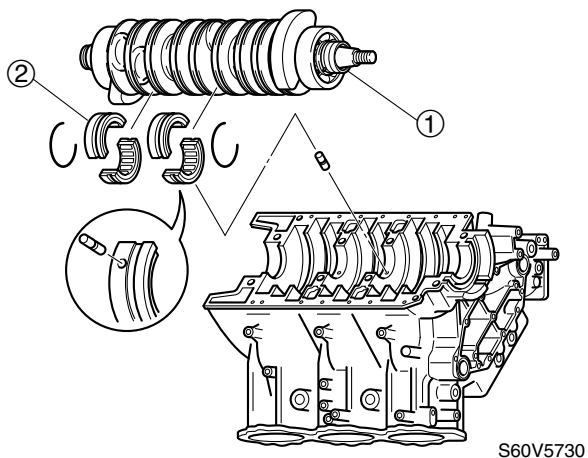
1. Remove the connecting rod bolts and the connecting rod caps, and then remove the piston with connecting rod.



NOTE:

- Be sure to keep the bearings in the order as they were removed.
- Mark each piston with the identification number (a) of the corresponding cylinder. Also, mark each connecting rod and connecting rod cap with an identification number (b) as shown.
- Do not mix the connecting rods and caps. Keep them organized in their each groups.

- Remove the crankshaft assembly.

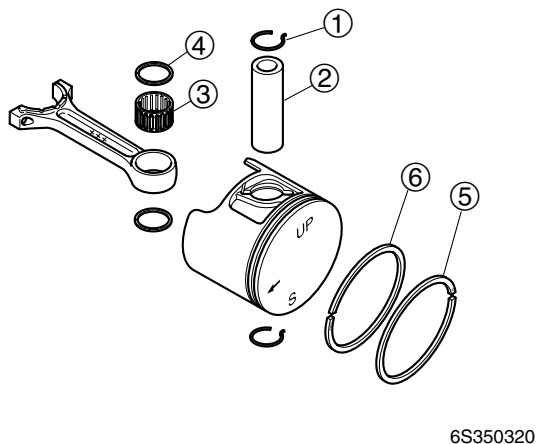


- Remove the roller bearing ① and main bearing ②.

NOTE: _____
Be sure to keep the main bearings ② in the order as they were removed.

Disassembling the piston and connecting rod assembly

- Remove the clips ① with pliers, and then remove the piston pin ②, needle bearing ③ and washers ④.
- Remove the top ring ⑤ and 2nd piston ring ⑥.

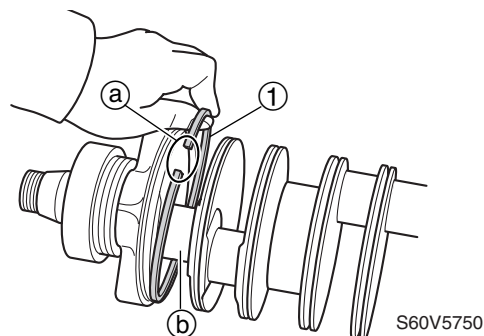


Checking the bearing

- Check the bearings for pitting or rumbling.

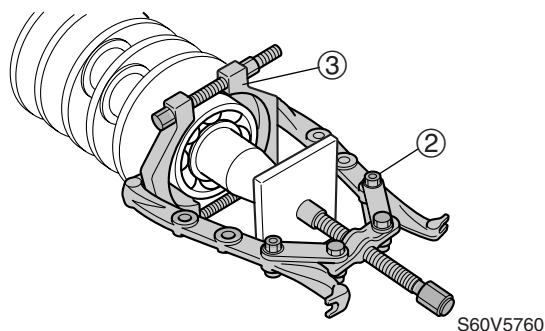
Disassembling the crankshaft

- Remove the seal rings ①.



NOTE: _____
To remove the seal rings ①, widen the seal ring end gap ①a, and then remove the ring from the groove and remove the crankpin ①b.

- Remove the upper ball bearing.

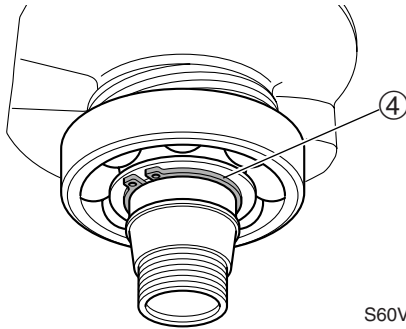


CAUTION: _____
Do not reuse the ball bearing, always replace it with a new one.

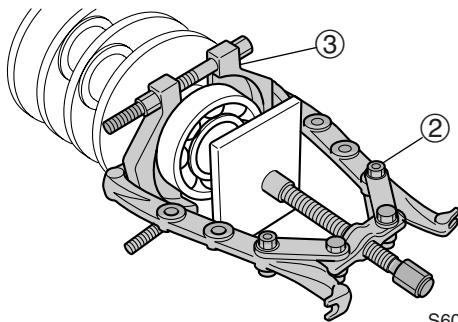
	Gear puller ②: 90890-06540
	Bearing separator ③: 90890-06534



- Remove the circlip ④, and then remove the lower ball bearing.



S60V5770



S60V5780

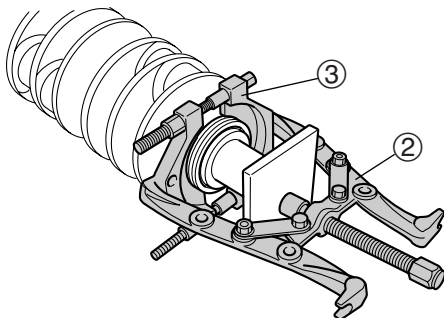
CAUTION:

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



Gear puller ②: 90890-06540
Bearing separator ③:
90890-06534

- Remove the oil pump drive gear.



S60V5790

CAUTION:

Do not reuse the oil pump drive gear, always replace it with a new one.



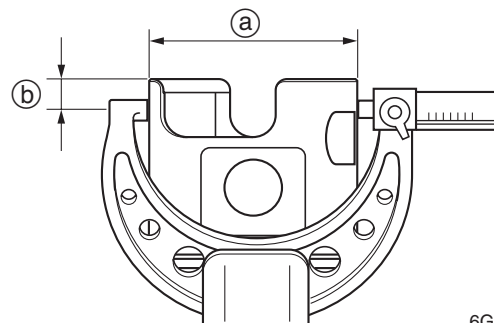
Gear puller ②: 90890-06540
Bearing separator ③:
90890-06534

Checking the oil pump driven gear and the oil pump drive gear

- Check the oil pump driven gear and the oil pump drive gear for cracks, damage, or wear. Replace if necessary.

Checking the piston diameter

- Measure the piston outside diameter at the specified measuring point. Replace the piston and piston rings as a set if out of specification.



6G450410



Piston diameter ①:

89.840–89.860 mm
(3.5370–3.5378 in)

Measuring point ②:

10.0 mm (0.39 in) up from the
bottom of the piston skirt.

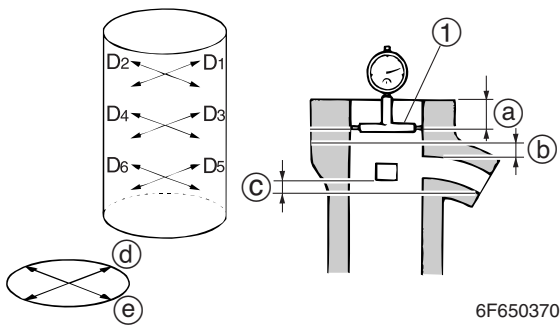
Oversize piston diameter ①:

1st
90.090–90.110 mm
(3.5468–3.5476 in)

2nd
90.340–90.360 mm
(3.5576–3.5575 in)


Checking the cylinder bore


1. Measure the cylinder bore (D_1 — D_6) at measuring points (a), (b), and (c), and in direction (d) (D_1 , D_3 , D_5), which is parallel to the crankshaft, and direction (e) (D_2 , D_4 , D_6), which is at a right angle to the crankshaft.



6F650370

- (a): 10.0 mm (0.39 in) from the cylinder head top surface
- (b): 5.0 mm (0.20 in) above the exhaust port upper edge
- (c): 5.0 mm (0.20 in) below the scavenging port lower edge

	Cylinder bore (D_1 — D_6): 90.000–90.020 mm (3.5433–3.5441 in)
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	Cylinder gauge ①: 90890-06759
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Checking the piston clearance

1. Calculate the piston clearance using the piston outside diameter and the cylinder bore specifications. Replace the piston and piston rings as a set or the cylinder block or all parts, or rebore the cylinder if out of specification.

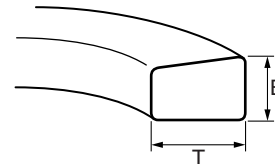
NOTE: _____

Be sure to rebore the cylinder for matching the replacement oversize pistons, when using the specified oversize pistons.


	Piston clearance: 0.155–0.161 mm (0.0061–0.0063 in)
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Checking the piston ring

1. Check the piston ring dimensions of B and T. Replace the piston and piston rings as a set if out of specification.

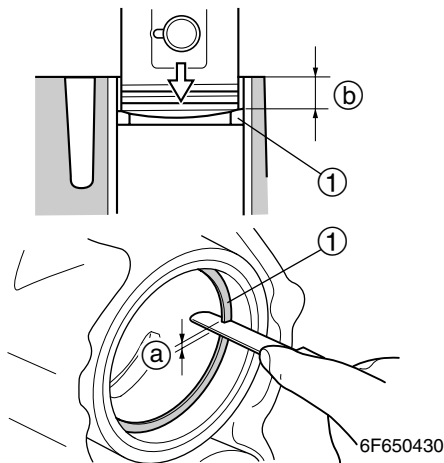



69D50410

	Piston ring dimension Top ring and 2nd piston ring: B: 1.970–1.990 mm (0.0776–0.0783 in) T: 2.700–2.900 mm (0.1063–0.1142 in)
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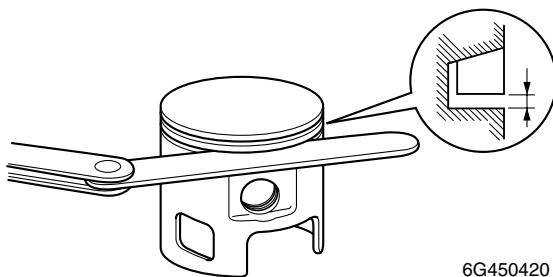
- Level the piston rings ① in a cylinder with a piston crown.
- Check the piston ring end gap ② at the specified measuring point ③. Replace the piston ring set if out of specification.




 **Piston ring end gap ②:**
 1st :
 0.30–0.50 mm
 (0.0118–0.0197 in)
 2nd :
 0.30–0.40 mm
 (0.0118–0.0157 in)
 Measuring point ③: 20 mm (0.79 in)

Checking the piston ring side clearance

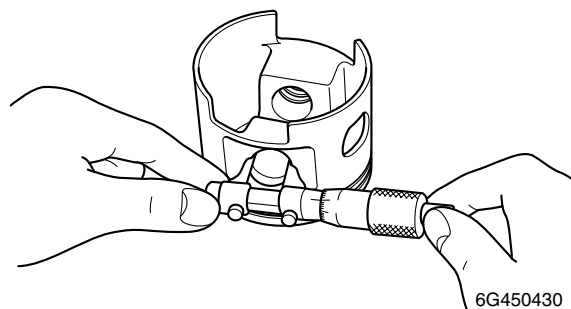
- Measure the piston ring side clearance. Replace the piston and piston rings as a set if out of specification.




 **Piston ring side clearance:**
 Top ring and 2nd piston ring:
 0.02–0.06 mm
 (0.0008–0.0024 in)

Checking the piston pin boss bore

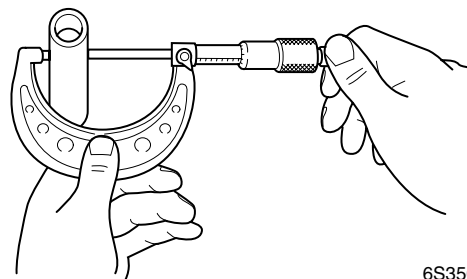
- Measure the piston pin boss bore. Replace the piston if out of specification.




 **Piston pin boss bore:**
 26.004–26.015 mm
 (1.0238–1.0242 in)

Checking the piston pin

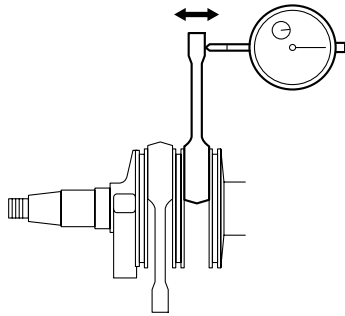
- Measure the piston pin outside diameter. Replace the piston pin if out of specification.



 **Piston pin diameter:**
 25.995–26.000 mm
 (1.0234–1.0236 in)

Checking the connecting rod small end axial play

1. Measure the connecting rod small end axial play. Replace the bearing and connecting rod if above specification.



NOTE:

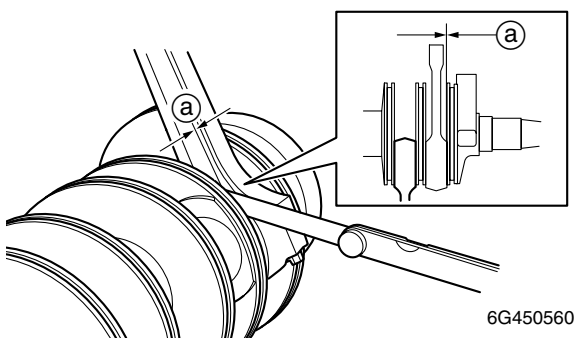
To measure the axial play, set the dial gauge at the connecting rod small end and parallel to the crankshaft.



Connecting rod small end axial play limit:
2.0 mm (0.08 in)

Checking the connecting rod big end side clearance

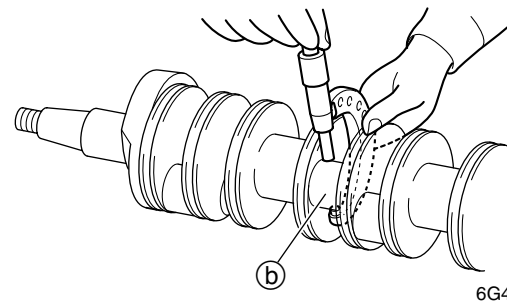
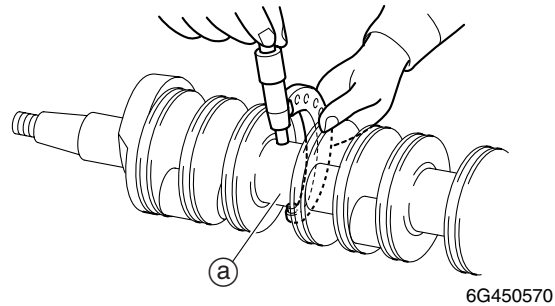
1. Measure the connecting rod big end side clearance (a). Replace the connecting rod or crankshaft or both if out of specification.



Connecting rod big end side clearance (a):
0.080–0.400 mm (0.0032–0.0157 in)

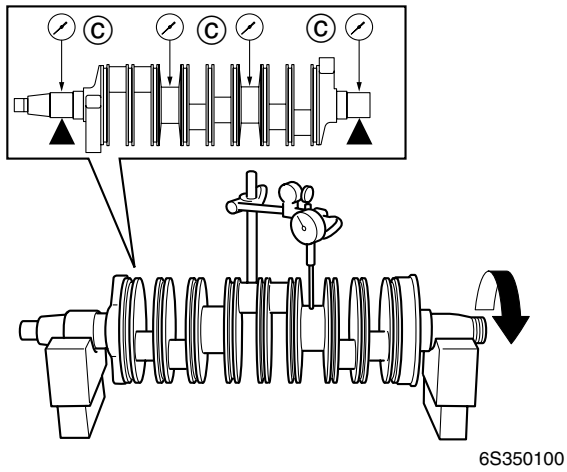
Checking the crankshaft


1. Measure the crankshaft journal diameter (a) and crankpin diameter (b). Replace the crankshaft if out of specification.



Crankshaft journal diameter (a):
58.975–58.991 mm
(2.3219–2.3225 in)
Crankpin diameter (b):
40.485–40.500 mm
(1.5939–1.5945 in)

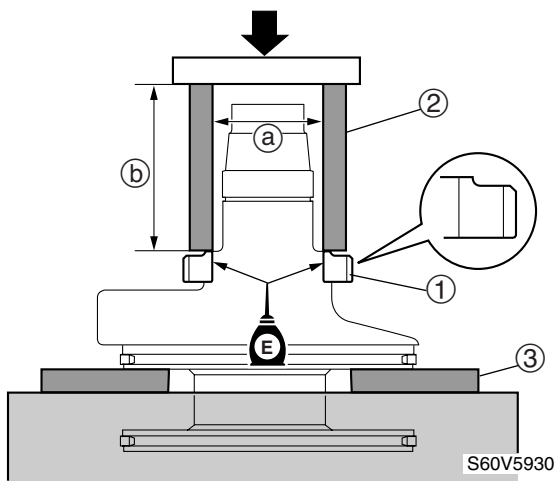
2. Measure the crankshaft runout. Replace the crankshaft if above specification.




 Crankshaft runout limit (C):
0.02 mm (0.0008 in)

Assembling the crankshaft

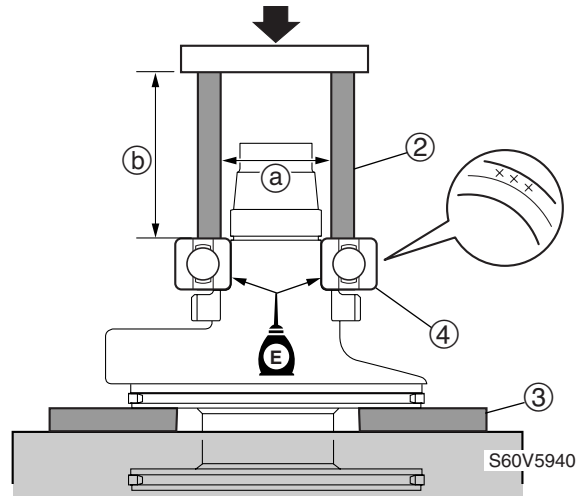
1. Install the oil pump drive gear (1).




CAUTION: _____
Do not reuse the oil pump drive gear, always replace it with a new one.

 General pipe (2):
a = 50 mm (1.97 in)
b = 80 mm (3.14 in) or more
Support (3):
90890-02394

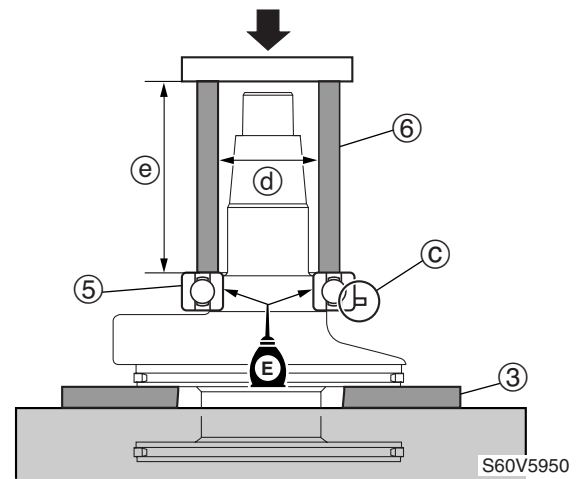
2. Install the lower ball bearing (4), then the circlip.



CAUTION: _____
Do not reuse the ball bearing, always replace it with a new one.

 General pipe (2):
a = 50 mm (1.97 in)
b = 80 mm (3.14 in) or more
Support (3):
90890-02394

3. Install the upper ball bearing (5).



CAUTION: _____
Do not reuse the ball bearing, always replace it with a new one.

NOTE:

Install the upper ball bearing with the projection © facing toward the wave side of crankshaft.



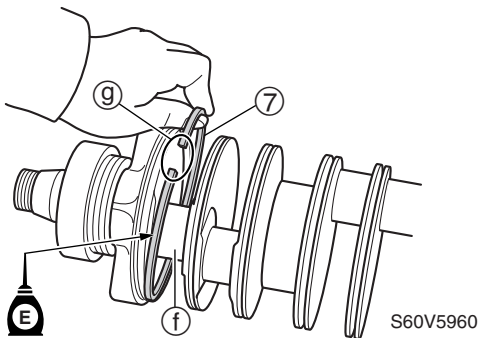
General pipe ⑥:

- ⓓ = 45 mm (1.77 in)
- ⓔ = 100 mm (3.93 in)

Support ③:

90890-02394

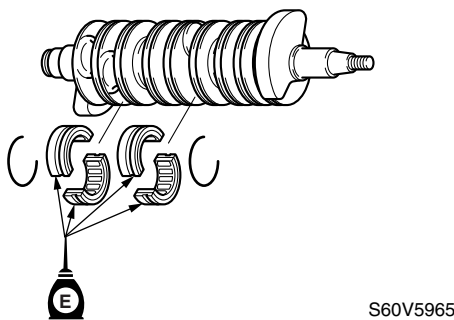
4. Install the seal rings ⑦



NOTE:

First pass the seal ring ⑦ over the crankpin ⑥, and then widen the seal ring end gap ⑨ to install the ring into the crankshaft groove.

5. Install the main bearings onto the crankshaft.

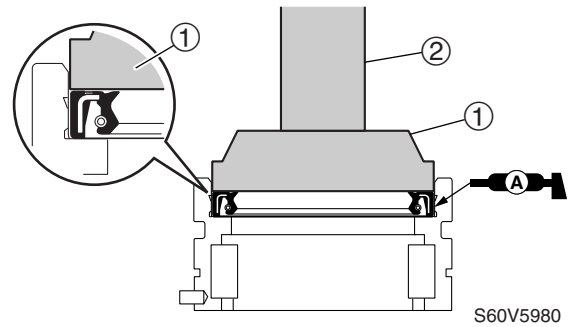


NOTE:

Face the dowel hole on the main bearings toward the bottom of the power unit.

Assembling the crankshaft roller bearing

1. Apply grease to the new oil seal, and then install it into the roller bearing.

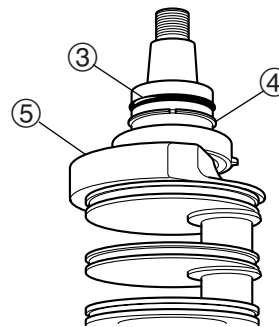


Bearing outer race attachment ①:

90890-06624

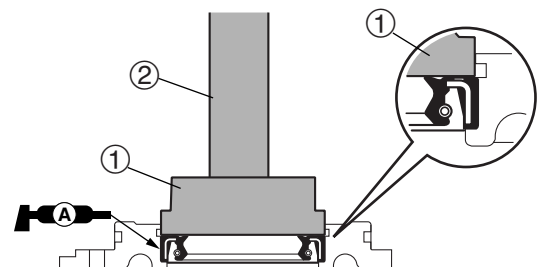
Driver rod LS ②: 90890-06606

2. Install a new O-ring ③ and the stopper ring ④ onto the roller bearing, and then install the roller bearing assembly onto the crankshaft ⑤.



Assembling the oil seal housing

1. Apply grease to the new oil seals and then install them into the oil seal housing.



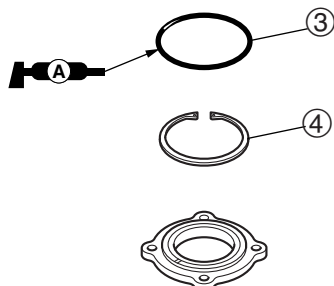
Needle bearing attachment ①:

90890-06654

Driver rod L3 ②: 90890-06652

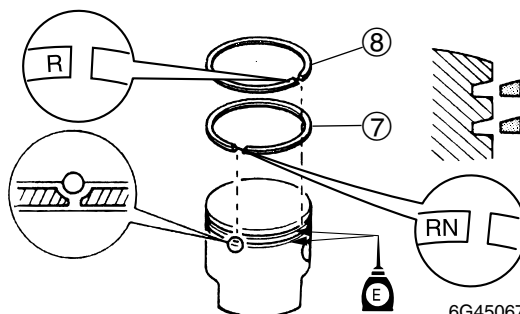


2. Install a new O-ring (3) and the circlip (4) into the oil seal housing.



S60V5A20

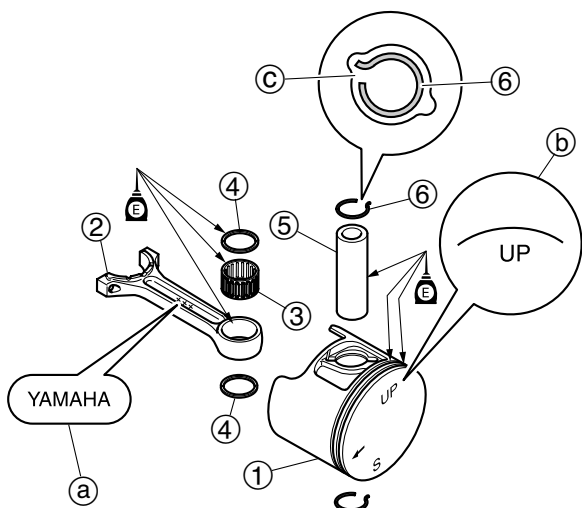
2. Install the 2nd piston ring (7) and top ring (8) onto the piston.



6G450670

Assembling the piston and connecting rod assembly

1. Assemble the piston (1), connecting rod (2), needle bearing (3), washer (4), piston pin (5), and new piston pin clips (6).



6S350330

NOTE:

- Face the embossed "YAMAHA" mark (a) on the connecting rod in the same direction as the "UP" mark (b) on the piston.
- Always use new piston pin clips.
- Be sure to align the piston pin clip end with the piston pin slot (c).

CAUTION:

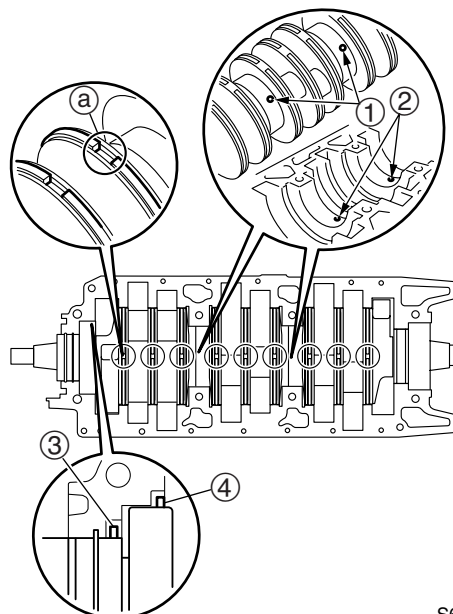
Do not scratch the pistons or break the piston rings.

NOTE:

Install the piston rings with the recess for the locating pin facing up toward the piston crown.

Assembling the power unit

1. Set the crankshaft in the cylinder block.

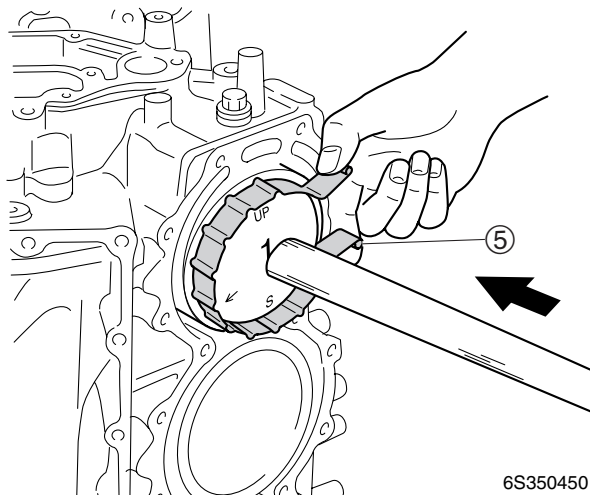
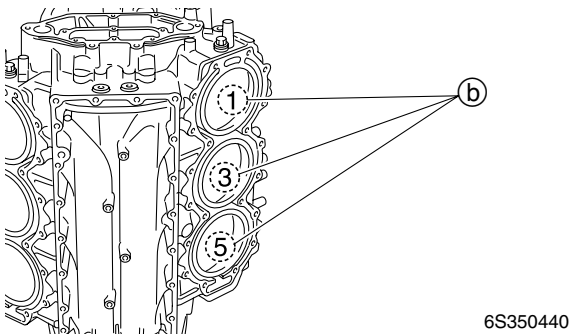
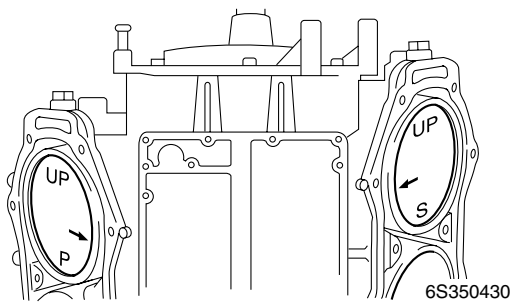


S60V5A50

NOTE:

- Fit dowels ① on the cylinder block into the dowel holes ② in the main bearings.
- Align the projection ③ and the projection ④ of the roller bearing with the groove in the cylinder block.
- Align the seal ring end gaps ⑤ with the cylinder center line.

2. Install the pistons into the cylinders with the "UP" mark on the piston crown facing towards the flywheel magnet.



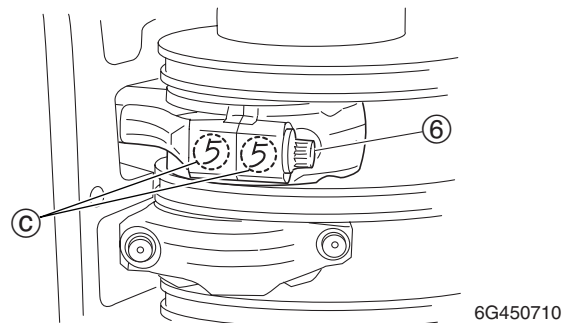
NOTE:

- Apply engine oil to the pistons and piston rings before installation.
- Be sure to install the piston and connecting rod assemblies into the corresponding cylinders according to the marks ⑤ made during disassembly. Also, be sure to install the assemblies with an "S" mark on the star-board side, and the assemblies with a "P" mark on the port side.



Piston slider ⑤:
90890-06530

3. Install the connecting rod bearings and connecting rod caps onto the connecting rods, and then tighten the connecting rod bolts ⑥ to the specified torques in five stages.



NOTE:

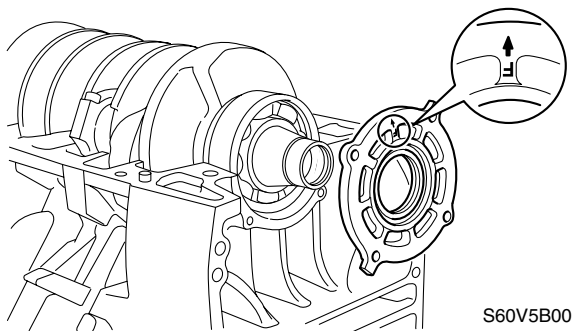
- Align the identification numbers ③ on the connecting rod caps and connecting rods, which you made during disassembly.
- Apply engine oil to the connecting rod bearings, connecting rod caps, and connecting rod bolts before installation.



Connecting rod bolt ⑥:
1st: 19 N·m (1.9 kgf·m, 14.0 ft·lb)
2nd: 36 N·m (3.6 kgf·m, 26.6 ft·lb)
3rd: Loosen completely
4th: 19 N·m (1.9 kgf·m, 14.0 ft·lb)
5th: 36 N·m (3.6 kgf·m, 26.6 ft·lb)



4. Install the oil seal housing onto the cylinder block.

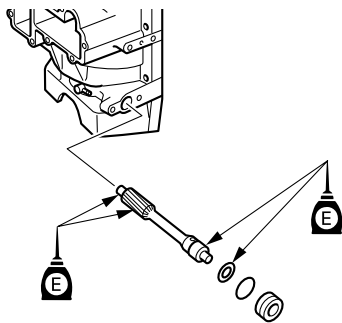


S60V5B00

NOTE:

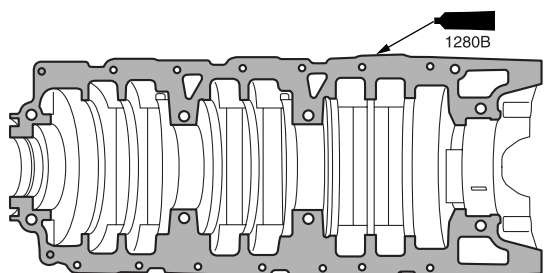
Install the oil seal housing with the arrow mark facing toward the crankcase.

5. Install the oil pump driven gear onto the crankcase.



6S350720

6. Apply sealant to the mating surface of the crankcase.

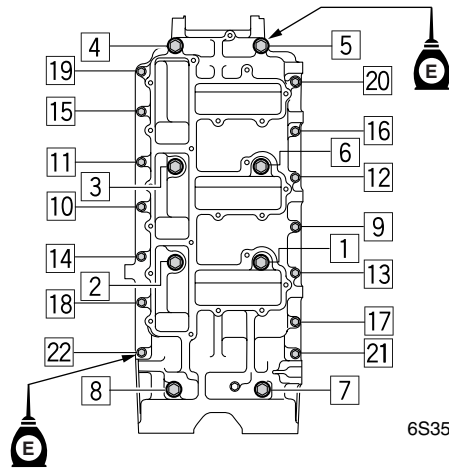


S60V5B20

NOTE:

Do not get any sealant on the journals.

7. Install the crankcase onto the cylinder block, and then tighten the crankcase bolts to the specified torques in two stages and in the sequence shown.



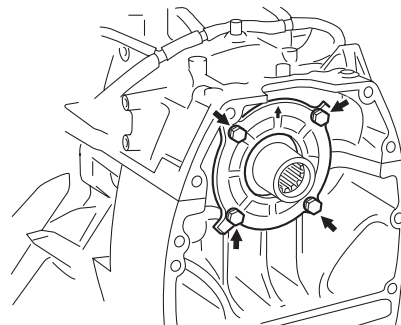
6S350080

NOTE:

- Apply engine oil to the crankcase bolts before installation.
- Tighten crankcase bolts 1—8 to the specified torques in two stages first, and then tighten crankcase bolts 9—22 to the specified torques in two stages.

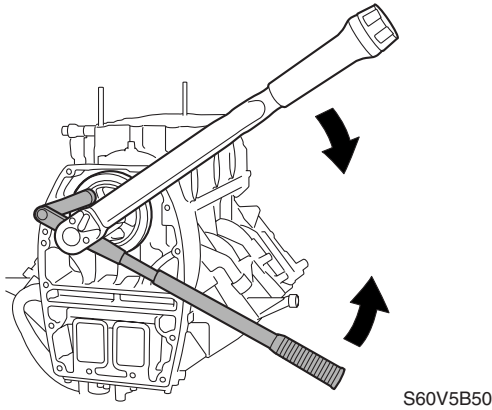
	1—8: Crankcase bolt (M10):
	1st: 20 N·m (2.0 kgf·m, 14.8 ft·lb) 2nd: 40 N·m (4.0 kgf·m, 29.5 ft·lb)
	9—22: Crankcase bolt (M6):
	1st: 4 N·m (4.0 kgf·m, 3.0 ft·lb) 2nd: 8 N·m (8.0 kgf·m, 5.9 ft·lb)

8. Tighten the oil seal housing bolts.




S60V5690


- Install the crankshaft balancer, and then tighten the crankshaft balancer nut to the specified torque.



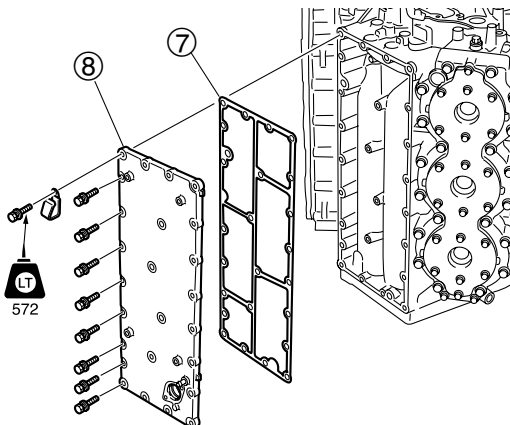
CAUTION: Apply force to the direction of the arrows shown, to prevent the flywheel holder from slipping off easily

NOTE: Apply engine oil to the crankshaft balancer nut thread before installation.

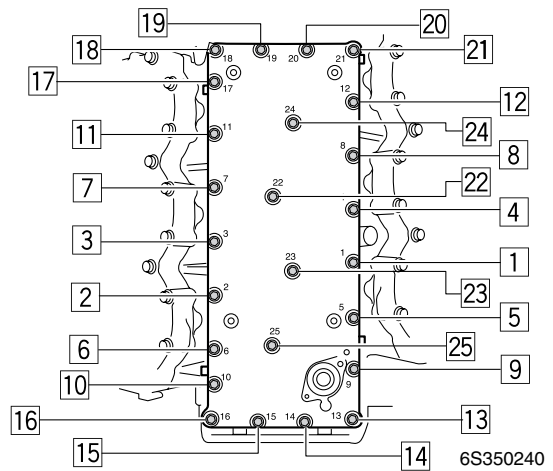
 Flywheel holder: 90890-06522

 Crankshaft balancer nut: 100 N·m (10 kgf·m, 73.8 ft·lb)


- Install the new gasket (7) and exhaust cover (8), and then tighten the exhaust cover bolts to the specified torques in two stages and in the sequence shown.



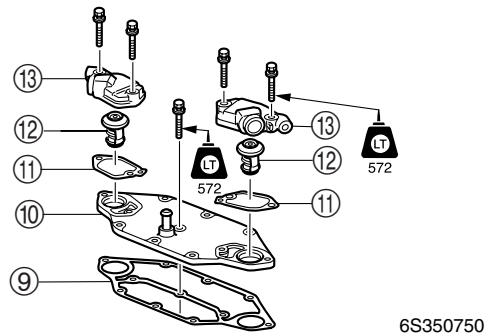
6S350340




NOTE: Apply LOCTITE 572 to the exhaust cover bolts before installation.

 Exhaust cover bolt:
1st: 5 N·m (0.5 kgf·m, 3.7 ft·lb)
2nd: 10 N·m (1.0 kgf·m, 7.4 ft·lb)

- Install the new gasket (9) thermostat base (10), new gaskets (11), thermostats (12), and thermostat cover (13).

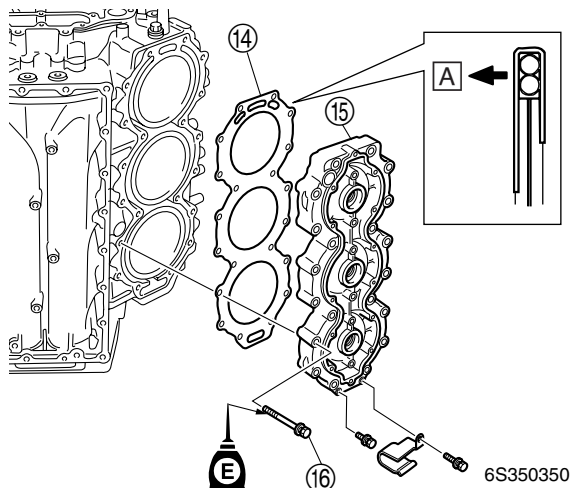


NOTE: Apply LOCTITE 572 to the exhaust cover bolts before installation.

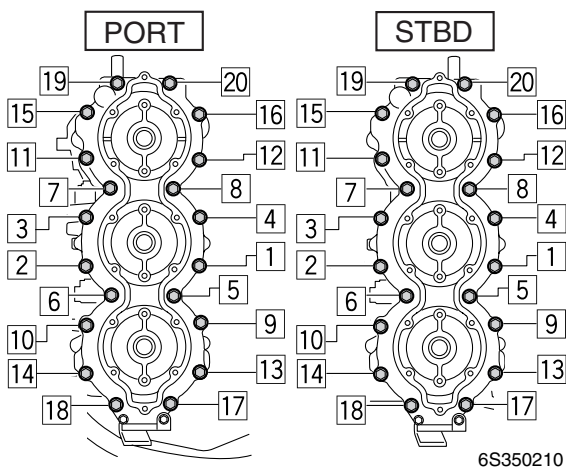
 Thermostat cover bolt:
10 N·m (1.0 kgf·m, 7.4 ft·lb)



12. Install the new gaskets (14) and the cylinder heads (15), and then tighten the cylinder head bolts (16) to the specified torques in two stages and in the sequence shown.



A Block side

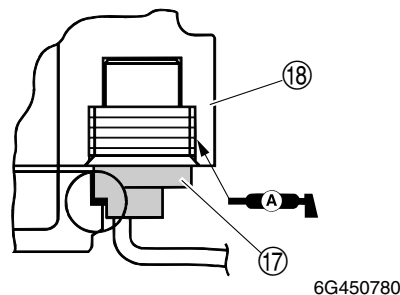


NOTE:

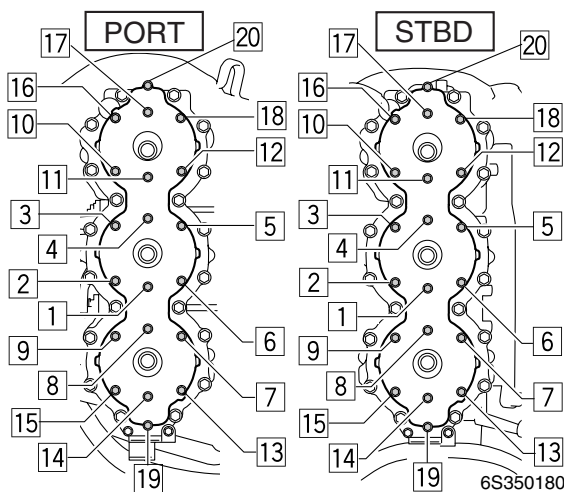
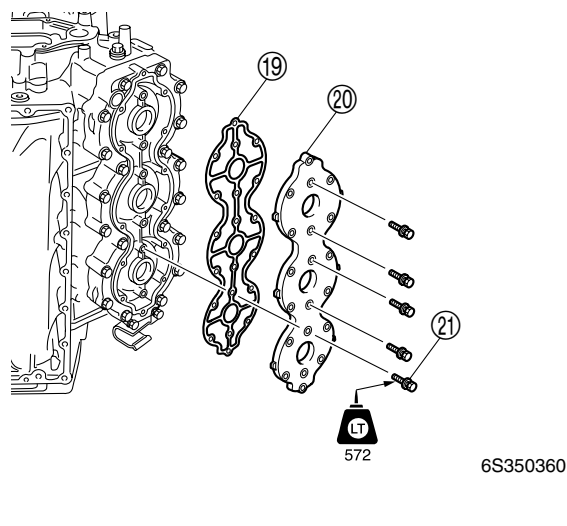
Apply engine oil to the cylinder head bolts (16) before installation.

	Cylinder head bolt (16):
	1st: 15 N·m (1.5 kgf·m, 11.1 ft·lb)
	2nd: 30 N·m (3.0 kgf·m, 22.1 ft·lb)

13. Install the thermostats (17) onto the cylinder head (18).




14. Install the new gaskets (19) and the cylinder head covers (20), and then tighten the cylinder head cover bolts (21) to the specified torques in two stages and in the sequence shown.

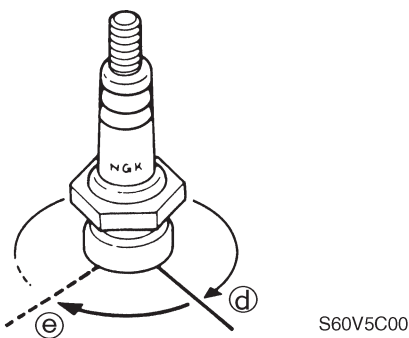


NOTE:

Apply LOCTITE 572 to the cylinder head cover bolts before installation.

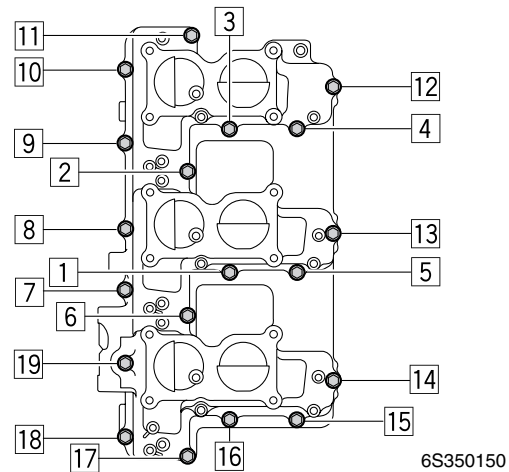
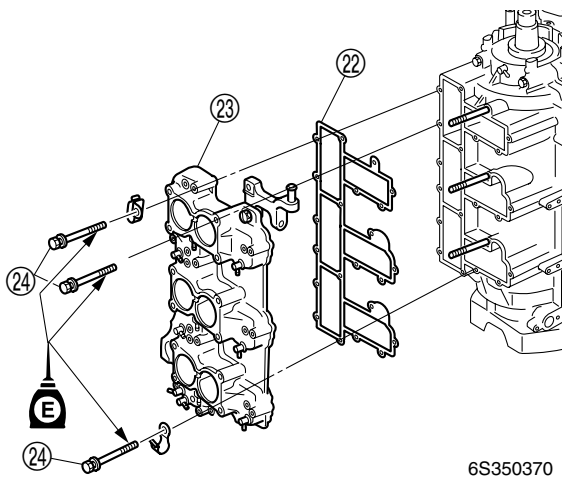
	Cylinder head cover bolt:
	1st: 5 N·m (0.5 kgf·m, 3.7 ft·lb)
	2nd: 11 N·m (1.1 kgf·m, 8.1 ft·lb)


15. Install the spark plugs temporary tight (d), then to the specified torque (e) with a spark plug wrench.



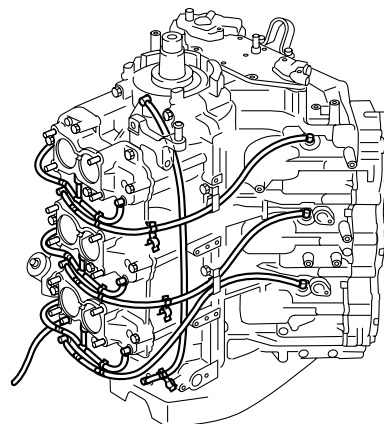
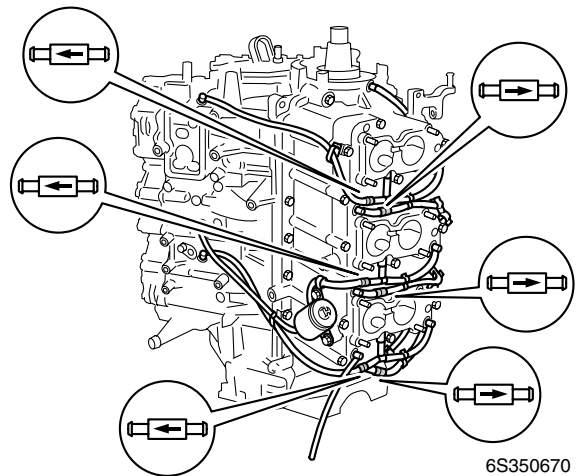
	Spark plug:
	25 N·m (2.5 kgf·m, 18.4 ft·lb)

16. Install the new gasket (22) and the intake manifold assembly (23), and then tighten the intake manifold bolts (24) to the specified torques in two stages and in the sequence shown.



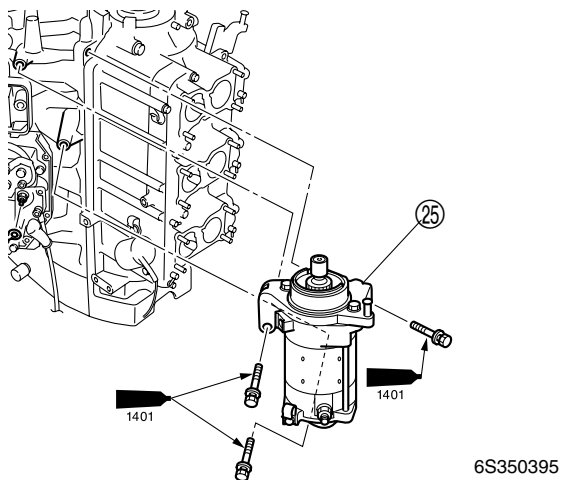
	Intake manifold bolt:
	1st: 4 N·m (0.4 kgf·m, 3.0 ft·lb)
	2nd: 8 N·m (0.8 kgf·m, 5.9 ft·lb)

17. Connect the hoses as shown below.

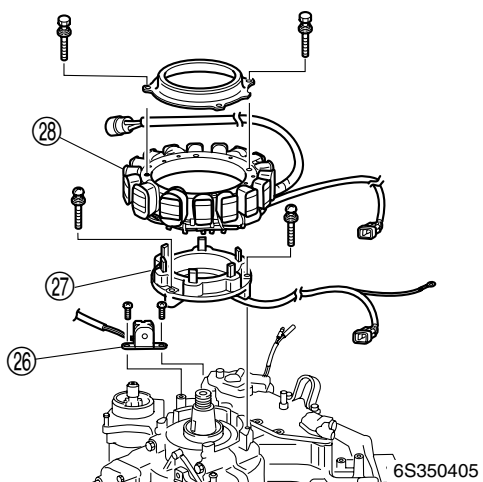




18. Install the starter motor (25), crank position sensor (26), pulser coil assembly (27) and stator coil (28) onto the power unit.



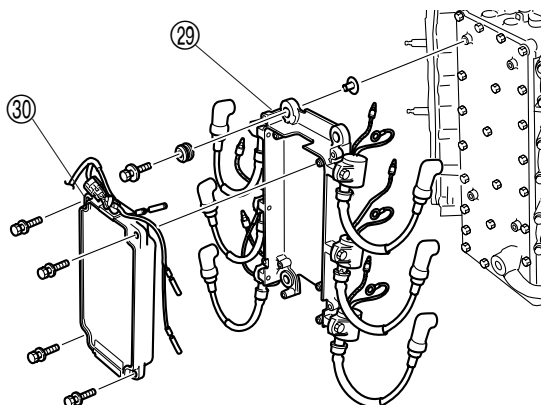
6S350395



6S350405

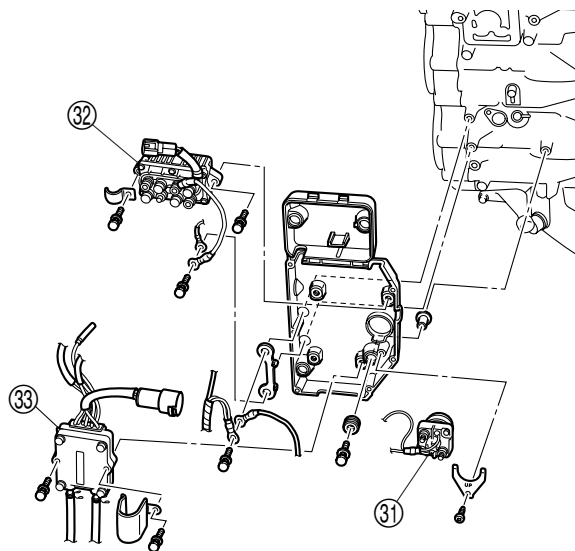
 **Starter motor mount bolt:**
18 N·m (1.8 kgf·m, 13.3 ft·lb)

19. Install the case (29) and the CDI unit (30) onto the power unit.



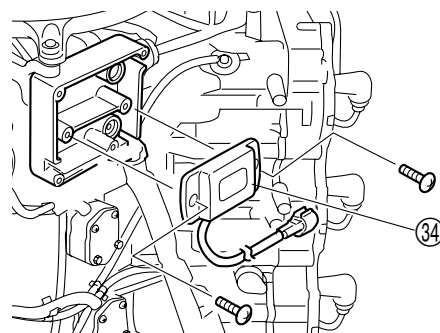
6S350425

20. Install the starter relay (31), the PTT relay assembly (32), and rectifier regulator (33) onto the power unit.




6S350526

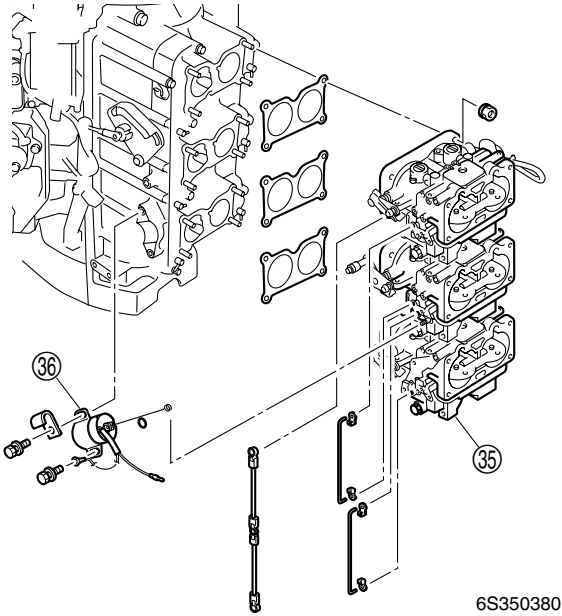
21. Install the hour meter (34) onto the power unit.



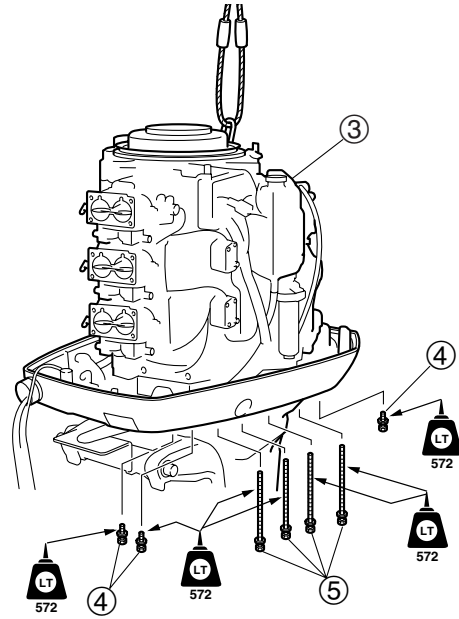
6S350415

 **Hour meter :**
3 N·m (0.3 kgf·m, 2.2 ft·lb)


22. Install the carburetor assemblies (35) and choke solenoid (36) onto the power unit.



6S350380

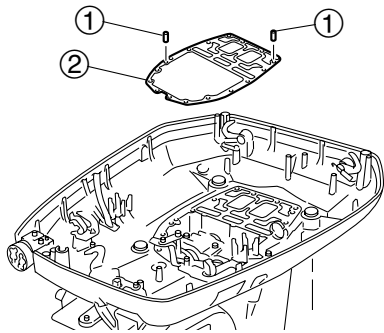


6S350065

 Power unit bolt (4), (5):
25 N·m (2.5 kgf·m, 18.4 ft·lb)

Installing the power unit

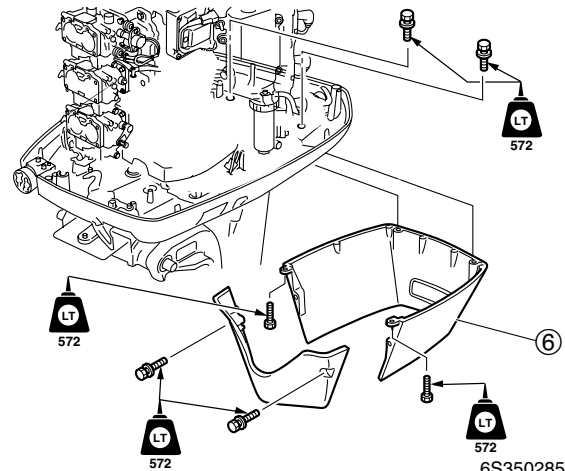
1. Clean the power unit matching surface, and install the dowels (1) and a new gasket (2).



6S350625

2. Install the power unit (3), and then tighten the power unit mounting bolts (4) and (5) to the specified torque.

3. Install the apron (6).

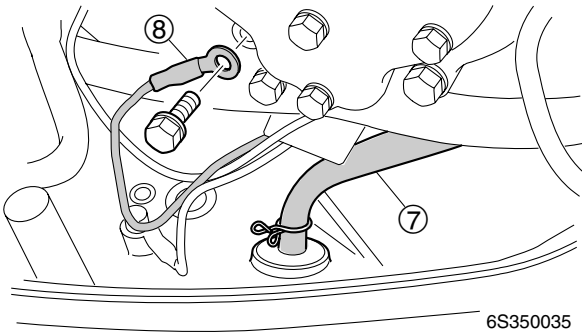


6S350285

 Apron bolt:
8 N·m (0.8 kgf·m, 5.9 ft·lb)

5

4. Connect the cooling water pilot hose ⑦ and ground lead ⑧.

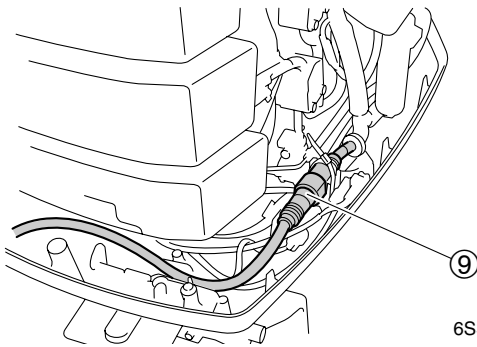


6S350035

5. Connect the fuel hose and oil hose.

6. Install the intake silencer.

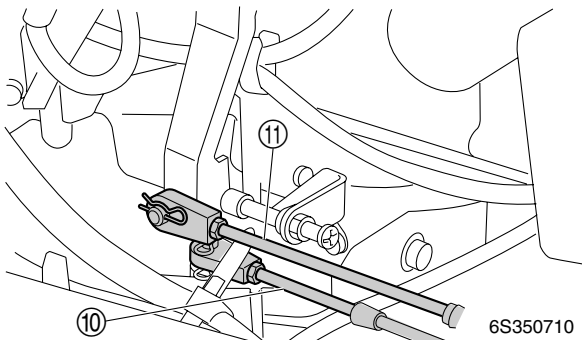
7. Connect the main coupler ⑨.



6S350045

8. Connect the PTT switch connector and trim sensor coupler.

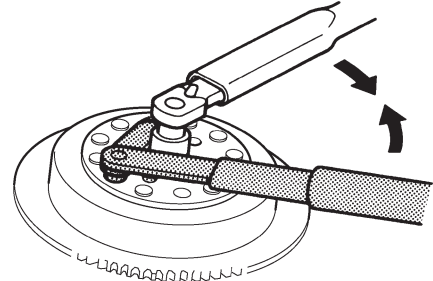
9. Connect the shift cable ⑩ and throttle cable ⑪, and then adjust their lengths. For adjustment procedures, see P3-8, "Adjusting the throttle cable," and P3-9 "Checking the gear shift operation" in chapter 3.



6S350710

10. Install the Woodruff key and flywheel magnet.

11. Tighten the flywheel magnet nut to the specified torque.



6F650700

CAUTION:

Apply force in the direction of the arrows shown, to prevent the flywheel holder from slipping off easily.

NOTE:

Apply engine oil to the flywheel magnet nut thread before installation.

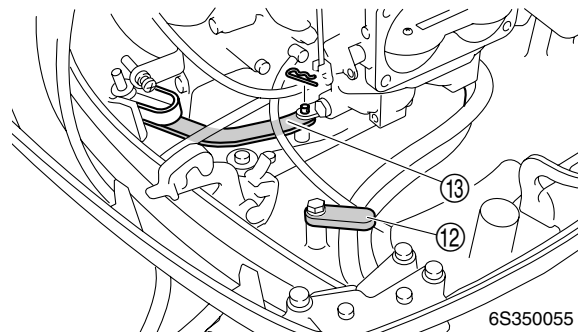


Flywheel holder: 90890-06522



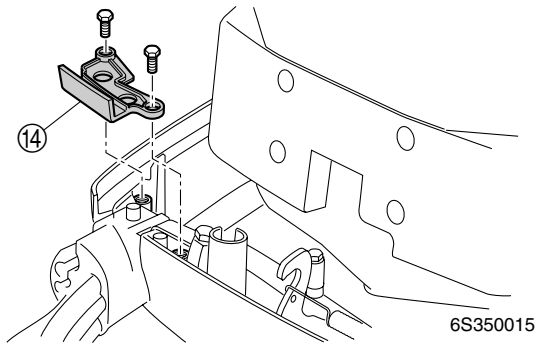
Flywheel magnet nut:
200 N·m (20 kgf·m, 148 ft·lb)

12. Tighten the cable holder plate ⑫ and install the shift lever ⑬.

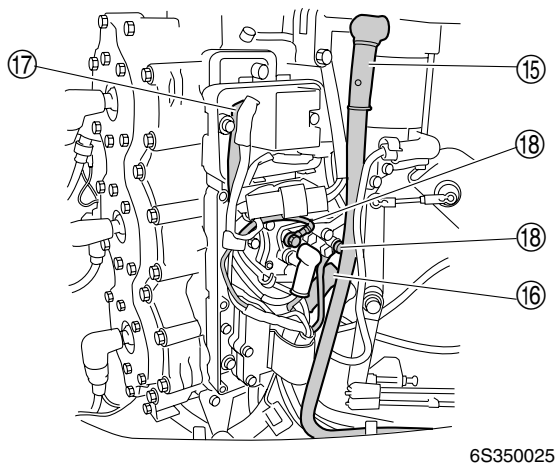


6S350055

13. Install the retaining plate (14).

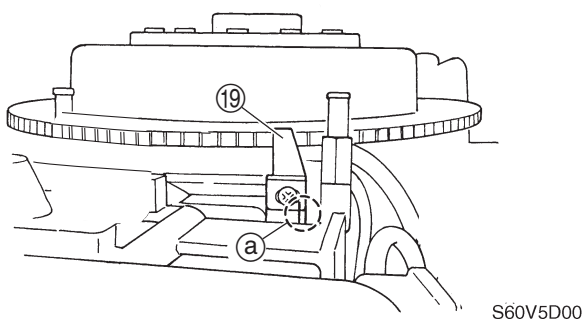


14. Connect the negative battery cable (15), positive battery cable (16), positive battery lead (17) and PTT motor lead (18).



	Positive terminal nut:
	7 N·m (0.7 kgf·m, 5.2 ft·lb)
	Starter motor negative battery cable bolt:
	18 N·m (1.8 kgf·m, 13.3 ft·lb)

15. Install the timing plate (19).



NOTE:

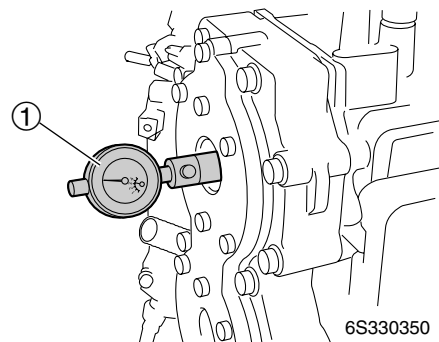
- Align the marks (a) on the timing plate (19), which you made during disassembly.
- For adjustment procedures, following "Adjusting the timing plate" steps.

16. Install the all removed parts.

Adjusting the timing plate

NOTE: Remove the all spark plugs and lock plate before adjusting the timing plate.

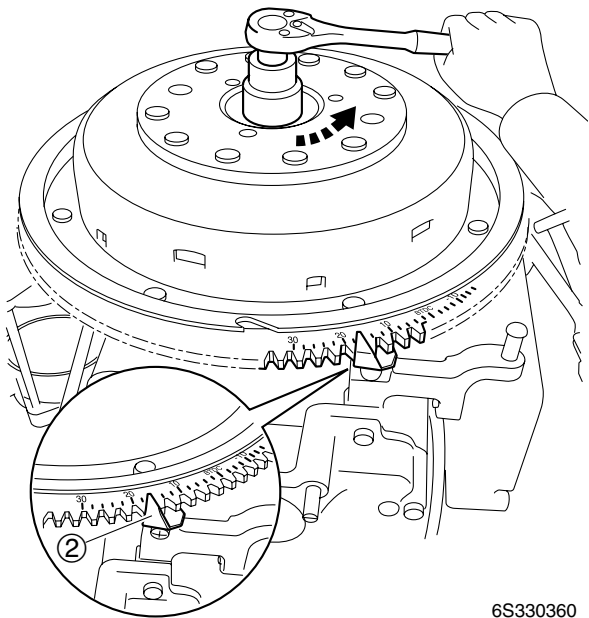
1. Remove the flywheel cover.
2. Slowly turn the flywheel magnet clockwise, align the piston of the #1 cylinder at the TDC.
3. Install the dial gauge (1) into the #1 cylinder.




NOTE: Set the dial gauge to "zero" position which is more than 3 mm from TDC.

	Dial gauge set (1): 90890-01252
--	---------------------------------

4. As look at the dial gauge, slightly turn the flywheel counterclockwise to the specified position.




6S330360

 Cylinder #1 piston stroke (BTDC):
2.76 mm (0.108 in)

5. Align the timing plate with the flywheel at BTDC 19° and install the timing plate ②.

NOTE: _____
When finish the adjusting of timing plate, flywheel must be turn clockwise twice.

6. Start the engine, and then check the ignition timing once more.

 Ignition timing:
ATDC 2–6°

7. If the ignition timing out of specification. Replace the CDI unit.

— MEMO —

5



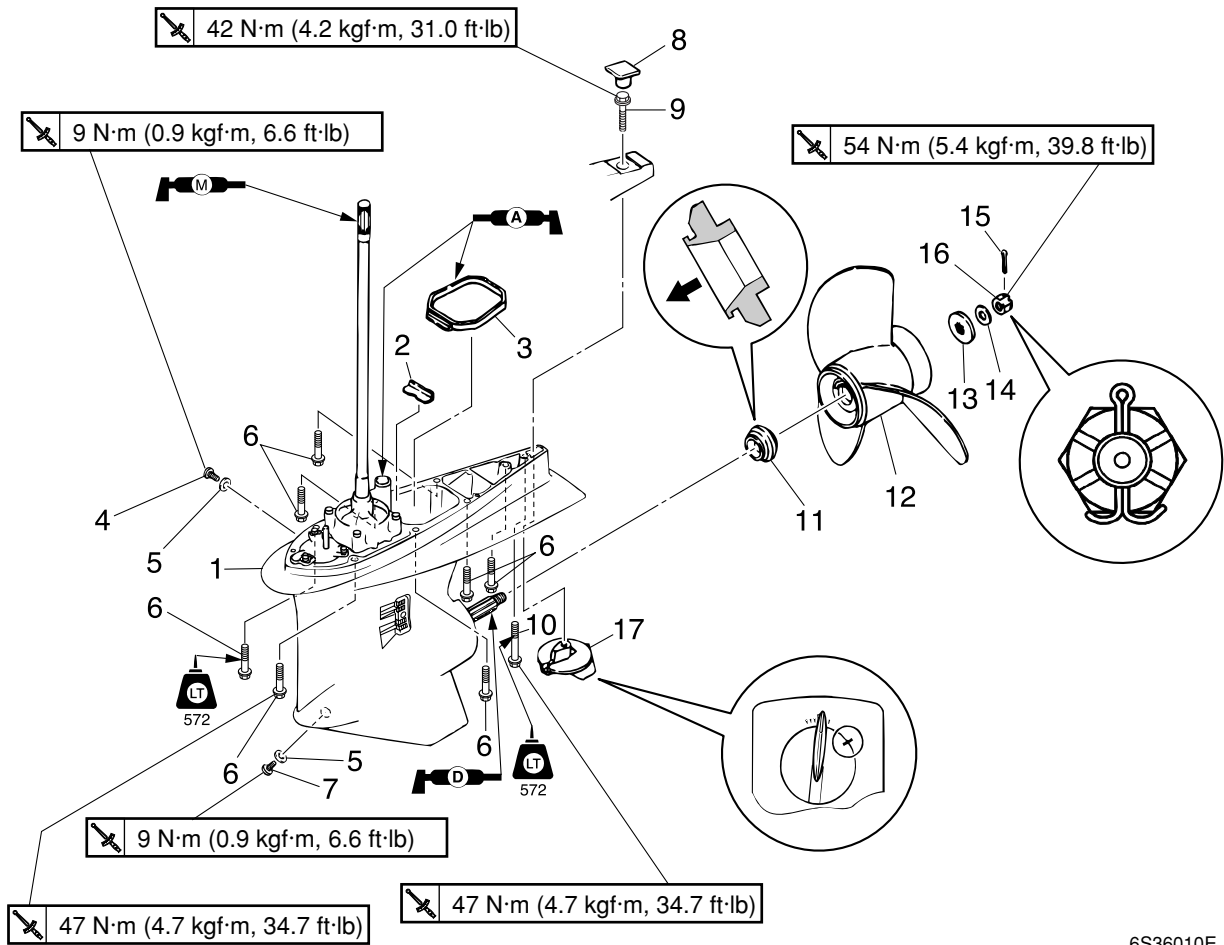
Lower unit

Lower unit (regular rotation model)	6-1
Removing the lower unit	6-4
Removing the water pump and shift rod	6-5
Checking the water pump and shift rod	6-5
Propeller shaft housing (regular rotation model)	6-6
Removing the propeller shaft housing assembly	6-8
Disassembling the propeller shaft assembly	6-8
Disassembling the propeller shaft housing	6-8
Checking the propeller shaft housing	6-9
Checking the propeller shaft	6-9
Assembling the propeller shaft assembly	6-9
Assembling the propeller shaft housing	6-10
Drive shaft and lower case (regular rotation model)	6-12
Removing the drive shaft	6-14
Disassembling the drive shaft housing	6-14
Disassembling the forward gear	6-14
Disassembling the lower case	6-15
Checking the pinion and forward gear	6-15
Checking the bearing	6-15
Checking the drive shaft	6-15
Checking the lower case	6-16
Assembling the lower case	6-16
Assembling the forward gear	6-16
Assembling the drive shaft housing	6-17
Installing the drive shaft	6-17
Installing the propeller shaft housing	6-18
Installing the water pump and shift rod	6-19
Installing the lower unit	6-20
Shimming (regular rotation model)	6-23
Shimming	6-24
Selecting the pinion shim	6-24
Selecting the forward gear shim	6-25
Selecting the reverse gear shim	6-26
Backlash (regular rotation model)	6-27
Measuring the forward and reverse gear backlash	6-27

Lower unit (counter rotation model)	6-30
Removing the lower unit	6-33
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Checking the water pump and shift rod.....	6-34
Propeller shaft housing (counter rotation model)	6-35
Removing the propeller shaft housing assembly.....	6-37
Disassembling the propeller shaft assembly 1	6-37
Disassembling the propeller shaft assembly 2	6-37
Disassembling the forward gear	6-39
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Assembling the propeller shaft housing	6-40
Assembling the propeller shaft assembly 1	6-42
Drive shaft and lower case (counter rotation model).....	6-43
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Disassembling the drive shaft housing	6-45
Disassembling the reverse gear	6-45
Disassembling the lower case	6-46
Checking the pinion and reverse gear.....	6-46
Checking the bearing.....	6-46
Checking the drive shaft	6-46
Checking the lower case	6-47
Assembling the lower case.....	6-47
Assembling the reverse gear.....	6-47
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Installing the propeller shaft housing.....	6-49
Installing the water pump and shift rod	6-50
Installing the lower unit.....	6-51
Shimming (counter rotation model)	6-54
Shimming.....	6-55
Selecting the pinion shim.....	6-55
Selecting the reverse gear shim	6-56
Selecting the forward gear shim	6-58
Selecting the propeller shaft shim	6-59
Backlash (counter rotation model).....	6-61
Measuring the forward and reverse gear backlash	6-61



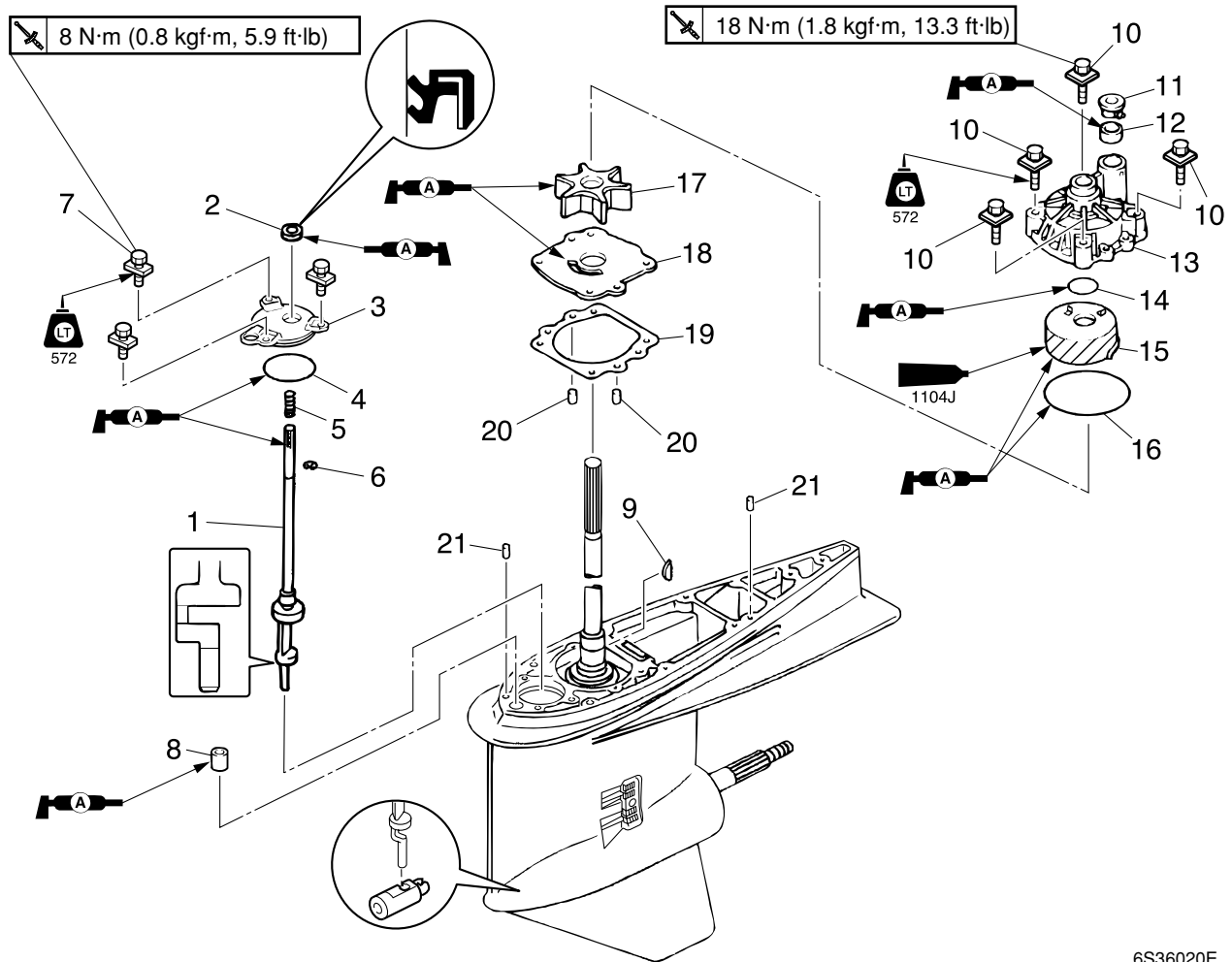
Lower unit (regular rotation model)



6S36010E

No.	Part name	Q'ty	Remarks
1	Lower unit	1	
2	Plate	1	
3	Rubber seal	1	
4	Check screw	1	
5	Gasket	2	Not reusable
6	Bolt	7	M10 × 45 mm
7	Drain screw	1	
8	Grommet	1	
9	Bolt	1	M10 × 45 mm
10	Bolt	1	M10 × 70 mm
11	Spacer	1	
12	Propeller	1	
13	Washer	1	
14	Washer	1	
15	Cotter pin	1	Not reusable
16	Propeller nut	1	
17	Trim tab	1	

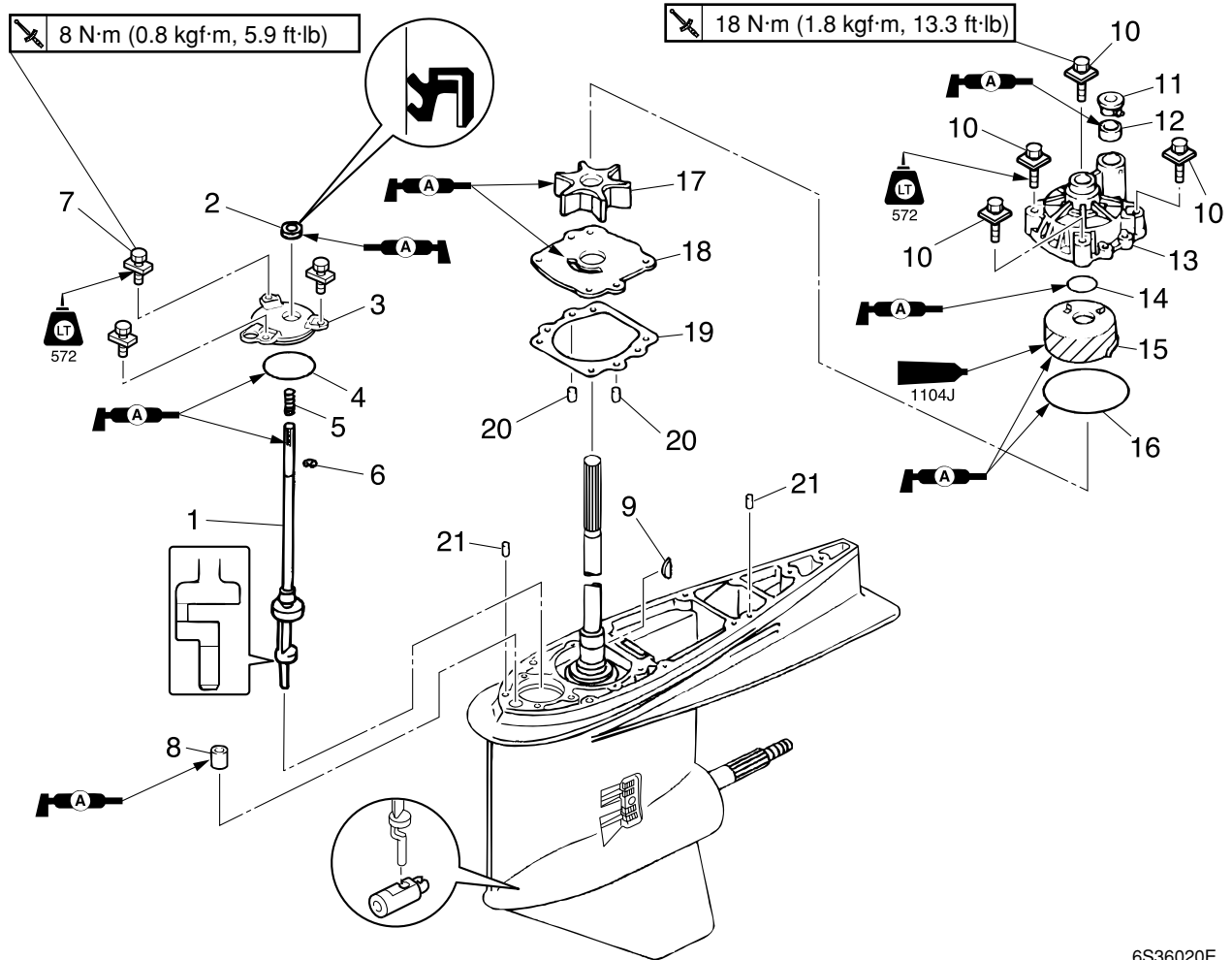
Lower unit (regular rotation model)



6S36020E

6

No.	Part name	Q'ty	Remarks
1	Shift rod	1	
2	Oil seal	1	Not reusable
3	Cover	1	
4	O-ring	1	Not reusable
5	Spring	1	
6	Circlip	1	
7	Bolt	3	M6 × 20 mm
8	Seal	1	
9	Woodruff key	1	
10	Bolt	4	M8 × 45 mm
11	Cover	1	
12	Seal	1	
13	Water pump housing	1	
14	O-ring	1	Not reusable
15	Insert cartridge	1	
16	O-ring	1	Not reusable
17	Impeller	1	

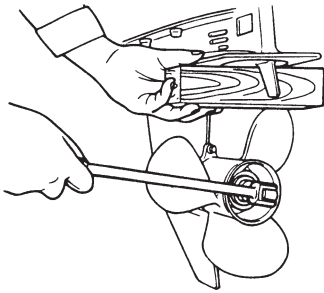


6S36020E

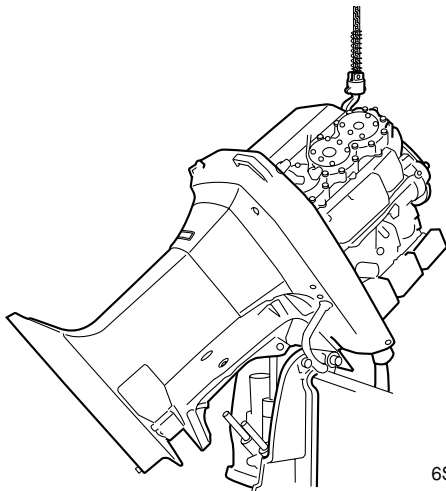
No.	Part name	Q'ty	Remarks
18	Outer plate cartridge	1	
19	Gasket	1	Not reusable
20	Dowel	2	
21	Dowel	2	

Removing the lower unit

1. Drain the gear oil. For draining procedures, see Chapter 3, "Changing the gear oil."
2. Set the gear shift to the neutral position, and place a block of wood between the anti-cavitation plate and propeller to keep the propeller from turning, and then remove the propeller nut and propeller.

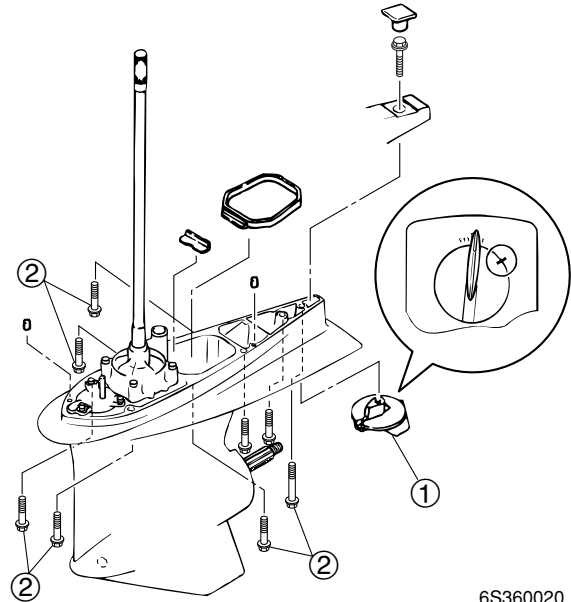


6F660020



6S360010

3. Mark the trim tab ① at the area shown, and then remove it.
4. Loosen the bolts ②, and then remove the lower unit from the upper case.



6S360020

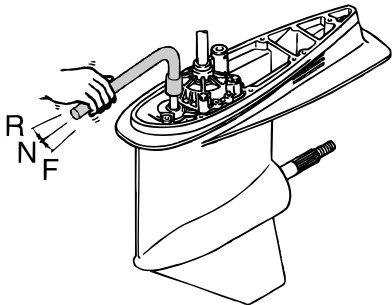
⚠ WARNING

- Do not hold the propeller with your hands when loosening or tightening it.
- Be sure to disconnect the battery cables from the battery and the lock plate from the engine stop lanyard switch.
- Put a block of wood between the anti-cavitation plate and propeller to keep the propeller from turning.
- When removing the lower unit without removing the power unit, be sure to suspend the outboard motor. Otherwise, the outboard motor could suddenly fall and result in injury.



Removing the water pump and shift rod

1. Remove the water pump housing ① and impeller ②.
2. Remove the woodruff key ③.
3. Remove the outer plate cartridge ④, gasket ⑤ and dowels ⑥.
4. Set the gear shift to the neutral position at the lower unit. Make sure that the shift rod is in the neutral position using a special service tool.

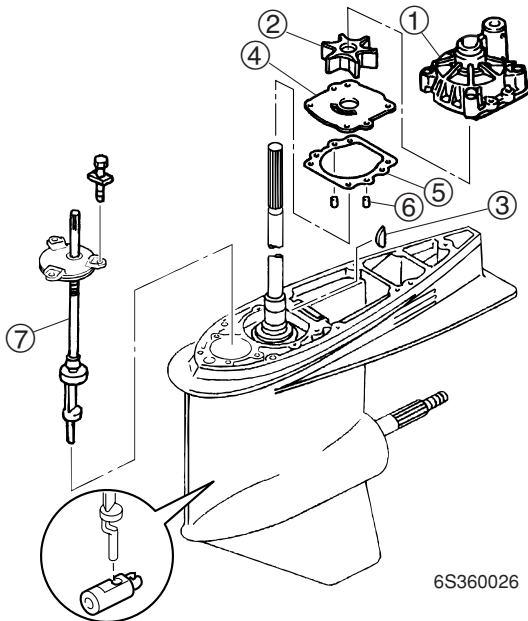


69D60036



Shift rod push arm:
90890-06052

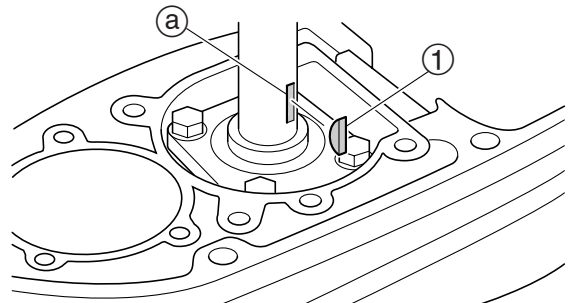
5. Remove the shift rod assembly ⑦.



6S360026

Checking the water pump and shift rod

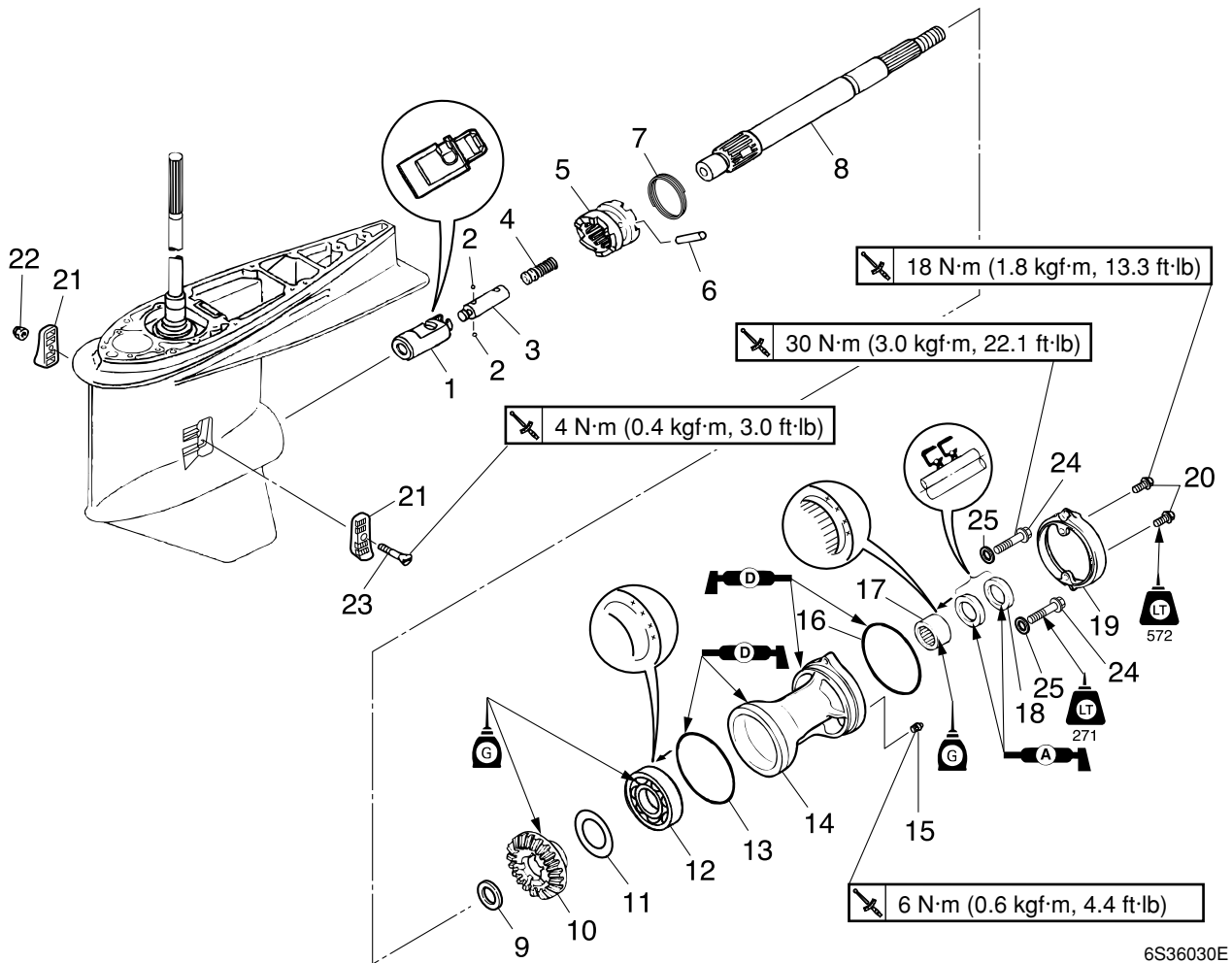
1. Check the water pump housing. Replace if there is deformation.
2. Check the impeller and insert cartridge. Replace if cracked or worn.
3. Check the Woodruff key ① and the groove ① on the drive shaft. Replace if worn.



6S360027

4. Check the shift rod. Replace if cracked or worn.

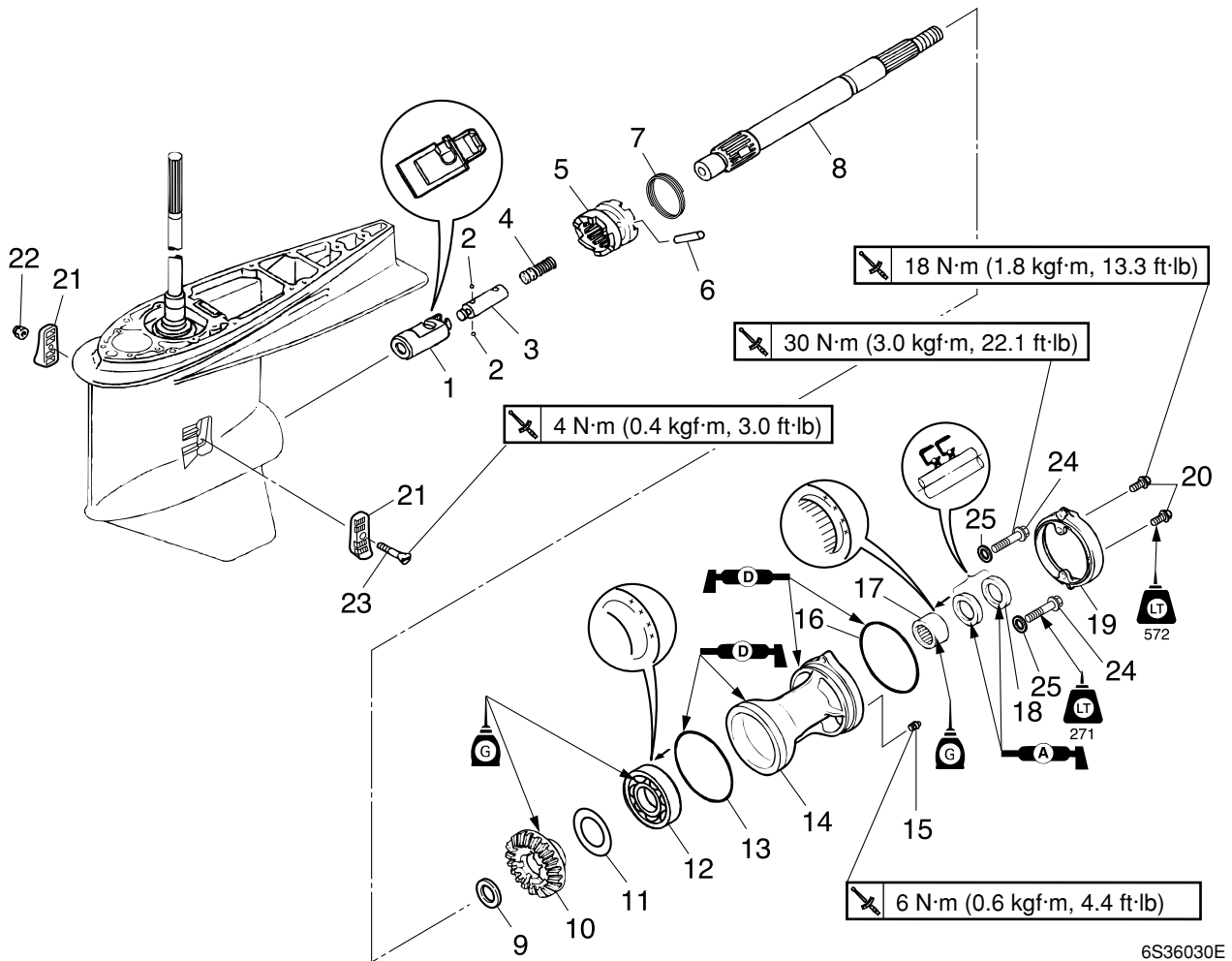
Propeller shaft housing (regular rotation model)



6S36030E

6

No.	Part name	Q'ty	Remarks
1	Shift rod joint	1	
2	Ball	2	
3	Shift slider	1	
4	Shift plunger	1	
5	Dog clutch	1	
6	Cross pin	1	
7	Spring	1	
8	Propeller shaft	1	
9	Washer	1	
10	Reverse gear	1	
11	Reverse gear shim	—	
12	Ball bearing	1	Not reusable
13	O-ring	1	Not reusable
14	Propeller shaft housing	1	
15	Grease nipple	1	
16	O-ring	1	Not reusable
17	Needle bearing	1	Not reusable

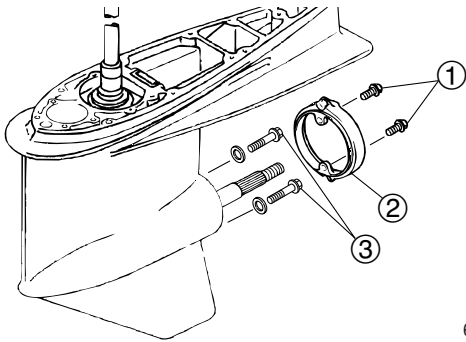


6S36030E

No.	Part name	Q'ty	Remarks
18	Oil seal	2	Not reusable
19	Ring	1	
20	Bolt	2	M8 × 20 mm
21	Cooling water inlet cover	2	
22	Nut	1	
23	Screw	1	
24	Bolt	2	M8 × 36 mm
25	Washer	2	

Removing the propeller shaft housing assembly

1. Remove the bolts ①, ring ② and bolts ③.

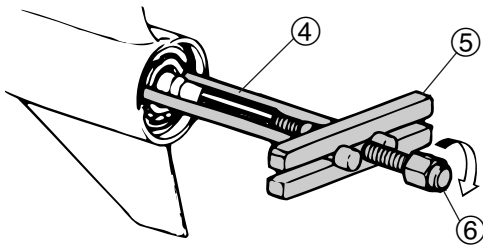


6S360030

NOTE: _____

Before removing the propeller shaft from the lower case, remove the shift rod.

2. Remove the propeller shaft housing use the special service tools.



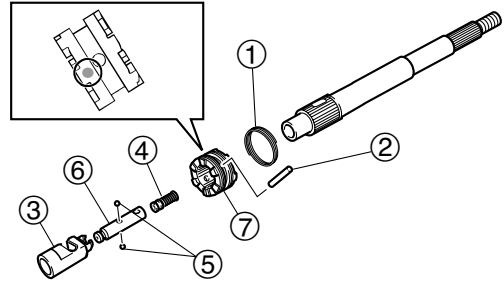
6F660545



Bearing housing puller claw L ④:
90890-06502
Stopper guide plate ⑤:
90890-06501
Center bolt ⑥: 90890-06504

Disassembling the propeller shaft assembly

1. Remove the spring ①, and then remove the cross pin ②, shift rod joint ③, shift plunger ④, balls ⑤, shift slider ⑥, and dog clutch ⑦.



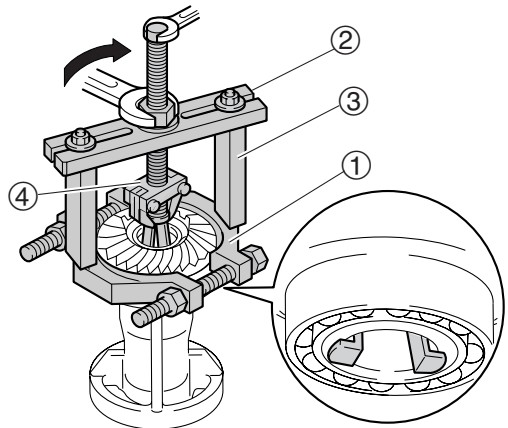
6S360040

NOTE: _____

Mark the front side of the dog clutch ⑦.

Disassembling the propeller shaft housing

1. Remove the reverse gear and ball bearings.



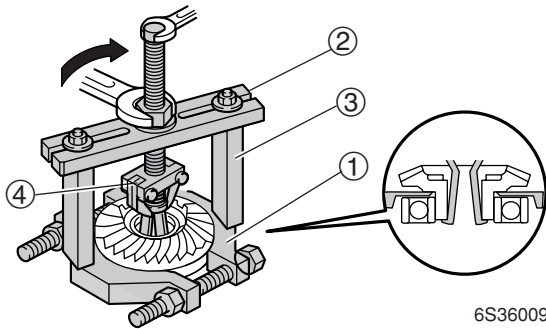
60h60140



Bearing separator ①: 90890-06534
Stopper guide plate ②:
90890-06501
Stopper guide stand ③:
90890-06538
Bearing puller assembly ④:
90890-06535



- Remove the ball bearing from reverse gear, and then remove the reverse gear shims.



6S360090

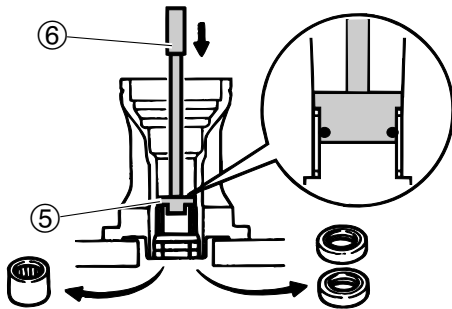
CAUTION:

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



- Bearing separator (1): 90890-06534
- Stopper guide plate (2): 90890-06501
- Stopper guide stand (3): 90890-06538
- Bearing puller assembly (4): 90890-06535

- Remove the oil seals and needle bearing.



S6S16580



- Needle bearing attachment (5): 90890-06653
- Driver rod L3 (6): 90890-06652

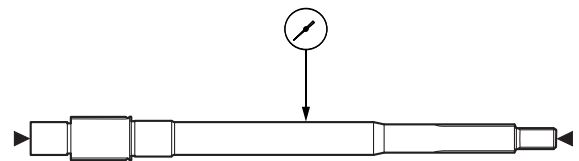
Checking the propeller shaft housing

- Clean the propeller shaft housing using a soft brush and cleaning solvent, and then check it. Replace if cracked or damaged.

- Check the teeth and dogs of the reverse gear. Replace if cracked or worn.
- Check the bearings. Replace if pitted or if there is rumbling.

Checking the propeller shaft

- Check the propeller shaft. Replace if bent or worn.
- Measure the propeller shaft runout.



S6P26200

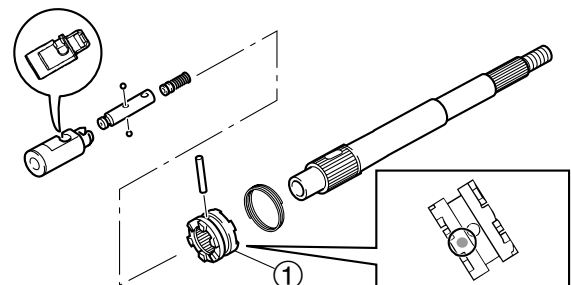


Runout limit: 0.02 mm (0.0008 in)

- Check the dog clutch, shift rod joint, and slider. Replace if cracked or worn.

Assembling the propeller shaft assembly

- Assemble the propeller shaft assembly as shown.



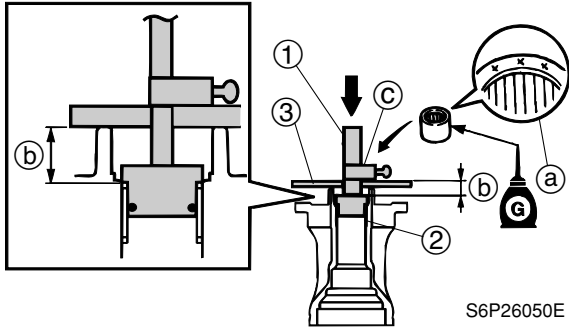
6S360050

NOTE:

Face the marking side to original direction, and then install the dog clutch (1).

Assembling the propeller shaft housing

1. Install the needle bearing into the propeller shaft housing to the specified depth.



S6P26050E

NOTE:

- Install the needle bearing with the manufacture identification mark (a) facing toward the oil seal (propeller side).
- Be careful not to let the stopper (c) get out of position when using the driver rod SS (1).

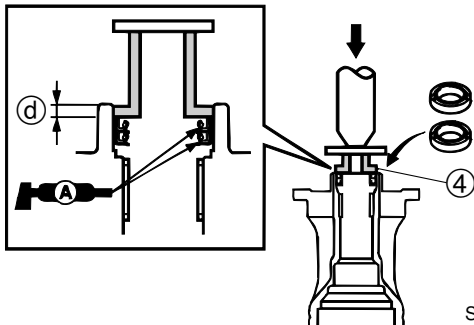


Driver rod SS (1): 90890-06604
 Needle bearing attachment (2):
 90890-06610
 Bearing depth plate (3):
 90890-06603



Depth (b):
 25.05 – 25.55 mm (0.98 – 1.00 in)

2. Apply grease to new oil seals, and then install them into the propeller shaft housing to the specified depth.



S6P26060E

NOTE:

Install an oil seal halfway into the propeller shaft housing, then the other oil seal.

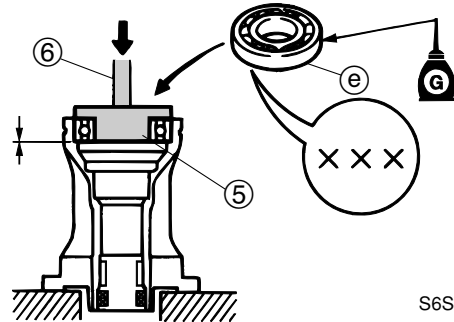


Bearing inner race attachment (4):
 90890-06640



Depth (d):
 4.75–5.25 mm (0.187–0.207 in)

3. Install the new ball bearing into the propeller shaft housing using a press.



S6S16140

NOTE:

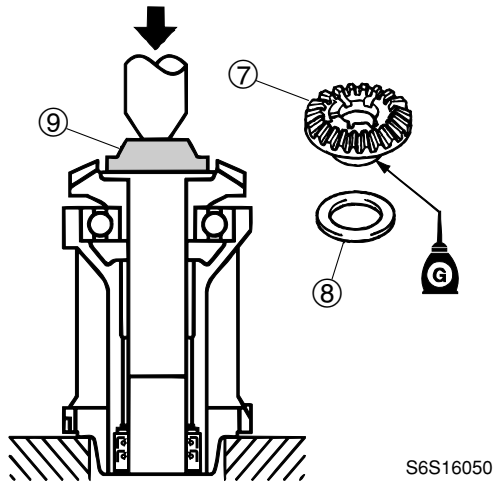
Install the ball bearing with the manufacture identification mark (e) facing toward the propeller shaft housing (propeller side).



Ball bearing attachment (5):
 90890-06656
 Driver rod LS (6): 90890-06606



4. Install the reverse gear ⑦ and original shim(s) ⑧ into the propeller shaft housing using a press.



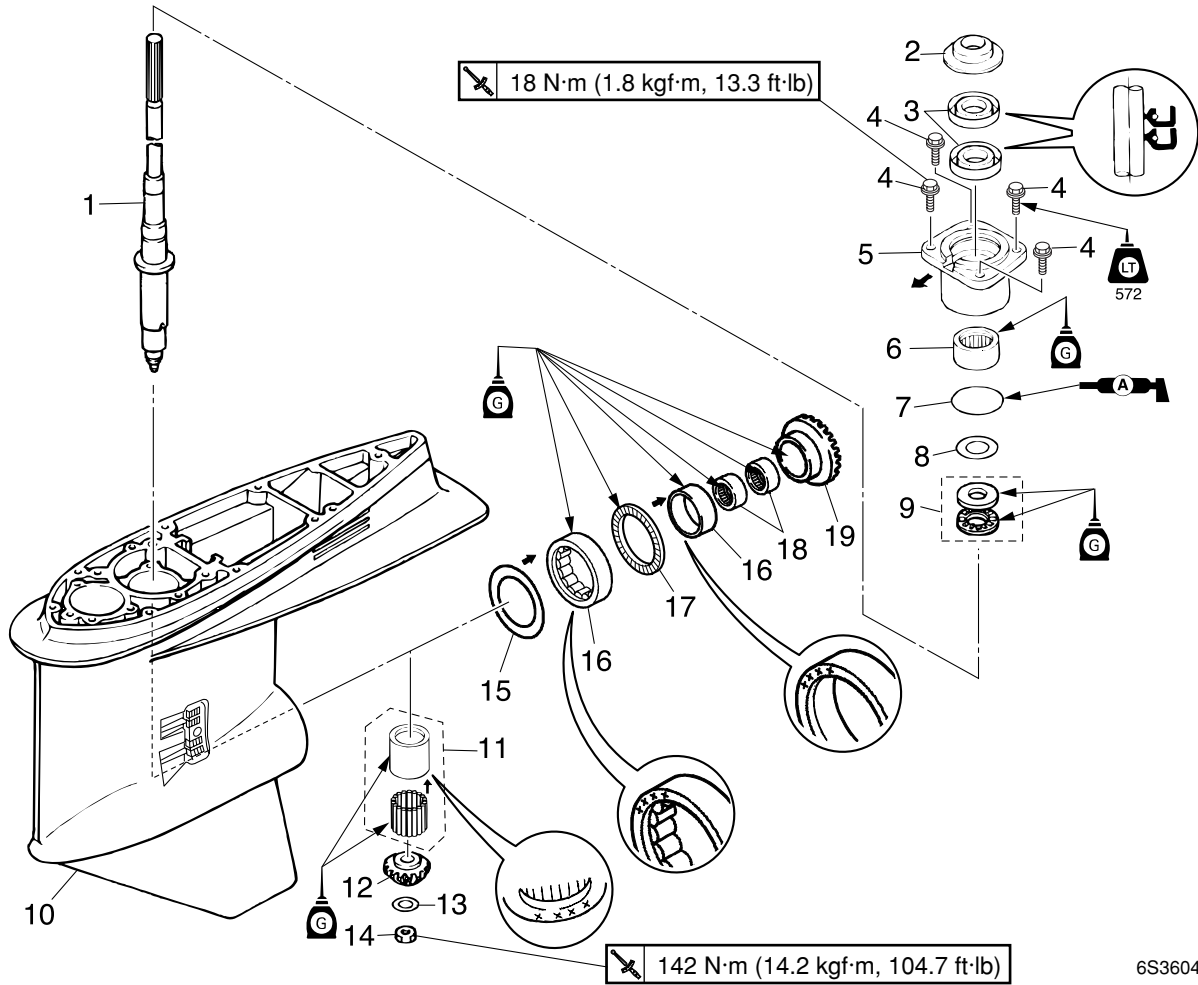
NOTE:

- Be sure to select the reverse gear shim(s) if replacing the propeller shaft housing, lower case, or ball bearing.
- To select the shims, see “Shimming (regular rotation model)”.
- After installing the reverse gear and shim(s), check that the reverse gear rotates smoothly.



Bearing outer race attachment ⑨:
90890-06622

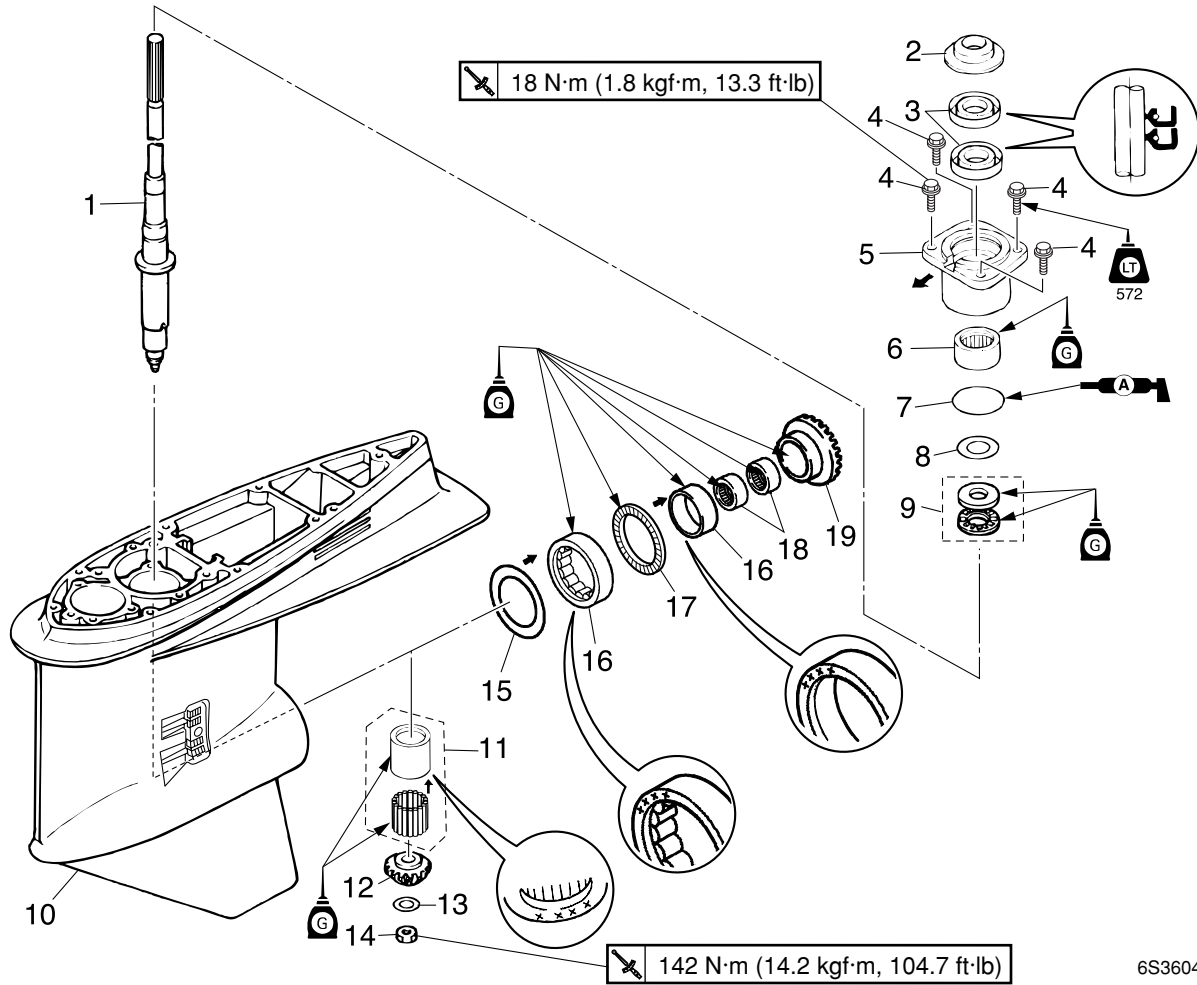
Drive shaft and lower case (regular rotation model)



6S36040E

6

No.	Part name	Q'ty	Remarks
1	Drive shaft	1	
2	Cover	1	
3	Oil seal	2	Not reusable
4	Bolt	4	M8 × 25 mm
5	Drive shaft housing	1	
6	Needle bearing	1	Not reusable
7	O-ring	1	Not reusable
8	Pinion shim	—	
9	Thrust bearing	1	
10	Lower case	1	
11	Needle bearing	1	
12	Pinion	1	
13	Washer	1	
14	Nut	1	
15	Forward gear shin	—	
16	Roller bearing	1	Not reusable
17	Thrust bearing	1	

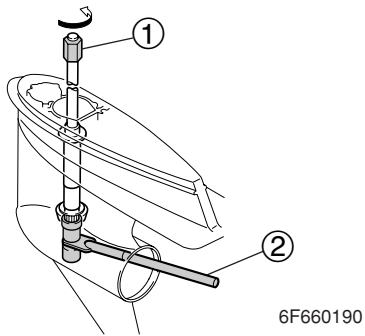


6S36040E

No.	Part name	Q'ty	Remarks
18	Needle bearing	2	Not reusable
19	Forward gear	1	

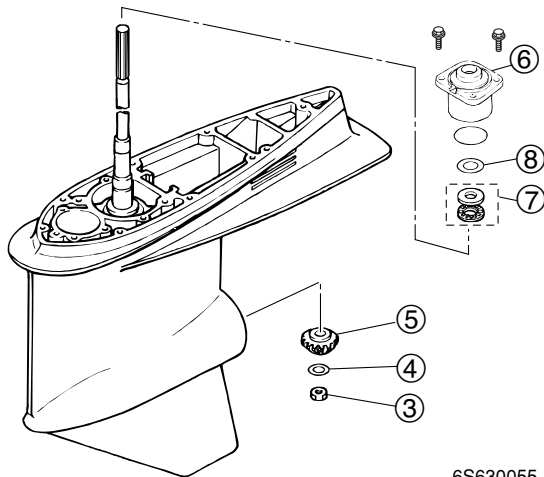
Removing the drive shaft

1. Loosen the pinion nut.



Drive shaft holder 6 (1):
90890-06520
Pinion nut holder (2):
90890-06715

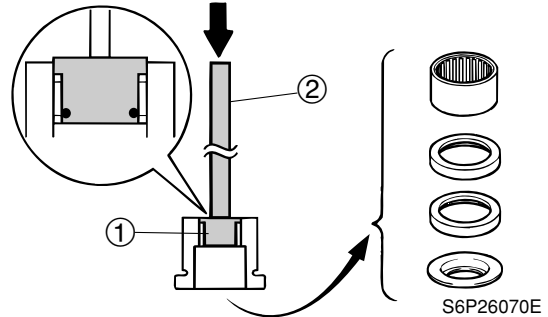
2. Remove the pinion nut (3), washer (4), pinion (5), drive shaft housing (6), thrust bearing (7), pinion shim(s) (8) from lower case.



3. Pull out the forward gear.

Disassembling the drive shaft housing

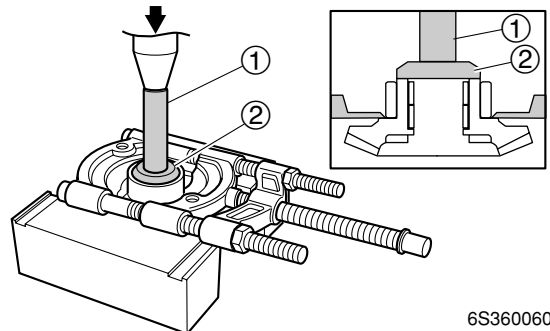
1. Remove the cover, oil seals, and needle bearing.



Needle bearing attachment (1):
90890-06610
Driver rod L3 (2): 90890-06652

Disassembling the forward gear

1. Remove the bearing inner race from the forward gear using a press.



CAUTION:

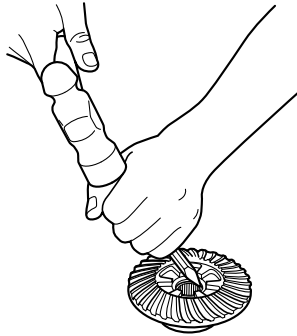
Do not reuse the bearing, always replace it with a new one.



Bearing separator:
(commercially available)
Driver rod LS (1): 90890-06606
Bearing outer race attachment (2):
90890-06626



- Remove the needle bearings from the forward gear using a chisel.



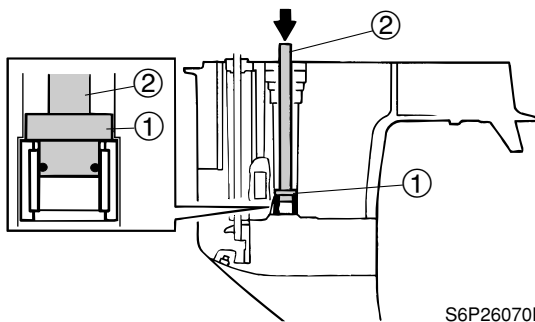
6G460100

CAUTION:

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

Disassembling the lower case

- Remove the needle bearing.



S6P26070E

NOTE:

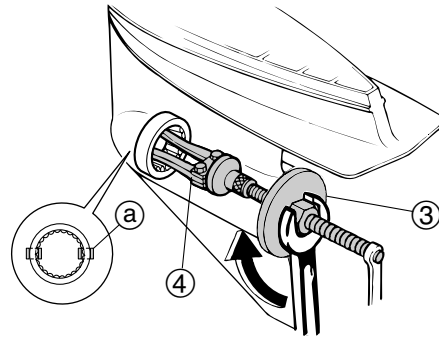
Since the diameter of the passage in the lower case and the diameter of the special service tool ① are both 40 mm (1.57 in), the special service tool may not fit into the lower case. In that case, use a special service tool with a smaller diameter.



Ball bearing attachment ①:
90890-06635

Driver rod LL ②: 90890-06605

- Remove the roller bearing outer race and shim(s).



6F660235



Bearing outer race puller assembly ③: 90890-06523
Outer race puller claw B ④: 90890-06533

NOTE:

Install the claws ④ as shown.

Checking the pinion and forward gear

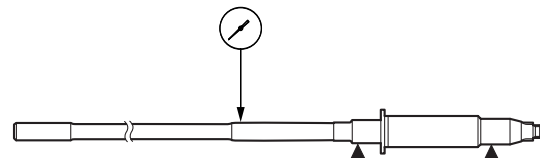
- Check the teeth of the pinion, and the teeth and dogs of the forward gear. Replace if cracked or worn.

Checking the bearing

- Check the bearing. Replace if pitted or if there is rumbling.

Checking the drive shaft

- Check the drive shaft. Replace if bent or worn.
- Measure the drive shaft runout.



S6P26210



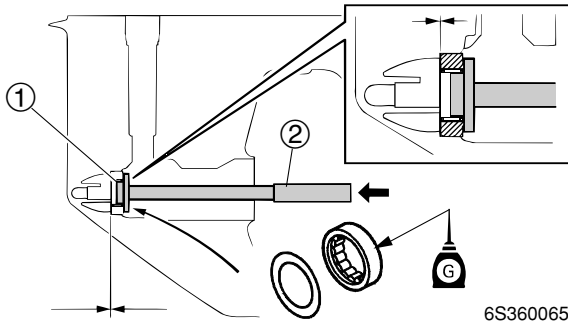
Runout limit: 0.2 mm (0.008 in)

Checking the lower case

1. Check the skeg and torpedo. Replace the lower case if cracked or damaged.

Assembling the lower case

1. Install the original shim(s) and roller bearing.



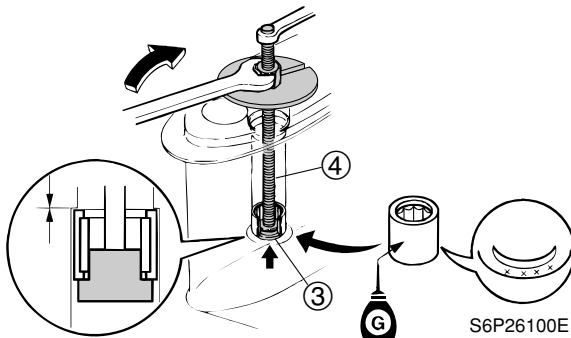
NOTE:

- Be sure to select the forward gear shim(s) if replacing the lower case or roller bearing assembly.
- To select the shim(s), see “Shimming (regular rotation model).”



Bearing outer race attachment ①:
90890-06658
Driver rod LL ②: 90890-06605

2. Install the needle bearing into the lower case.



NOTE:

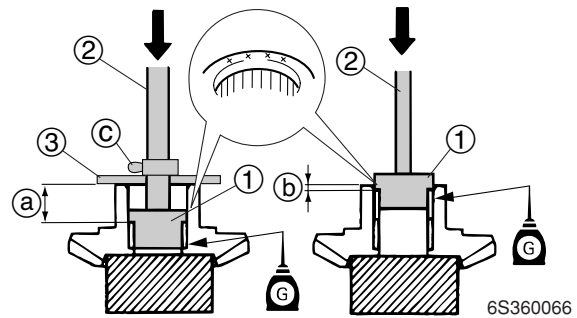
- Apply gear oil to the needle bearing before installation.
- The needle bearing contains 24 rollers.



Ball bearing attachment ③:
90890-06655
Bearing outer race puller
assembly ④:
90890-06523

Assembling the forward gear

1. Install new needle bearings into the forward gear to the specified depth.



NOTE:

Be careful not to let the stopper © get out of position when using the driver rod.

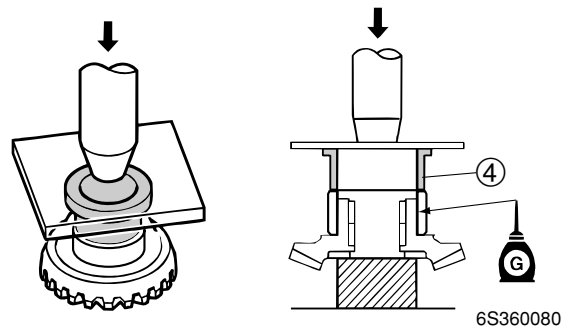


Needle bearing attachment ①:
90890-06653
Driver rod SS ②: 90890-06604
Bearing depth plate ③:
90890-06603



Depth ①a:
20.75–21.25 mm (0.817–0.837 in)
Depth ①b:
4.25–4.75 mm (0.167–0.187 in)

2. Install a new inner race into the forward gear using a press.

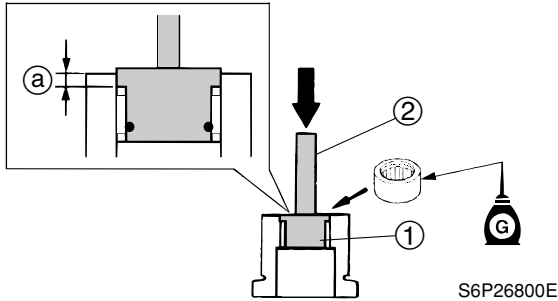


Bearing inner race attachment ④:
90890-06659



Assembling the drive shaft housing

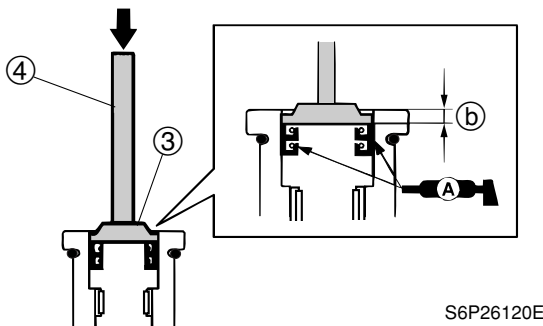
1. Install the needle bearing into the drive shaft housing to the specified depth.



	Needle bearing attachment ①: 90890-06610 Driver rod SS ②: 90890-06604
--	---

	Depth ①a: 4.25 – 4.75 mm (0.167 – 0.187 in)
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2. Apply grease to new oil seals, new O-ring, and then install them into the drive shaft housing to the specified depth.



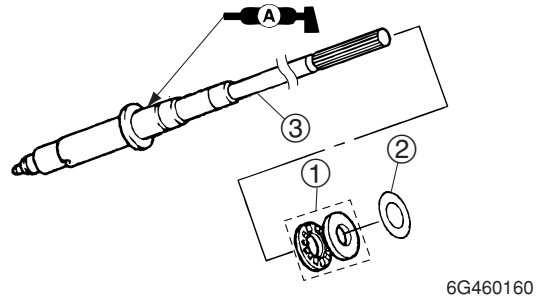
NOTE: _____
Install an oil seal halfway into the drive shaft housing, then the other oil seal.

	Bearing outer race attachment ③: 90890-06628 Driver rod LS ④: 90890-06606
--	---

	Depth ①b: 0.25 – 0.75 mm (0.01–0.03 in)
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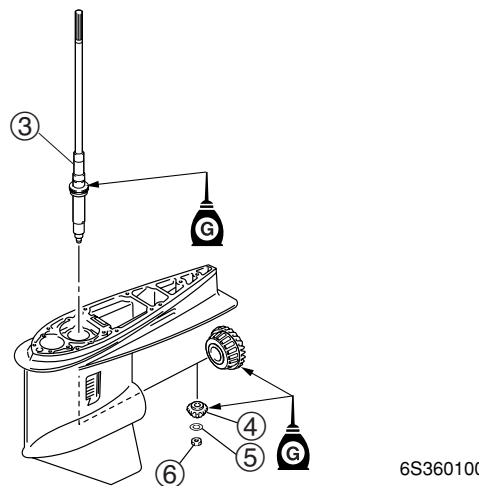
Installing the drive shaft

1. Install the forward gear into the lower case.
2. Install the thrust bearing ① and original shim(s) ② onto the drive shaft ③.



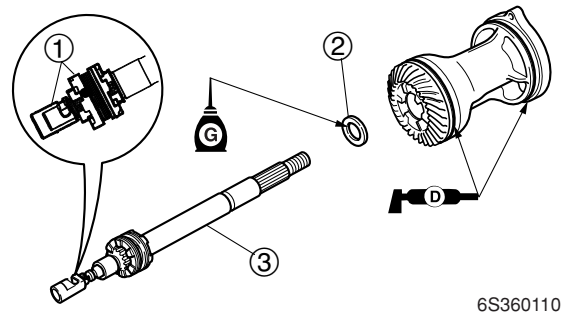
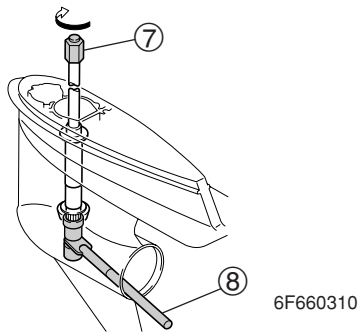
NOTE: _____
• Be sure to select the pinion shim(s) if replacing the thrust bearing, drive shaft housing, drive shaft or lower case.
• To select the shim(s), see “Shimming (regular rotation model).”


3. Install the drive shaft ③ into the lower case. Install the pinion ④, washer ⑤, pinion nut ⑥, and then tighten the pinion nut ⑥ to the specified torque.




NOTE: _____
Install the drive shaft by lifting it up slightly, then aligning it with the pinion and the spline of the drive shaft.

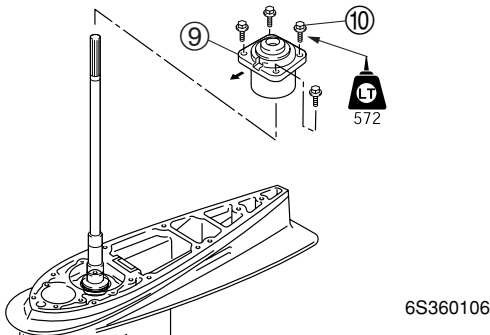
Drive shaft and lower case (regular rotation model)




	Drive shaft holder 6 (7): 90890-06520 Pinion nut holder (8): 90890-06715
---	---

	Pinion nut: 142 N·m (14.2 kgf·m, 104.7 ft·lb)
---	--

4. Install the drive shaft housing (9), and then tighten the drive shaft housing bolt (10).



NOTE:
Apply LOCTITE 572 to the drive shaft housing bolts before installation.

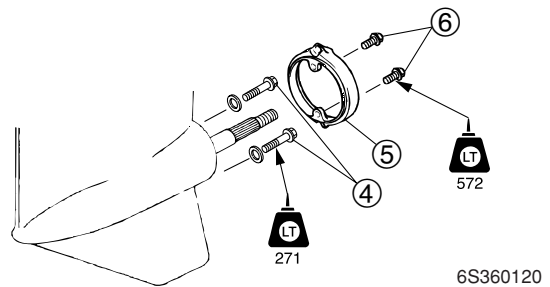
	Drive shaft housing bolt (10): 18 N·m (1.8 kgf·m, 13.3 ft·lb)
---	--

Installing the propeller shaft housing


1. Set the shift rod joint and dog clutch (1) to the neutral position as shown.
2. Apply grease to a new O-rings, and then install it onto the propeller shaft housing.
3. Install the washer (2) and propeller shaft assembly (3) into the propeller shaft housing assembly.

NOTE:
Face the shift plunger connect part to upward.

4. Install the propeller shaft housing assembly into the lower case, and then tighten the bolts (4) to the specified torque.
5. Install the ring (5) and bolts (6).



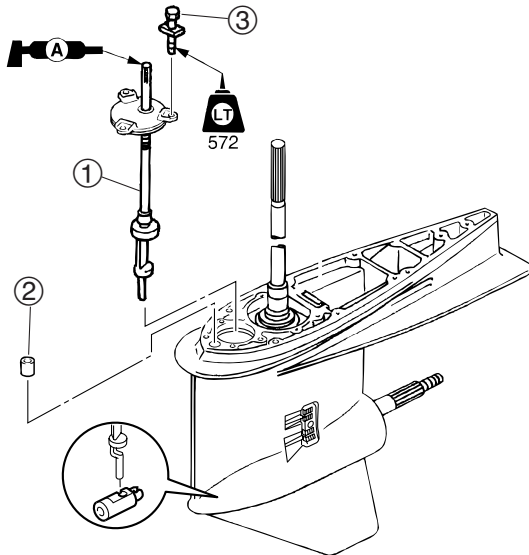
NOTE:
Apply LOCTITE 271 to the drive shaft housing bolts (4) and LOCTITE 572 to the bolts (6) before installation.

	Propeller shaft housing bolt (4) : 30 N·m (3.0 kgf·m, 22.1 ft·lb) Bolt (6) : 18 N·m (1.8 kgf·m, 13.3 ft·lb)
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Installing the water pump and shift rod

1. Install the shift rod assembly ① and seal ②.



6S360127

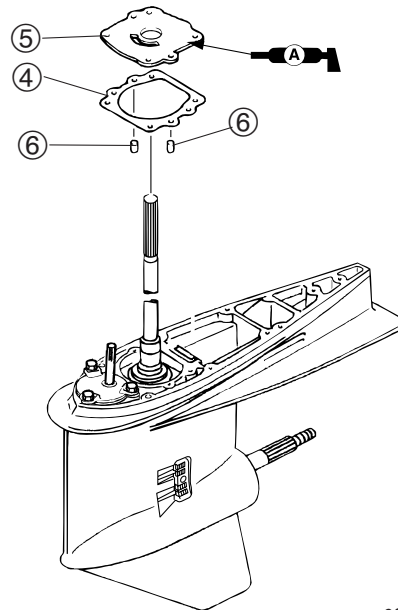


Shift rod cover bolt ③:
8 N·m (0.8 kgf·m, 5.9 ft·lb)

NOTE:

- Check the gear shift to the neutral position, when installing the shift rod.
- After assembling the lower unit, check that the shift rod operates smoothly, and check that the drive shaft and propeller shaft rotates smoothly.

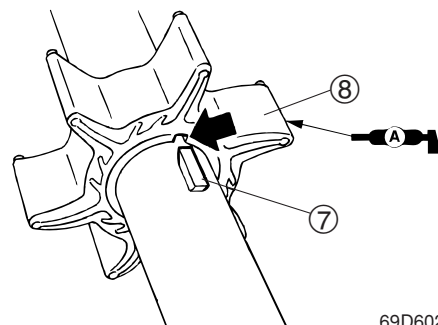
2. Install a new gasket ④, the outer plate cartridge ⑤, and dowels ⑥.



6S360128

3. Install the Woodruff key ⑦ into the drive shaft.

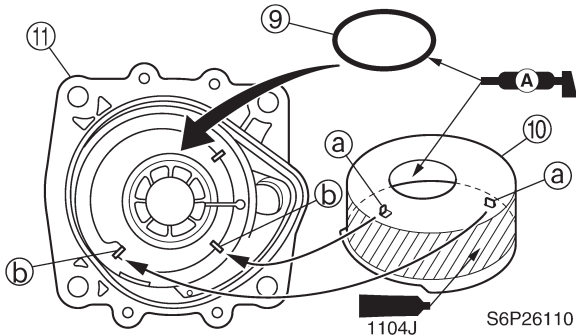
4. Align the groove in the impeller ⑧ with the Woodruff key ⑦, and then install the impeller onto the drive shaft.



69D60235

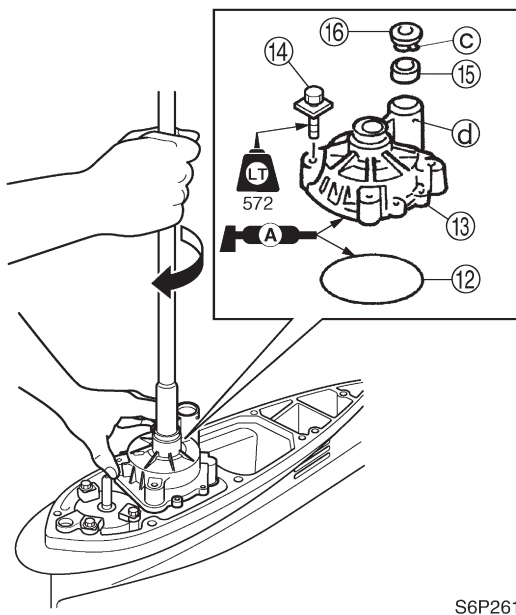
Drive shaft and lower case (regular rotation model)

- Install the new O-ring ⑨ and insert cartridge ⑩ into the pump housing ⑪.



NOTE: _____
Align the insert cartridge projections ① with the holes ② in the pump housing.

- Install the new O-ring ⑫ and pump housing assembly ⑬ into the lower case, tighten the bolts ⑭, and then install the seal ⑮ and cover ⑯.



CAUTION:

Do not turn the drive shaft counterclockwise, otherwise the water pump impeller may be damaged.



Water pump housing bolt ⑭:
18 N·m (1.8 kgf·m, 13.3 ft·lb)

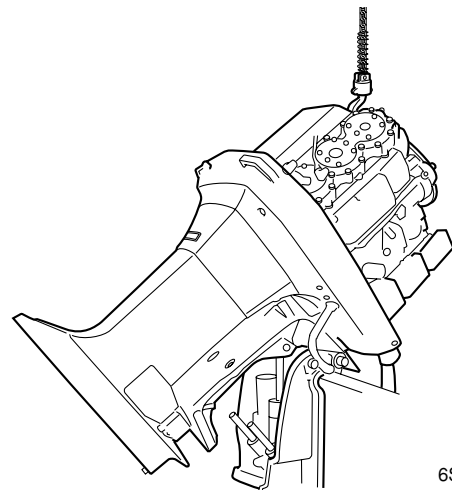
NOTE:

- When installing the pump housing, apply grease to the inside of the housing, and then turn the drive shaft clockwise while pushing down the pump housing.
- Align the cover projection ③ with the hole ④ in the pump housing.

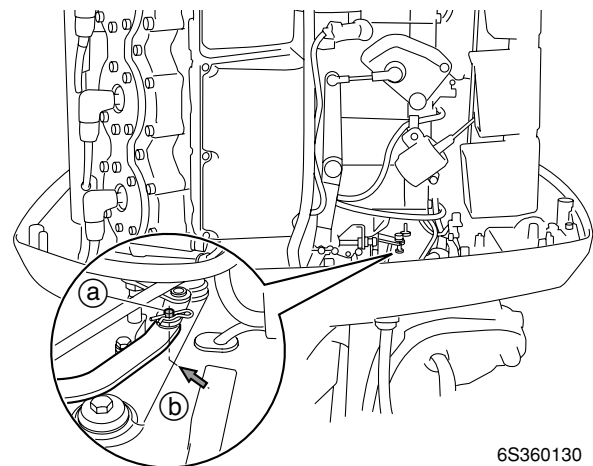
Installing the lower unit

WARNING

When installing the lower unit without removing the power unit, be sure to suspend the outboard motor. Otherwise, the outboard motor could suddenly fall and result in injury.

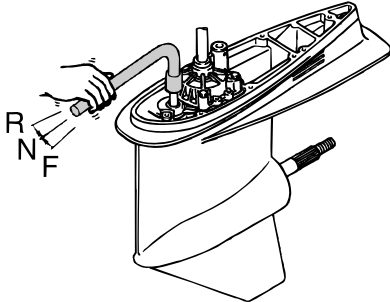


- Align the center of the set pin ① with the alignment mark ② on the bottom cowling.





- Set the gear shift to the neutral position at the lower unit. Make sure that the shift rod is in the neutral position using a special service tool.

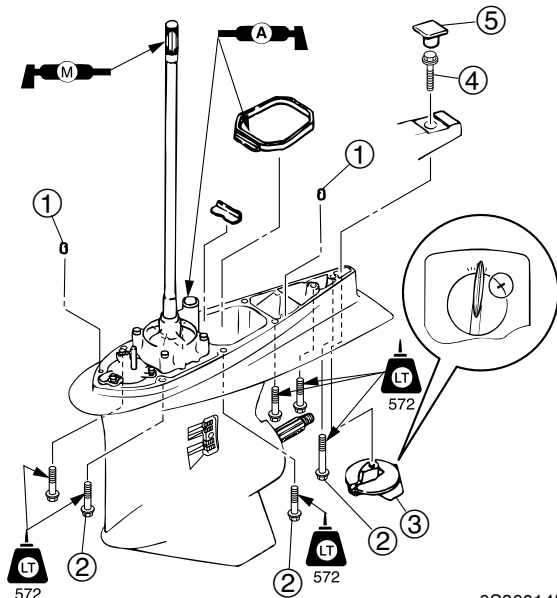


69D60036



Shift rod push arm:
90890-06052

- Install the 2 dowels ① into the lower unit.
- Install the lower unit into the upper case, and then tighten the lower case mount bolts ② to the specified torque.
- Install the trim tab ③ to its original position, and then tighten the trim tab bolt ④ to the specified torque.

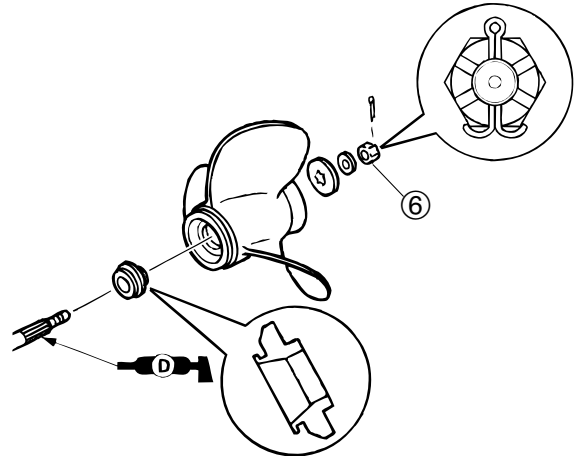


6S360145

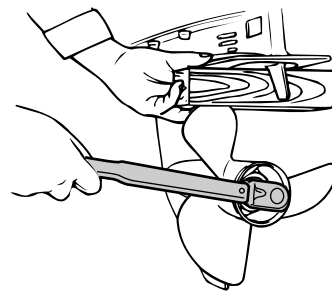


Lower case mount bolt ②:
47 N·m (4.7 kgf·m, 34.7 ft·lb)
Trim tab bolt ④:
42 N·m (4.2 kgf·m, 31.0 ft·lb)

- Install the grommet ⑤.
- Install the propeller and propeller nut ⑥, and then temporarily tighten the nut. Place a block of wood between the anti-cavitation plate and propeller to keep the propeller from turning, and then tighten the nut to the specified torque.



6G460280



6F660420

⚠WARNING

- Do not hold the propeller with your hands when loosening or tightening it.
- Be sure to disconnect the battery cables from the battery and remove the lock plate from the engine stop lanyard switch.
- Put a block of wood between the anti-cavitation plate and propeller to keep the propeller from turning.

NOTE:

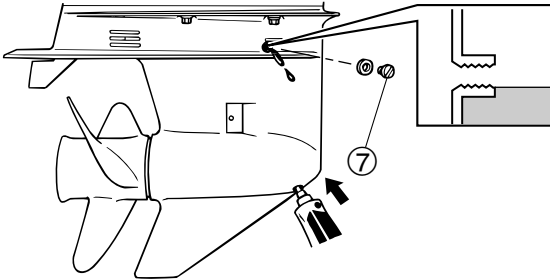
If the grooves in the propeller nut ⑥ do not align with the cotter pin hole, tighten the nut until they are aligned.

Drive shaft and lower case (regular rotation model)



Propeller nut ⑥:
54 N·m (5.4 kgf·m, 39.8 ft·lb)

8. Insert a gear oil tube or gear oil pump into the drain hole and slowly fill the gear oil until oil flows out of the check hole and no air bubbles are visible.



69D10050



Recommended gear oil:
Hypoid gear oil
API: GL-4
SAE: 90
Gear oil quantity:
1,150 cm³
(38.88 US oz, 40.56 Imp oz)

9. Install the new gasket, check screw ⑦ and quickly install the drain screw, then tighten to specified torque.

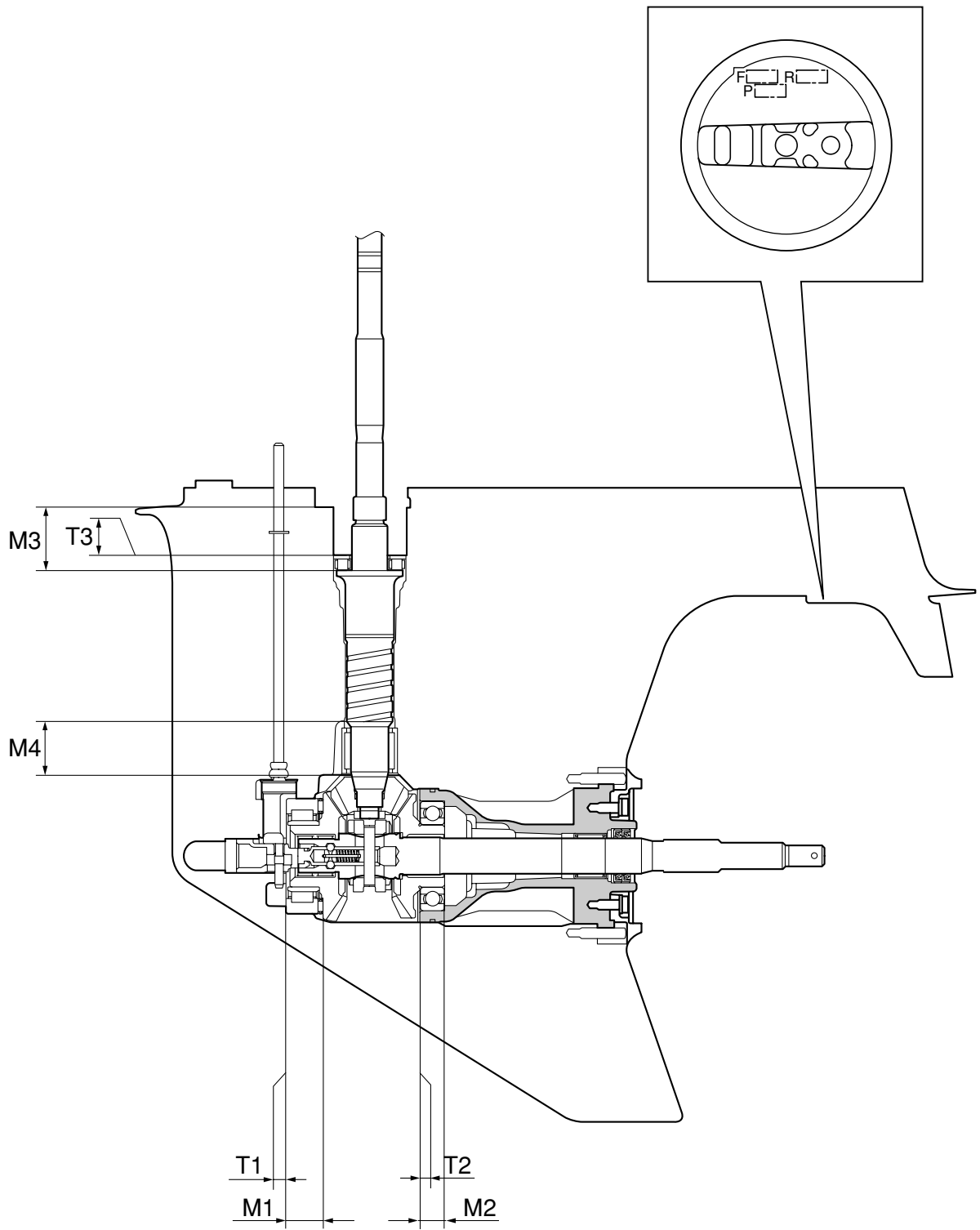


Check screw ⑦ and drain screw:
9 N·m (0.9 kgf·m, 6.6 ft·lb)

6



Shimming (regular rotation model)



6S36050EA

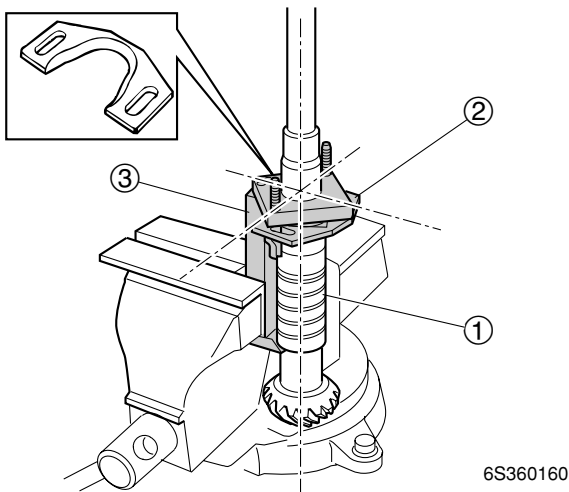
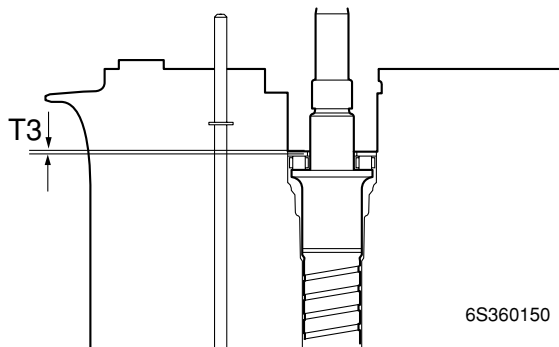
Shimming

NOTE:

- Shimming is not required when assembling the original lower case and inner parts.
- Shimming is required when assembling the original inner parts and a new lower case.
- Shimming is required when replacing the inner part(s).


Selecting the pinion shim

1. Install the special service tools onto the drive shaft ①.




NOTE:

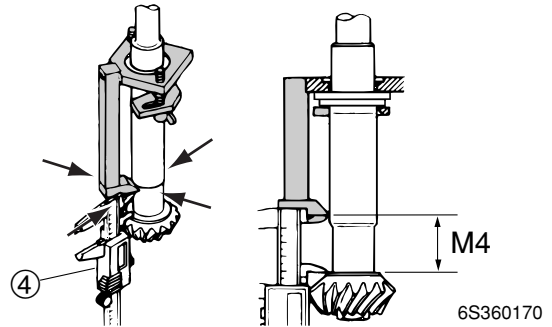
- Select the shim thickness (T3) by using the specified measurement(s) and the calculation formula.
- Install the special service tools onto the drive shaft so that the shaft is at the center of the hole.
- Tighten the wing nuts another 1/4 of a turn after they contact the fixing plate ②.

	Pinion height gauge ③: 90890-06710
---	---------------------------------------

2. Install the pinion and pinion nut, and then tighten the nut to the specified torque.


	Pinion nut: 142 N·m (14.2 kgf·m, 104.7 ft·lb)
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3. Measure the distance (M4) between the special service tool and the pinion as shown.

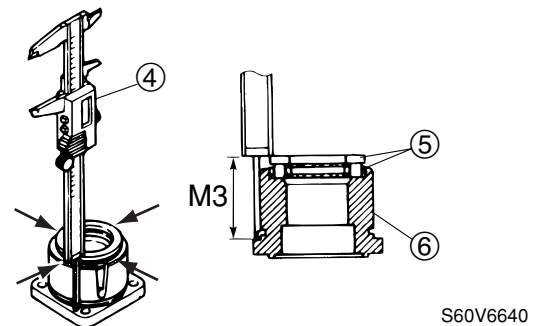


NOTE:

- Measure the pinion at 4 points to find the distance average.
- Make of note the each measurement numerical.

	Digital caliper ④: 90890-06704
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4. Turn the thrust bearing ⑤ 2 or 3 times to seat the drive shaft housing ⑥, and then measure the housing height (M3) as shown.

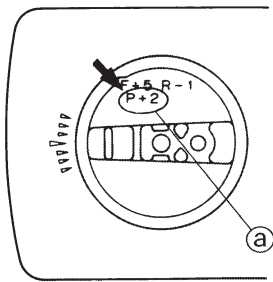


NOTE:

- Measure the thrust bearing at 4 points to find the height average.
- Make of note the each measurement numerical.



5. Calculate the pinion shim thickness (T3) as shown in the examples below.



6G460340

NOTE:

“P” is the deviation of the lower case dimension from standard. The “P” mark (a) is stamped on the trim tab mounting surface of the lower case in 0.01 mm units. If the “P” mark is unreadable, assume that “P” is zero and check the backlash when the unit is assembled.

Calculation formula:

$$\text{Pinion shim thickness (T3)} = 82.00 + P/100 - M3 - M4$$

Example:

If “M3” is 50.75 mm and “M4” is 30.57 mm and “P” is (+ 2), then

$$\begin{aligned} T3 &= 82.00 + (+ 2)/100 - 50.75 - 30.57 \text{ mm} \\ &= 82.00 + 0.02 - 50.75 - 30.57 \text{ mm} \\ &= 0.70 \text{ mm} \end{aligned}$$

6. Select the pinion shim(s) (T3) as follows.

Calculated numeral at 1/100th place	Rounded numeral
1, 2	0
3, 4, 5	2
6, 7, 8	5
9, 10	8

Available shim thicknesses:

0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm

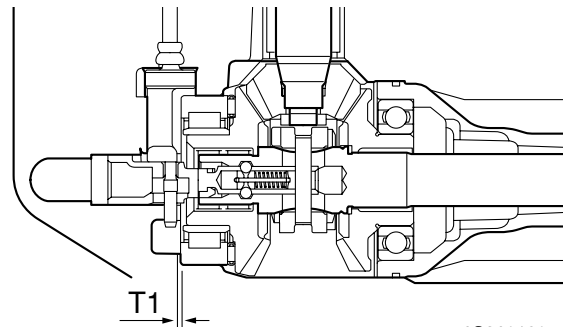
Example:

If “T3” is 0.70 mm, then the pinion shim is 0.68 mm.

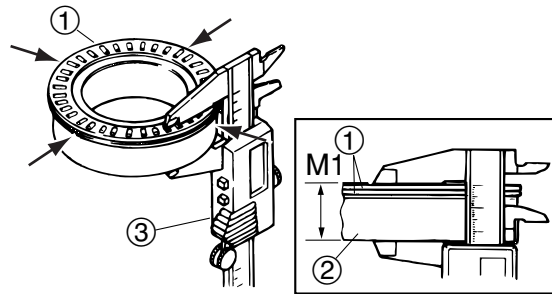
If “T3” is 0.74 mm, then the pinion shim is 0.72 mm.

Selecting the forward gear shim

1. Turn the thrust bearing (1) 2 or 3 times to seat the roller bearing outer race (2), and then measure the bearing height (M1) as shown.



6S360180



6S360185

NOTE:

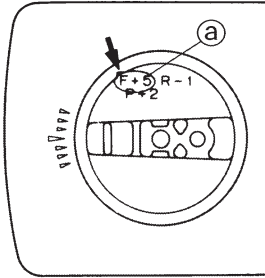
- Select the shim thickness (T1) by using the specified measurement(s) and the calculation formula.
- Measure the thrust bearing to seat the roller bearing at 4 points to find the height average.
- Make of note the each measurement numerical.



Digital caliper (3): 90890-06704

Shimming (regular rotation model)

2. Calculate the forward gear shim thickness (T1) as shown in the examples below.



6G460360

NOTE:

“F” is the deviation of the lower case dimension from standard. The “F” mark (a) is stamped on the trim tab mounting surface of the lower case in 0.01 mm units. If the “F” mark is unreadable, assume that “F” is zero and check the backlash when the unit is assembled.

Calculation formula:

$$\text{Forward gear shim thickness (T1)} = 30.60 + F/100 - M1$$

Example:

If “M1” is 30.20 mm and “F” is (+5), then

$$\begin{aligned} T1 &= 30.60 + (+5)/100 - 30.20 \text{ mm} \\ &= 30.60 + 0.05 - 30.20 \text{ mm} \\ &= 0.45 \text{ mm} \end{aligned}$$

If “M1” is 30.20 mm and “F” is (0), then

$$\begin{aligned} T1 &= 30.60 + (0)/100 - 30.20 \text{ mm} \\ &= 30.60 + 0 - 30.20 \text{ mm} \\ &= 0.40 \text{ mm} \end{aligned}$$

3. Select the forward gear shim(s) (T1) as follows.

Calculated numeral at 1/100th place	Rounded numeral
1, 2	0
3, 4, 5	2
6, 7, 8	5
9, 10	8

Available shim thicknesses:

0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm

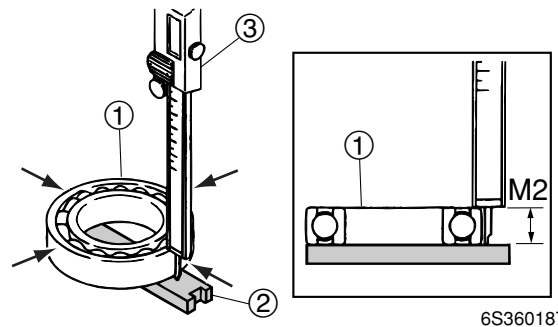
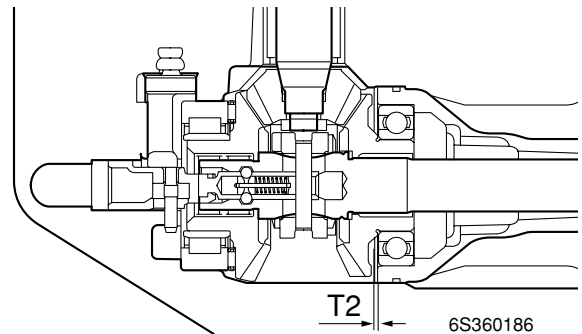
Example:

If “T1” is 0.45 mm, then the forward gear shim is 0.42 mm.

If “T1” is 0.40 mm, then the forward gear shim is 0.38 mm.

Selecting the reverse gear shim

1. Measure the bearing (1) height (M2) as shown.



6S360187

NOTE:

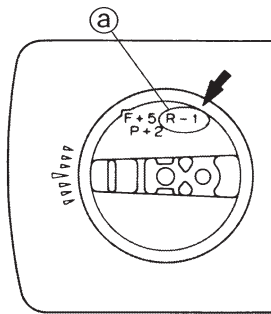
- Select the shim thickness (T2) by using the specified measurement(s) and the calculation formula.
- Measure the reverse gear at 4 points to find the height average.
- Make of note the each measurement numerical.



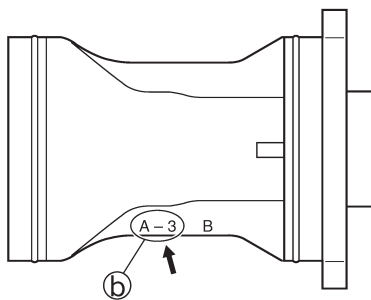
Shimming plate (2): 90890-06701
Digital caliper (3): 90890-06704



2. Calculate the reverse gear shim thickness (T2) as shown in the examples below.



6G460380



S69J6625

NOTE:

“R” is the deviation of the lower case dimension from standard, and “A” is the deviation of the propeller shaft housing from standard. The “R” mark (a) is stamped on the trim tab mounting surface of the lower case, and the “A” mark (b) is stamped on the propeller shaft housing in 0.01 mm units. If the “R” mark or “A” mark is unreadable, assume that “R” and “A” are zero and check the backlash when the unit is assembled.

Calculation formula:

$$\text{Reverse gear shim thickness (T2)} = 21.00 - R/100 - A/100 - M2$$

Example:

If “M2” is 19.92 mm and “R” is (- 1) and “A” is (- 3), then

$$\begin{aligned} T2 &= 21.00 - (- 1)/100 - (- 3)/100 \\ &= 21.00 + 0.01 + 0.03 - 19.92 \text{ mm} \\ &= 1.10 \text{ mm} \end{aligned}$$

If “M2” is 19.92 mm and “R” is (+ 3) and “A” is (- 5), then

$$\begin{aligned} T2 &= 21.00 - (+ 3)/100 - (- 5)/100 \\ &= 21.00 - 0.03 + 0.05 - 19.92 \text{ mm} \\ &= 1.16 \text{ mm} \end{aligned}$$

3. Select the reverse gear shim(s) (T2) as follows.

Calculated numeral at 1/100th place	Rounded numeral
1, 2	0
3, 4, 5	2
6, 7, 8	5
9, 10	8

Available shim thicknesses:

0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm

Example:

If “T2” is 1.10 mm, then the reverse gear shim is 1.08 mm.

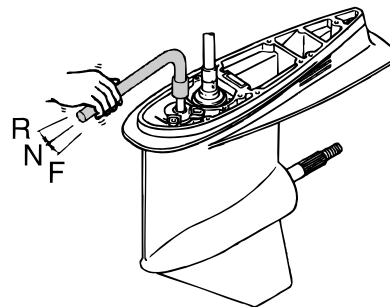
If “T2” is 1.16 mm, then the reverse gear shim is 1.15 mm.

Backlash

(regular rotation model)

Measuring the forward and reverse gear backlash

1. Remove the water pump assembly.
2. Set the gear shift to the neutral position at the lower unit.



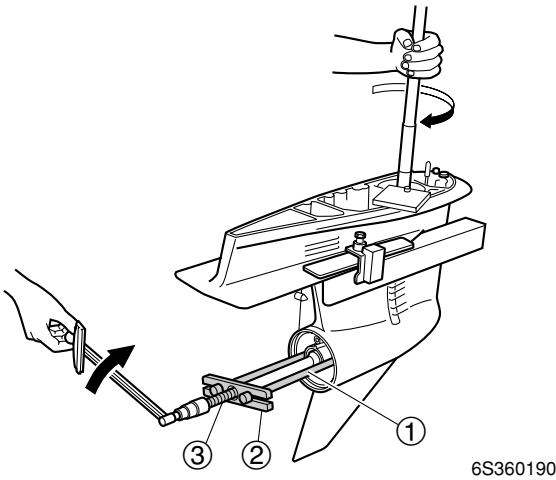
69D60035




Shift rod push arm:
90890-06052


Shimming (regular rotation model)/Backlash (regular rotation model)

3. Install the special service tools so that it pushes against the propeller shaft.



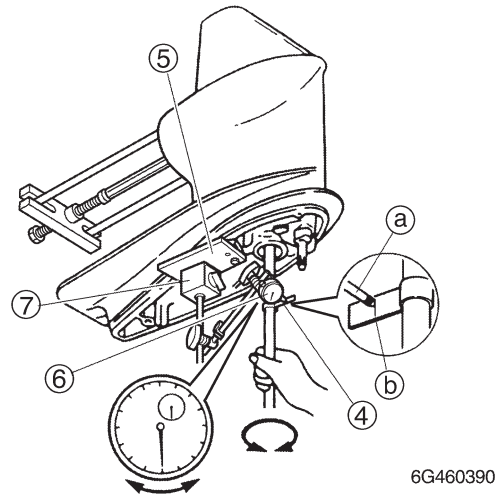
NOTE: While turning the drive shaft clockwise 5-6 times to contact the gear evenly it tightens center bolt ③ to specified torque.

 Center bolt ③:
5 N·m (0.5 kgf·m, 3.7 ft·lb)


 Bearing housing puller claw L ①:
90890-06502
Stopper guide plate ②:
90890-06501
Center bolt ③: 90890-06504

4. Install the backlash indicator onto the drive shaft (22.4 mm [0.88 in] in diameter), then the dial gauge onto the lower unit.


5. Set the lower unit upside down.



NOTE: Install the dial gauge so that the plunger ① contacts the mark ② on the backlash indicator.

 Backlash indicator ④: 90890-06706
Magnet base plate ⑤: 90890-07003
Dial gauge set ⑥: 90890-01252
Magnet base B ⑦: 90890-06844

6. Slowly turn the drive shaft clockwise and counterclockwise, and measure the backlash when the drive shaft stops in each direction.

 Forward gear backlash:
0.13 – 0.45 mm
(0.0051–0.0177 in)

7. Add or remove shim(s) if out of specification.

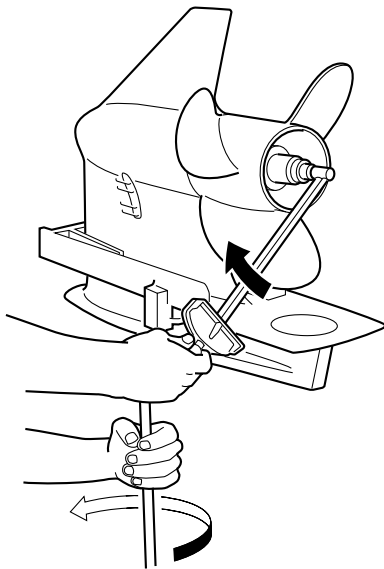
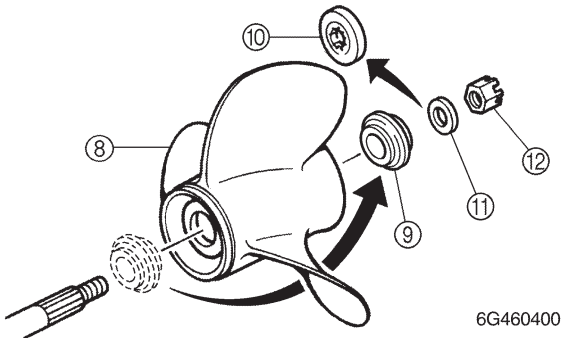
Forward gear backlash	Shim thickness
Less than 0.13 mm (0.0051 in)	To be decreased by $(0.29 - M) \times 0.78$
More than 0.45 mm (0.0177 in)	To be increased by $(M - 0.29) \times 0.78$

M: Measurement

Available shim thicknesses:
0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm




8. Remove the special service tools from the propeller shaft.
9. Apply a load to the reverse gear by installing the propeller (8), the spacer (9) (without the washer (10)), then the washer (11) as shown.

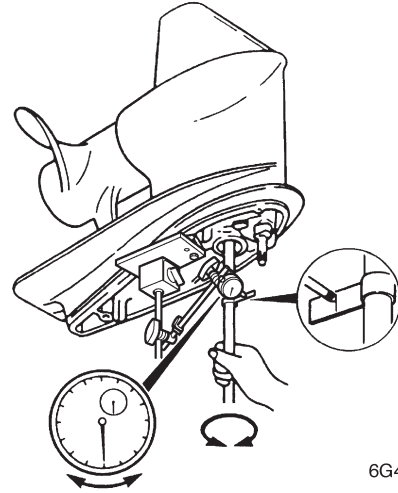


6S360200


NOTE: While turning the drive shaft clockwise and counterclockwise 5-6 times to contact the gear evenly it tightens propeller nut (12) to specified torque.

	<p>Propeller nut (12): 5 N·m (0.5 kgf·m, 3.7 ft·lb)</p>
---	---

10. Slowly turn the drive shaft clockwise and counterclockwise, and measure the backlash when the drive shaft stops in each direction.



6G460410

	<p>Reverse gear backlash: 0.64–0.93 mm (0.0252–0.0366 in)</p>
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11. Add or remove shim(s) if out of specification.

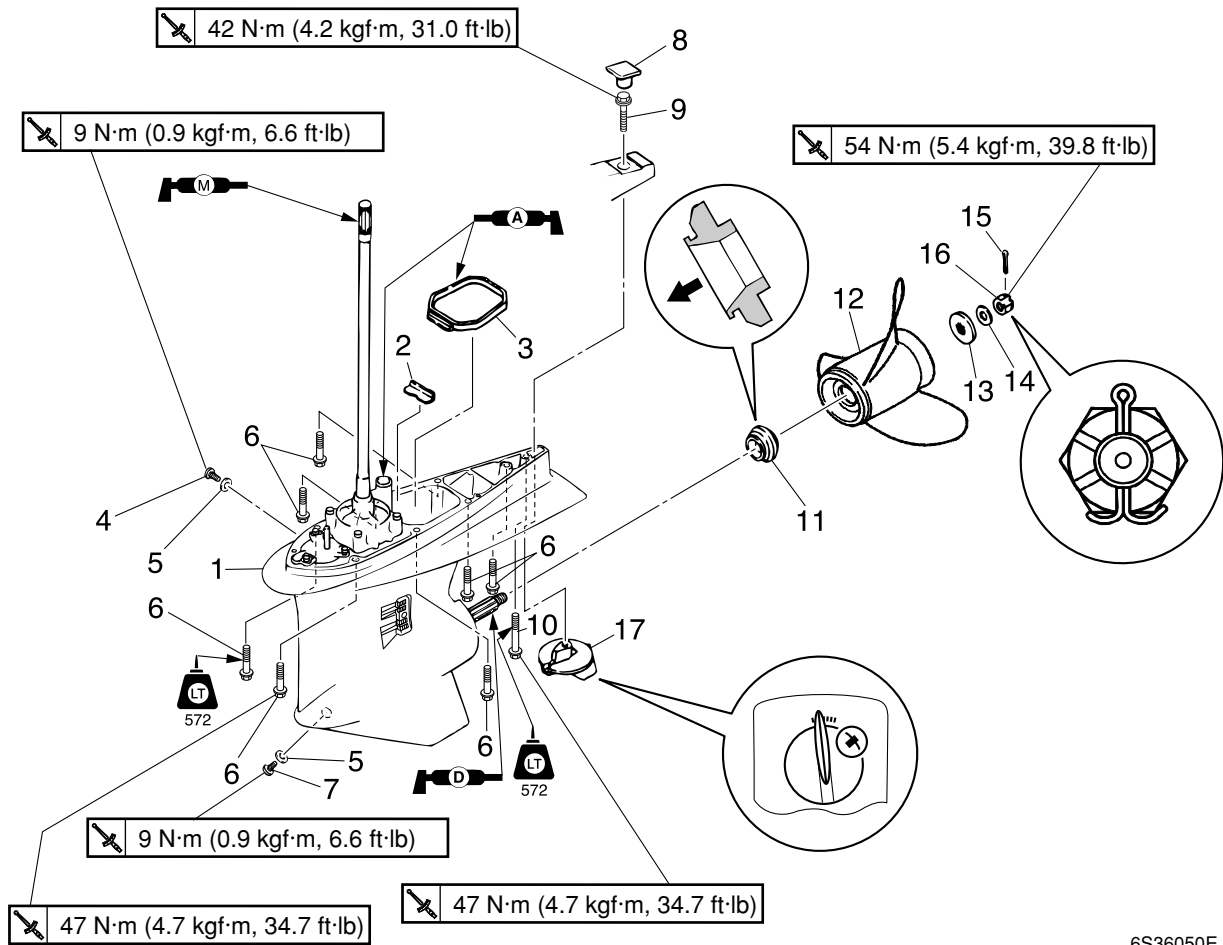
Reverse gear backlash	Shim thickness
Less than 0.64 mm (0.0251 in)	To be decreased by $(0.79 - M) \times 0.78$
More than 0.93 mm (0.0366 in)	To be increased by $(M - 0.79) \times 0.78$

M: Measurement

<p>Available shim thicknesses: 0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm</p>

12. Remove the special service tools, and then install the water pump assembly.

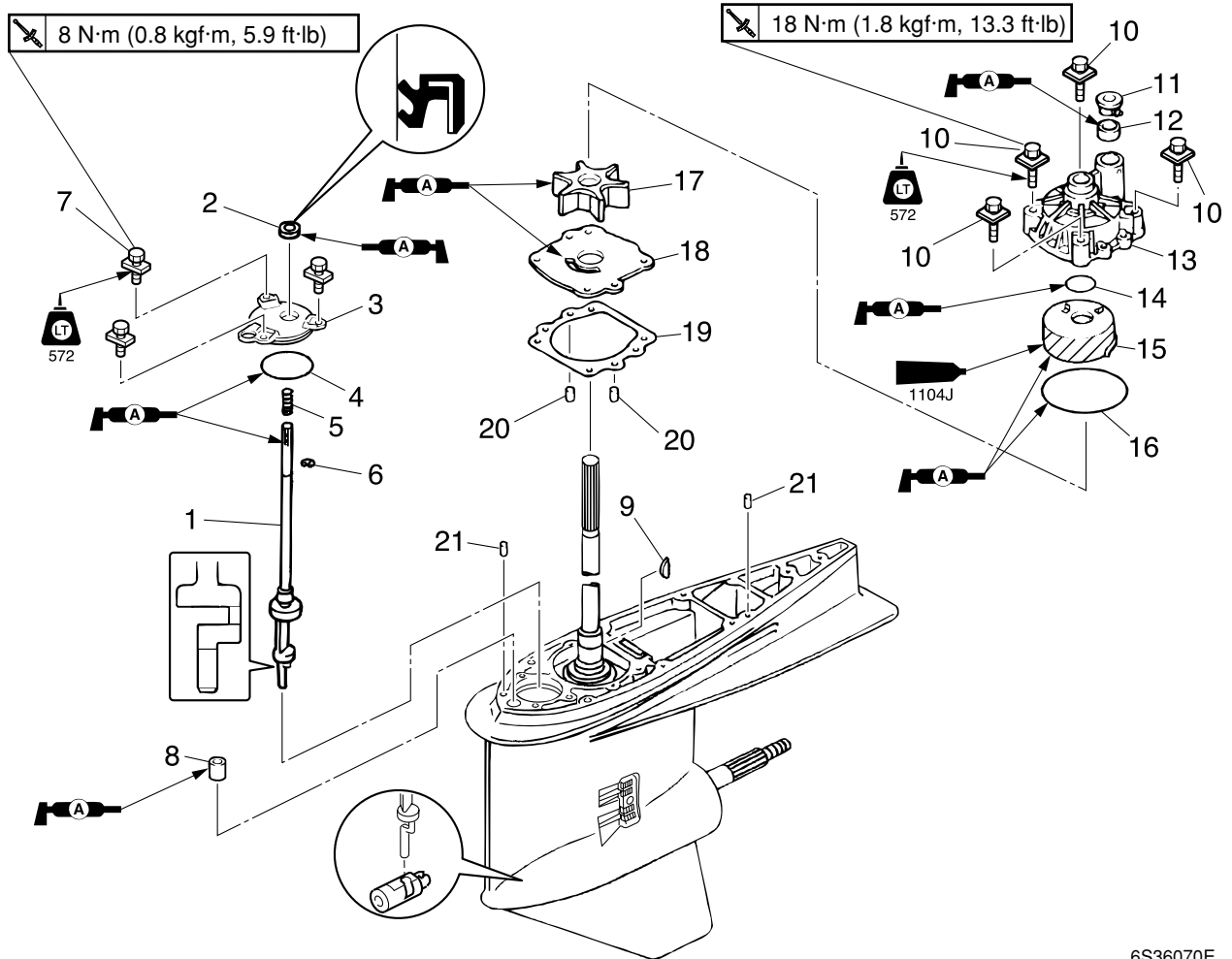
Lower unit (counter rotation model)



6S36050E

6

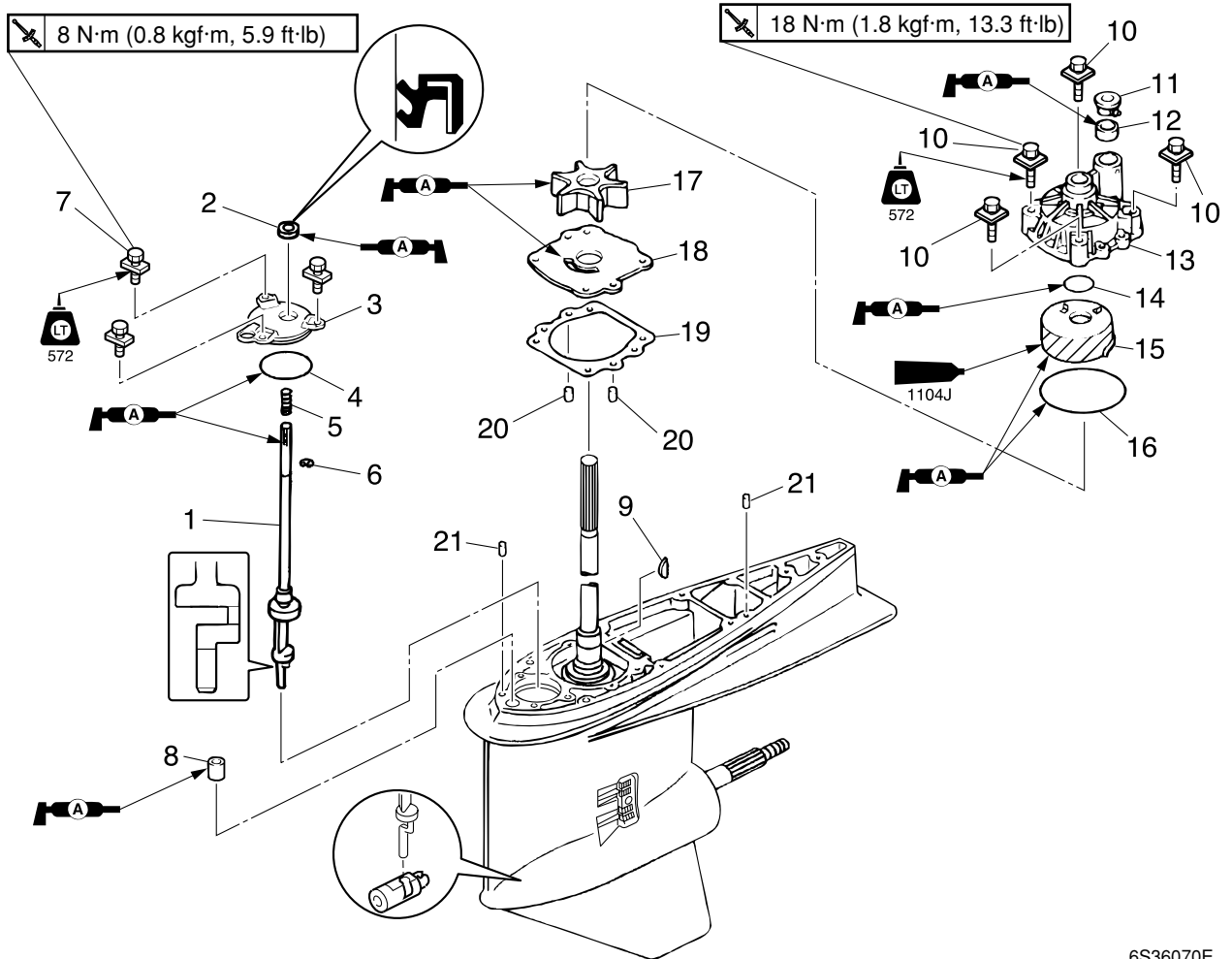
No.	Part name	Q'ty	Remarks
1	Lower unit	1	
2	Plate	1	
3	Rubber seal	1	
4	Check screw	1	
5	Gasket	2	Not reusable
6	Bolt	7	M10 × 45 mm
7	Drain screw	1	
8	Grommet	1	
9	Bolt	1	M10 × 45 mm
10	Bolt	1	M10 × 70 mm
11	Spacer	1	
12	Propeller	1	
13	Washer	1	
14	Washer	1	
15	Cotter pin	1	Not reusable
16	Propeller nut	1	
17	Trim tab	1	



6S36070E

No.	Part name	Q'ty	Remarks
1	Shift rod	1	
2	Oil seal	1	Not reusable
3	Cover	1	
4	O-ring	1	Not reusable
5	Spring	1	
6	Circlip	1	
7	Bolt	3	M6 × 20 mm
8	Seal	1	
9	Woodruff key	1	
10	Bolt	4	M8 × 45 mm
11	Cover	1	
12	Seal	1	
13	Water pump housing	1	
14	O-ring	1	Not reusable
15	Insert cartridge	1	
16	O-ring	1	Not reusable
17	Impeller	1	

Lower unit (counter rotation model)



6S36070E

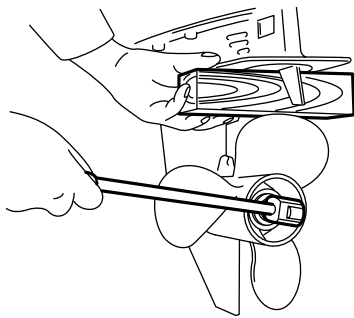
6

No.	Part name	Q'ty	Remarks
18	Outer plate cartridge	1	
19	Gasket	1	Not reusable
20	Dowel	2	
21	Dowel	2	

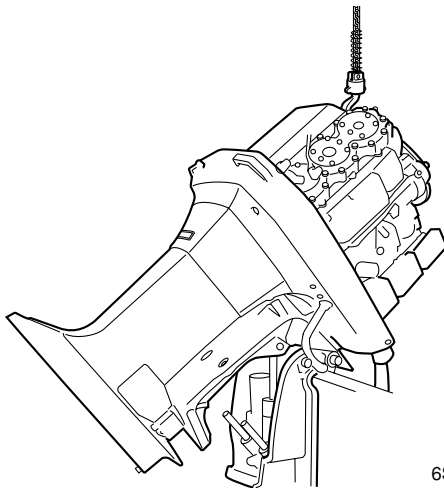


Removing the lower unit

1. Drain the gear oil. For draining procedures, see Chapter 3, "Changing the gear oil."
2. Set the gear shift to the neutral position, and place a block of wood between the anti-cavitation plate and propeller to keep the propeller from turning, and then remove the propeller nut and propeller.

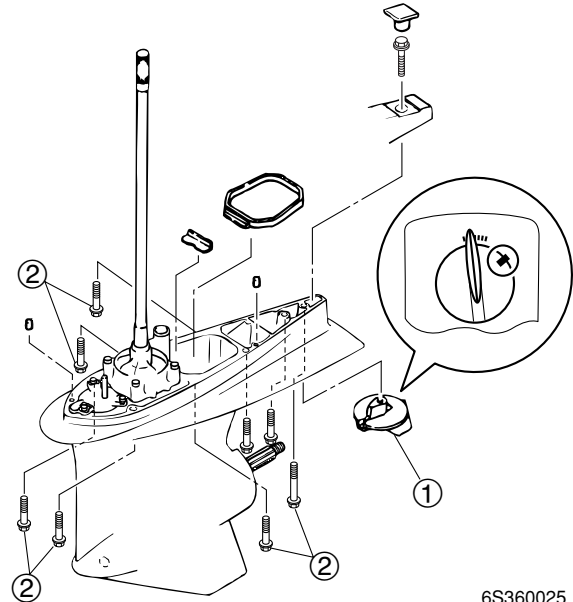


6G460420



6S360010

3. Mark the trim tab ① at the area shown, and then remove it.
4. Loosen the bolts ②, and then remove the lower unit from the upper case.



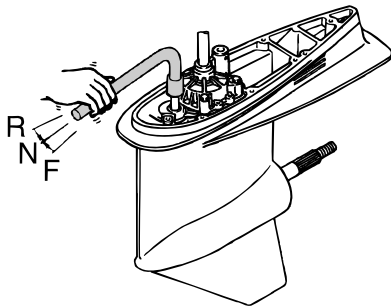
6S360025

⚠ WARNING

- Do not hold the propeller with your hands when loosening or tightening it.
- Be sure to disconnect the battery cables from the battery and the lock plate from the engine stop lanyard switch.
- Put a block of wood between the anti-cavitation plate and propeller to keep the propeller from turning.
- When removing the lower unit without removing the power unit, be sure to suspend the outboard motor. Otherwise, the outboard motor could suddenly fall and result in injury.

Removing the water pump and shift rod

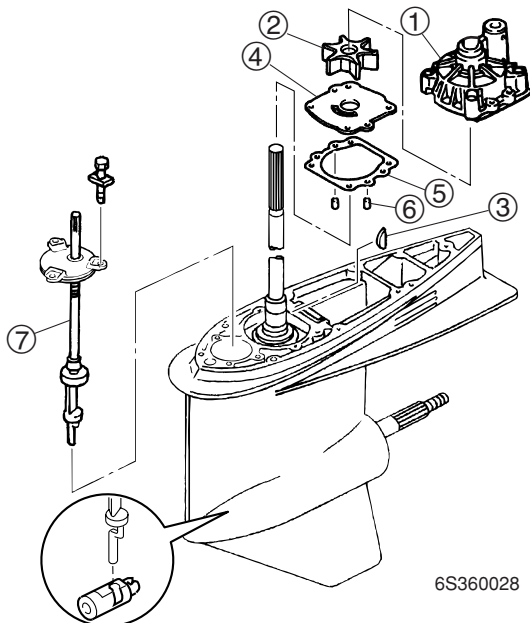
1. Remove the water pump housing ① and impeller ②.
2. Remove the woodruff key ③.
3. Remove the outer plate cartridge ④, gasket ⑤ and dowels ⑥.
4. Set the gear shift to the neutral position at the lower unit. Make sure that the shift rod is in the neutral position using a special service tool.



69D60036

	Shift rod push arm: 90890-06052
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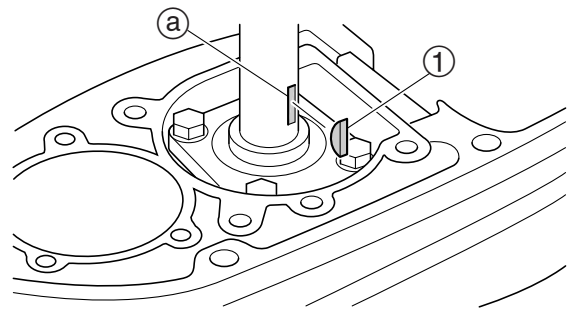
5. Remove the shift rod assembly ⑦.



6S360028

Checking the water pump and shift rod

1. Check the water pump housing. Replace if there is deformation.
2. Check the impeller and insert cartridge. Replace if cracked or worn.
3. Check the Woodruff key ① and the groove ① on the drive shaft. Replace if worn.

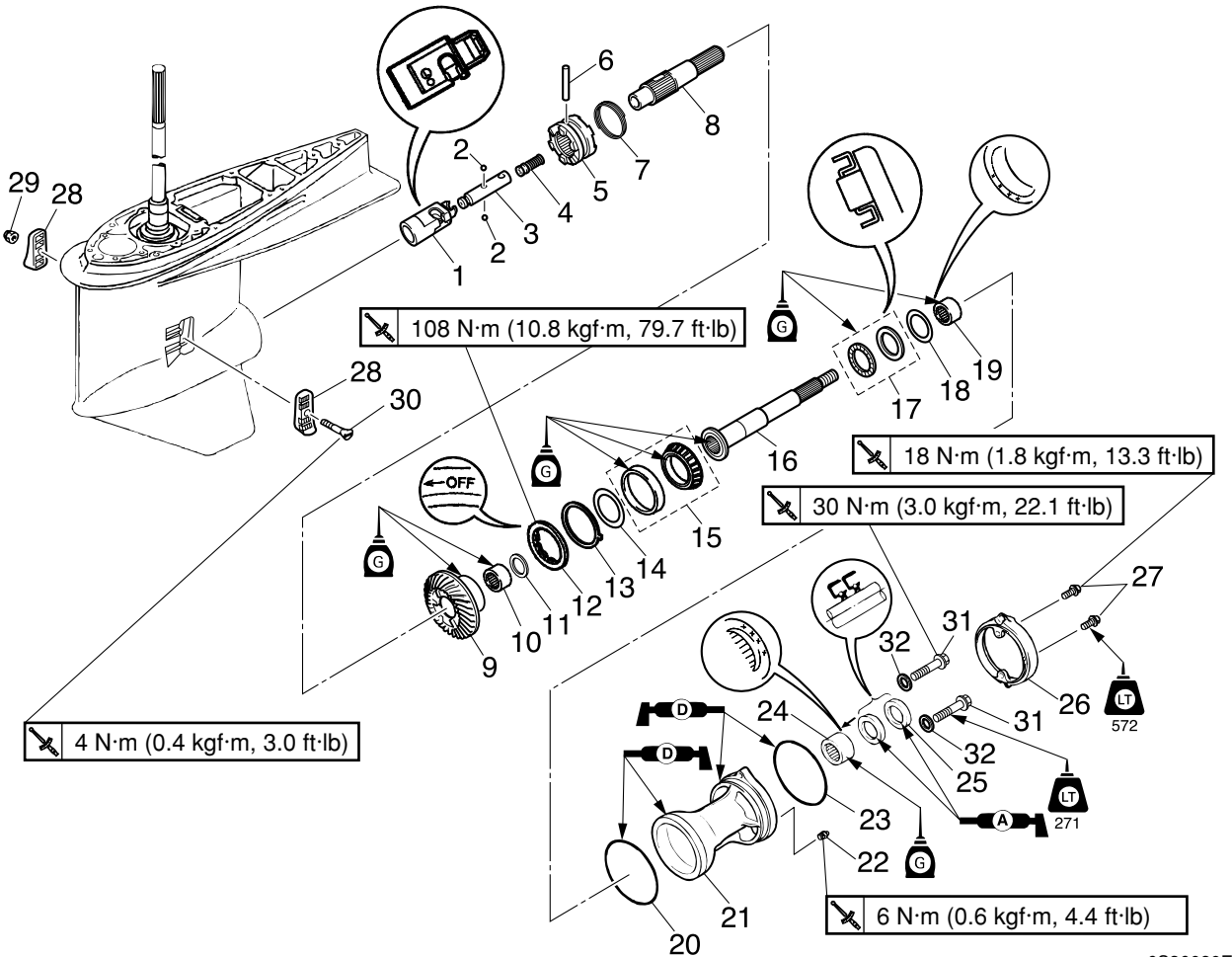


6S360027

4. Check the shift rod. Replace if cracked or worn.



Propeller shaft housing (counter rotation model)



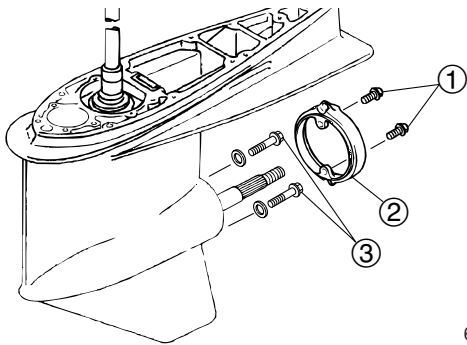
6S36080E

No.	Part name	Q'ty	Remarks
1	Shift rod joint	1	
2	Ball	2	
3	Shift slider	1	
4	Shift plunger	1	
5	Dog clutch	1	
6	Cross pin	1	
7	Spring	1	
8	Propeller shaft 1	1	
9	Forward gear	1	
10	Needle bearing	1	Not reusable
11	Bushing	1	
12	Ring nut	1	
13	Claw washer	1	
14	Forward gear shim	—	
15	Taper roller bearing	1	Not reusable
16	Propeller shaft 2	1	
17	Thrust bearing	1	



Removing the propeller shaft housing assembly

1. Remove the bolts ①, ring ② and bolts ③.

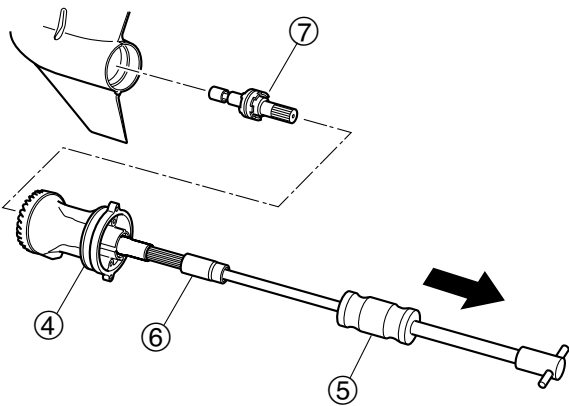


6S360030

NOTE:

Before removing the propeller shaft from the lower case, remove the shift rod.

2. Pull out the propeller shaft housing assembly ④.



6S360220

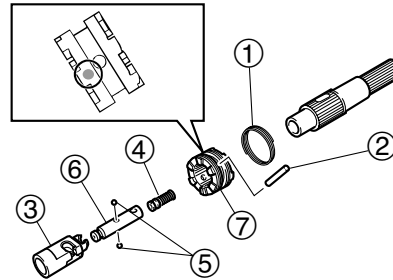


Slide hammer handle ⑤:
90890-06531
Puller head ⑥: 90890-06514

3. Remove the propeller shaft assembly 1 ⑦ from lower case.

Disassembling the propeller shaft assembly 1

1. Remove the spring ①, and then remove the cross pin ②, shift rod joint ③, shift plunger ④, balls ⑤, shift slider ⑥, and dog clutch ⑦.



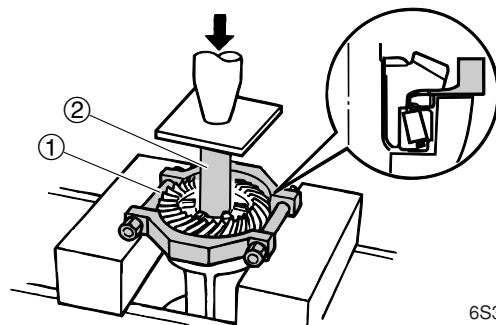
6S360230

NOTE:

Mark the front side of the dog clutch ⑦.

Disassembling the propeller shaft assembly 2

1. Remove the forward gear and forward gear shim(s) from the propeller shaft housing using a press.



6S360240



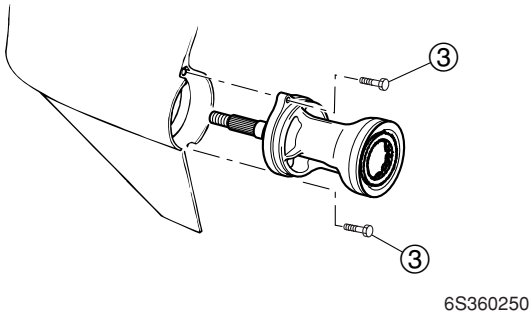
Bearing separator ①: 90890-06534
Pressure pin B ②: 90890-02390

NOTE:

Use a pressure pin B ② or proper size extension (D = 25 mm, L = 160 mm).

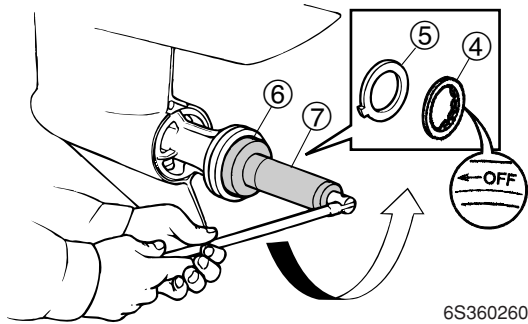
Propeller shaft housing (counter rotation model)


2. Install the propeller shaft housing assembly in the reverse direction into the lower case.



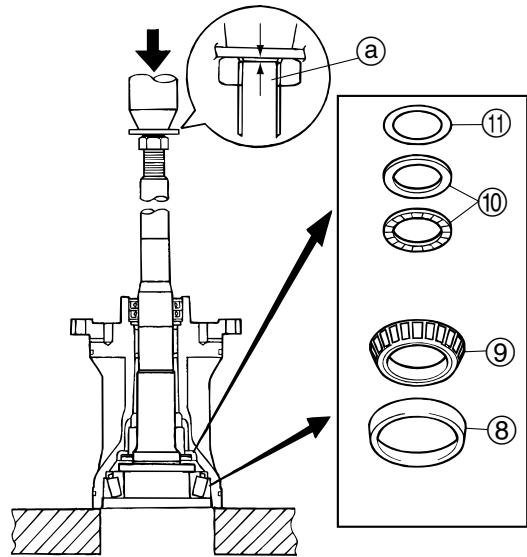
NOTE: _____
Use M8 bolt (3) for mount the propeller housing.

3. Remove the ring nut (4) and claw washer (5) using the special service tools.



 Ring nut wrench 4 (6): 90890-06510
Ring nut wrench extension (7): 90890-06513

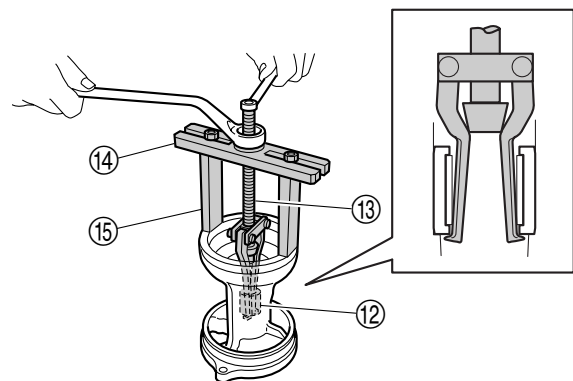
4. Remove the bearing outer race (8), taper roller bearing (9), thrust bearing (10), and propeller shaft shim(s) (11) using a press.




CAUTION: _____

- Do not press the propeller shaft threads (a) directly.
- Do not reuse the taper roller bearing, always replace it with a new one.

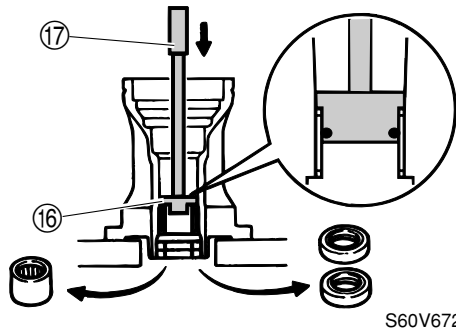
5. Remove the needle bearing (12)



 Bearing puller assembly (13): 90890-06535
Stopper guide plate (14): 90890-06501
Stopper guide stand (15): 90890-06538



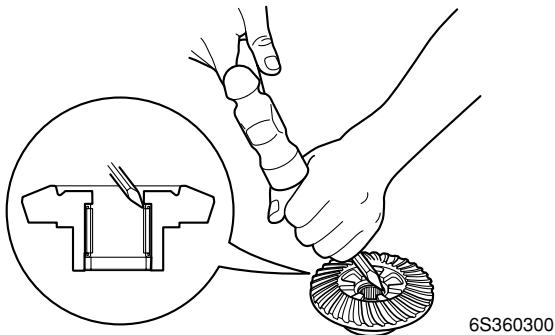
- Remove the oil seals and needle bearing.



Needle bearing attachment (16):
90890-06611
Driver rod L3 (17): 90890-06652

Disassembling the forward gear

- Remove the needle bearing and bushing from the forward gear using the chisel.



CAUTION:

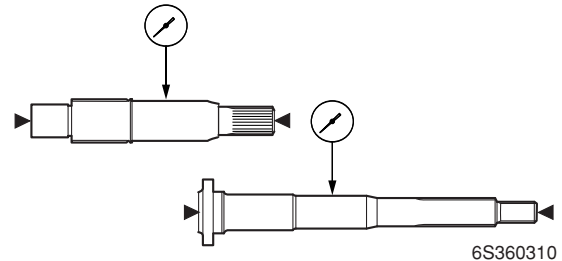
Do not reuse the bearing, always replace it with a new one.

Checking the propeller shaft housing

- Clean the propeller shaft housing using a soft brush and cleaning solvent, and then check it. Replace if cracked or damaged.
- Check the bearings. Replace if pitted or if there is rumbling.

Checking the propeller shaft

- Check the each propeller shaft. Replace if bent or worm the spline.
- Measure the propeller shaft runout.

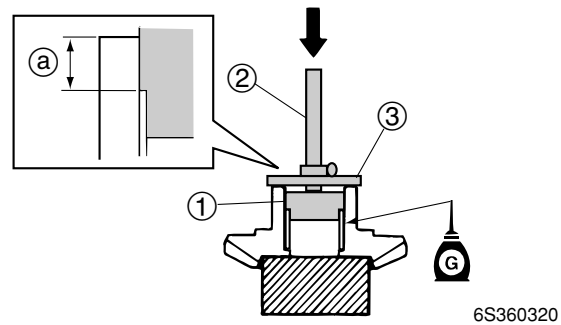


Runout limit: 0.02 mm (0.0008 in)

- Check the dog clutch, shift rod joint, and slider. Replace if cracked or worn.

Assembling the forward gear

- Install the new needle bearing into the forward gear to the specified depth.



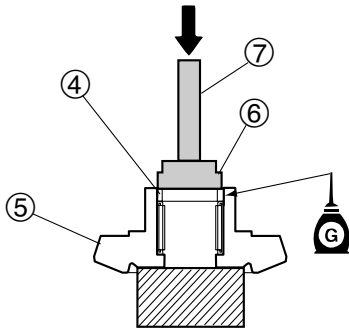
Needle bearing attachment (1):
90890-06610
Driver rod SS (2): 90890-06604
Bearing depth plate (3):
90890-06603



Depth (a):
11.75–12.25 mm (0.46–0.48 in)

Propeller shaft housing (counter rotation model)

- Install the new bushing (4) into the forward gear (5).



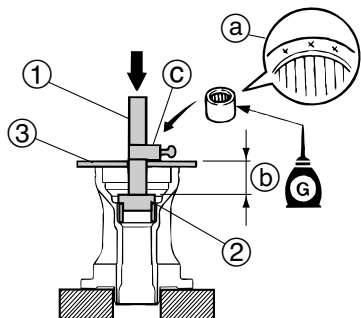
6S360340



Needle bearing attachment (6):
90890-06653
Driver rod LS (7): 90890-06606

Assembling the propeller shaft housing

- Install the needle bearing into the propeller shaft housing to the specified depth.



6S360350

NOTE:

- Install the needle bearing with the manufacture identification mark (a) facing toward the forward gear side.
- Be careful not to let the stopper (c) get out of position when using the driver rod SS (1).

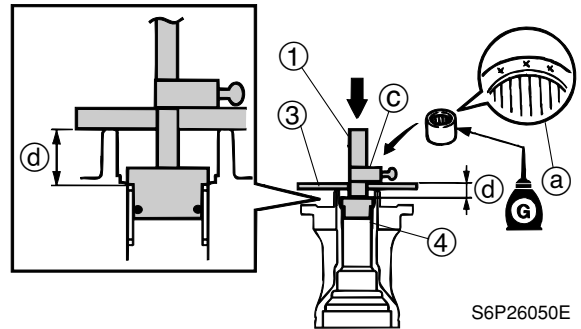


Driver rod SS (1): 90890-06604
Needle bearing attachment (2):
90890-06608
Bearing depth plate (3):
90890-06603



Depth (b):
44.75–45.25 mm (1.76–1.78 in)

- Install the needle bearing into the propeller shaft housing to the specified depth.



S6P26050E

NOTE:

- Install the needle bearing with the manufacture identification mark (a) facing toward the oil seal (propeller side).
- Be careful not to let the stopper (c) get out of position when using the driver rod SS (1).

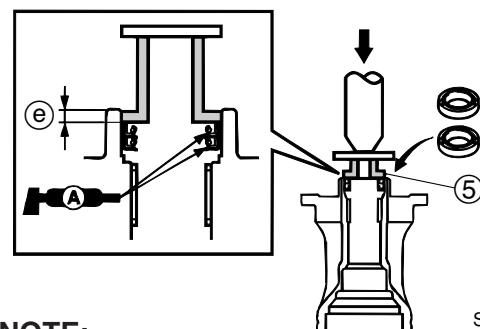


Driver rod SS (1): 90890-06604
Bearing depth plate (3):
90890-06603
Needle bearing attachment (4):
90890-06610



Depth (d):
25.05 – 25.55 mm (0.98 – 1.00 in)

- Apply grease to new oil seals, and then install them into the propeller shaft housing using a press to the specified depth.



S6P26060E

NOTE:

Install an oil seal halfway into the propeller shaft housing, then the other oil seal.



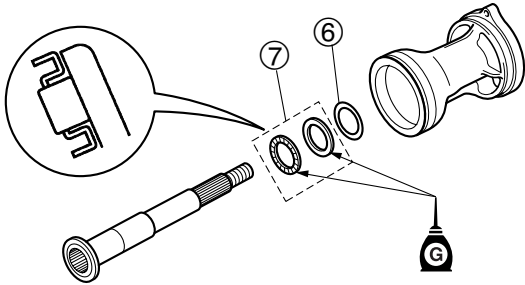
Bearing inner race attachment (5):
90890-06640



Depth (e):
4.75–5.25 mm (0.187–0.207 in)



4. Install the original shim(s) ⑥ and thrust bearing ⑦ with the propeller shaft 2 into the propeller shaft housing.

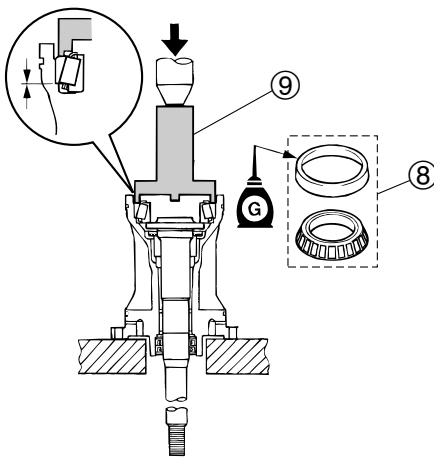


6S360360

NOTE:

- Be sure to select the propeller shaft shim(s) if replacing the propeller shaft, propeller shaft housing, thrust bearing or taper roller bearing.
- To select the shim(s), see “Shimming (counter rotation model).”

5. Install a new taper roller bearing ⑧ into the propeller shaft housing using a press.

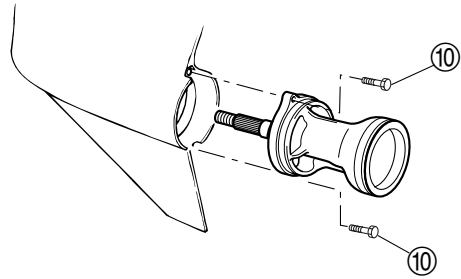


6S360370



Ring nut wrench ⑨: 90890-06578

6. Install the propeller shaft housing assembly in the reverse direction into the lower case.

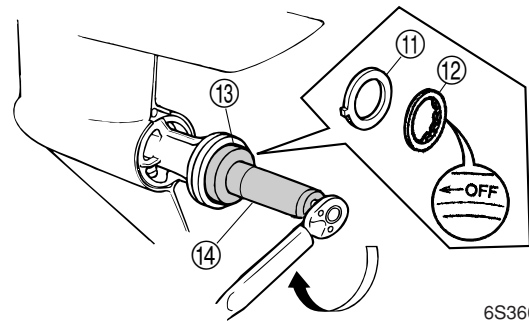


6S360255

NOTE:

Use M8 bolt ⑩ for mount the propeller housing.

7. Install the claw washer ⑪ and ring nut ⑫, and then tighten the ring nut to the specified torque.



6S360370



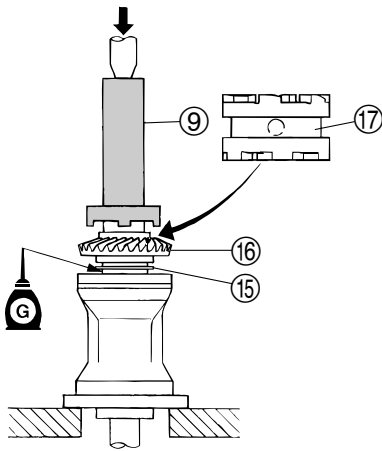
Ring nut wrench 4 ⑬: 90890-06510
 Ring nut wrench extension ⑭:
 90890-06513



Ring nut ⑫:
 108 N·m (10.8 kgf·m, 79.7 ft·lb)

Propeller shaft housing (counter rotation model)

8. Install the original shim(s) ⑮, forward gear ⑯, and dog clutch ⑰ using a press.



S6S16210

NOTE:

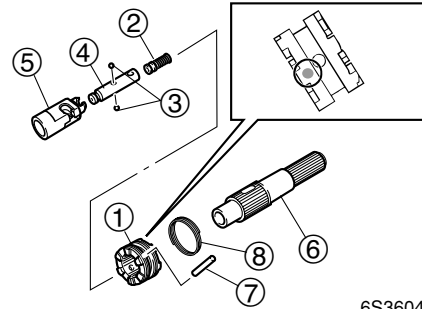
- Be sure to select the forward gear shim(s) if replacing the propeller shaft housing, taper roller bearing, or lower case.
- To select shim(s), see "Shimming (counter rotation model)."
- After installing the forward gear, check that the propeller shaft and forward gear rotates smoothly.



Ring nut wrench ⑨: 90890-06578

Assembling the propeller shaft assembly 1

1. Install the dog clutch ①, shift plunger ②, ball ③, slider ④ and shift rod joint ⑤, into the propeller shaft ⑥, and then install the cross pin ⑦ and spring ⑧.

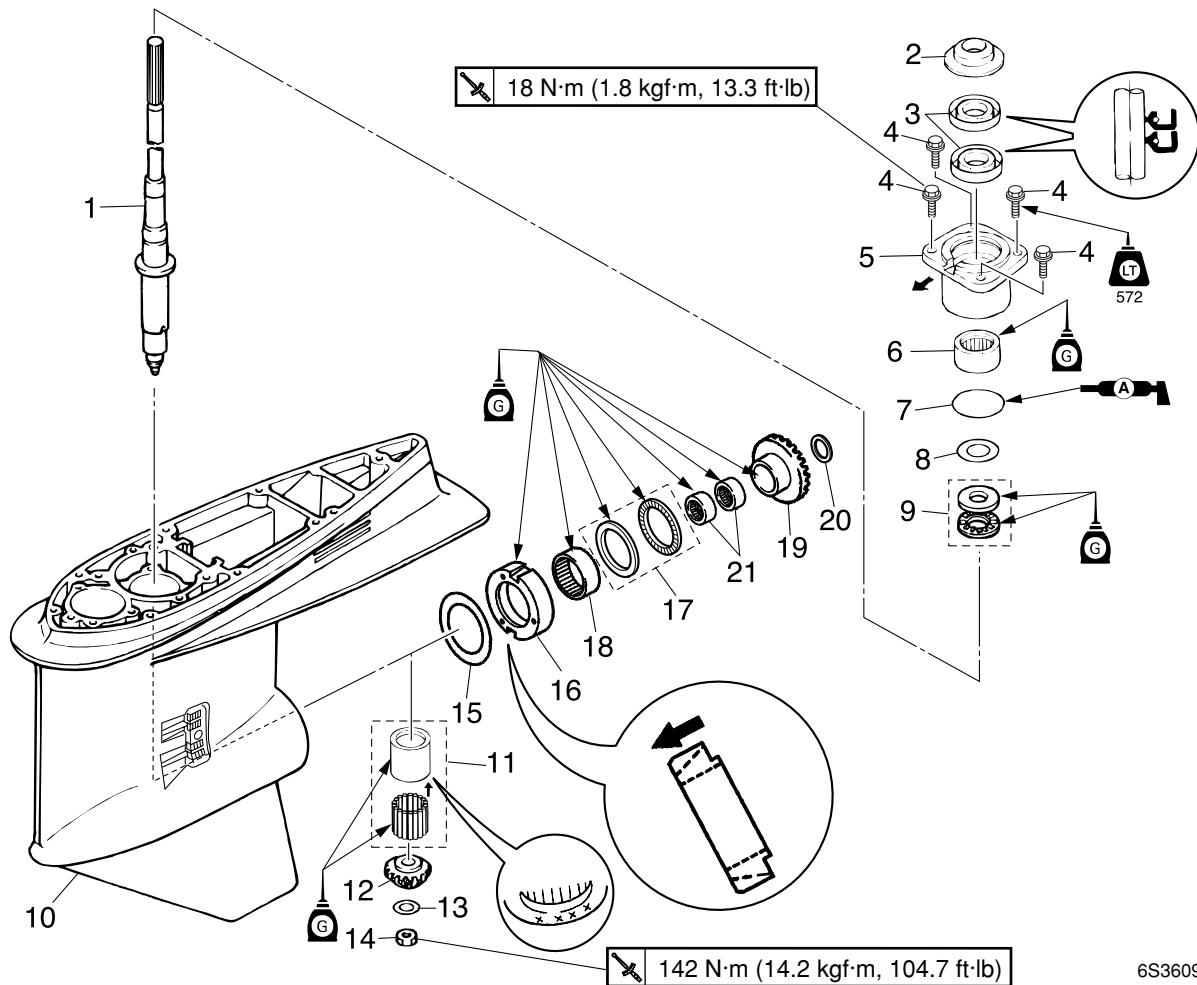


6S360400

2. Install the propeller shaft assembly 1 into the propeller shaft housing.



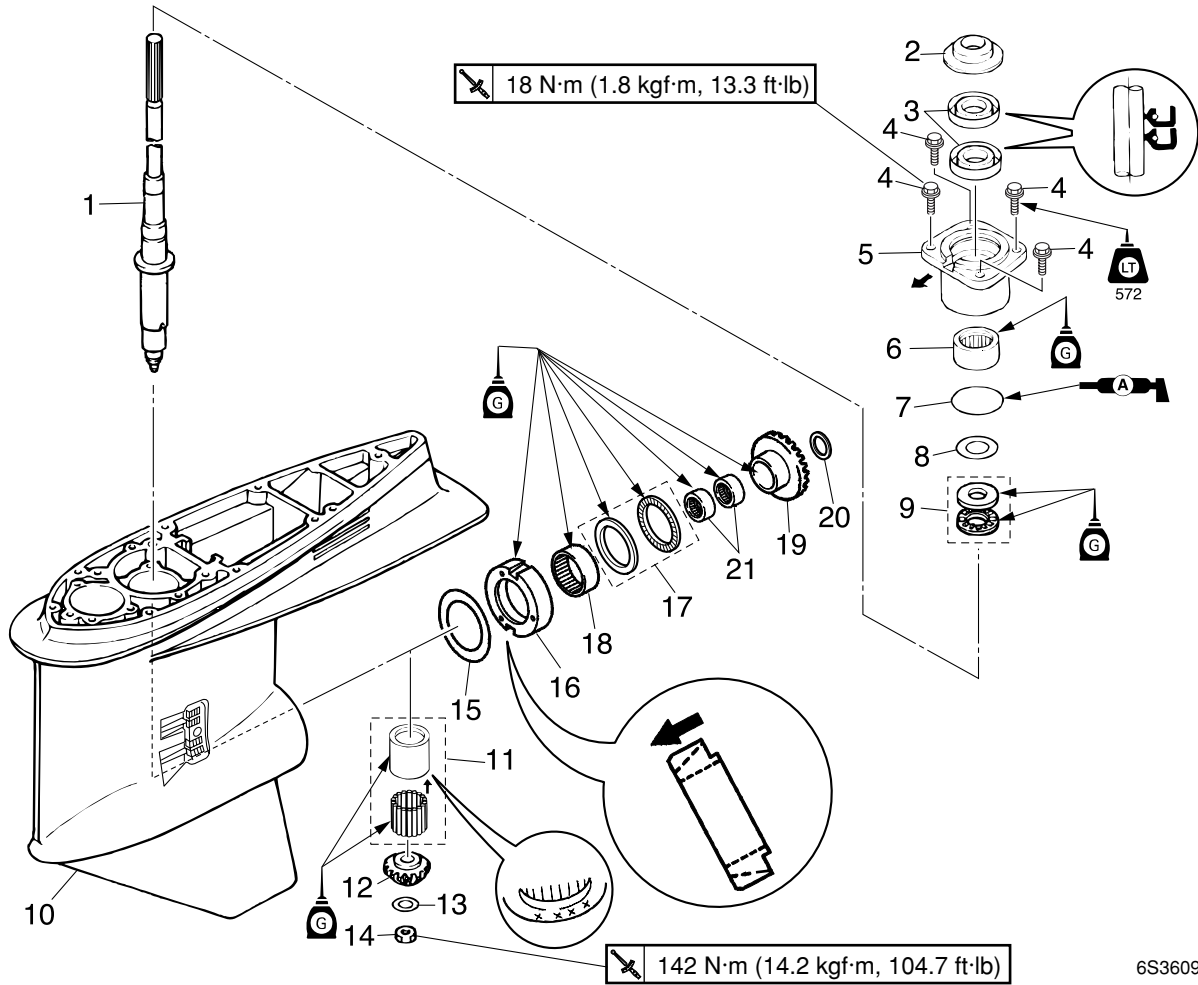
Drive shaft and lower case (counter rotation model)



6S36090E

No.	Part name	Q'ty	Remarks
1	Drive shaft	1	
2	Cover	1	
3	Oil seal	2	Not reusable
4	Bolt	4	M8 × 25 mm
5	Drive shaft housing	1	
6	Needle bearing	1	
7	O-ring	1	Not reusable
8	Pinion shim	—	
9	Thrust bearing	1	
10	Lower case	1	
11	Needle bearing	1	
12	Pinion	1	
13	Washer	1	
14	Nut	1	
15	Reverse gear shim	—	
16	Retainer	1	
17	Thrust bearing	1	

Drive shaft and lower case (counter rotation model)



6S36090E

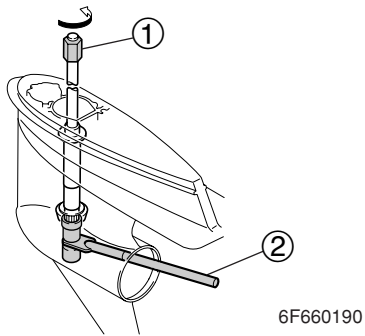
6

No.	Part name	Q'ty	Remarks
18	Needle bearing	1	
19	Reverse gear	1	
20	Washer	1	
21	Needle bearing	2	



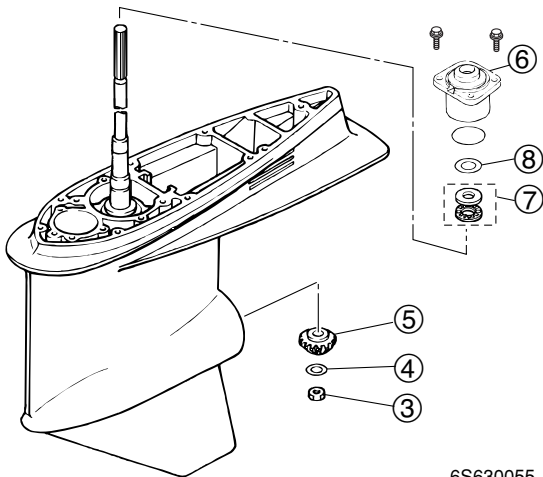
Removing the drive shaft

1. Loosen the pinion nut.



Drive shaft holder 6 ①:
90890-06520
Pinion nut holder ②:
90890-06715

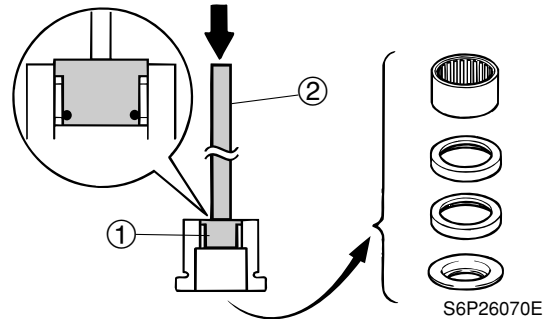
2. Remove the pinion nut ③, washer ④, pinion ⑤, drive shaft housing ⑥, thrust bearing ⑦, pinion shim(s) ⑧ from lower case.



3. Pull out the reverse gear.

Disassembling the drive shaft housing

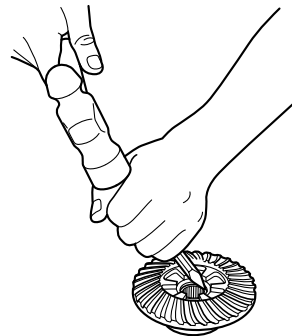
1. Remove the cover, oil seals, and needle bearing.



Needle bearing attachment ①:
90890-06610
Driver rod L3 ②: 90890-06652

Disassembling the reverse gear

1. Remove the needle bearings from the reverse gear using a chisel.



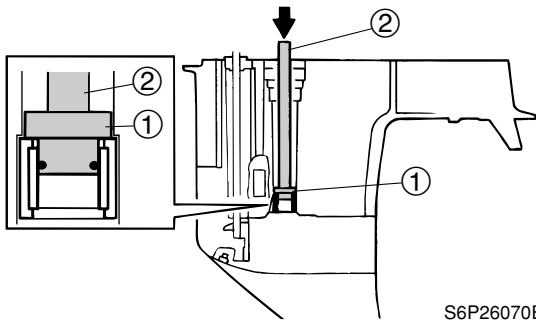
CAUTION:

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

Drive shaft and lower case (counter rotation model)

Disassembling the lower case

1. Remove the needle bearing.



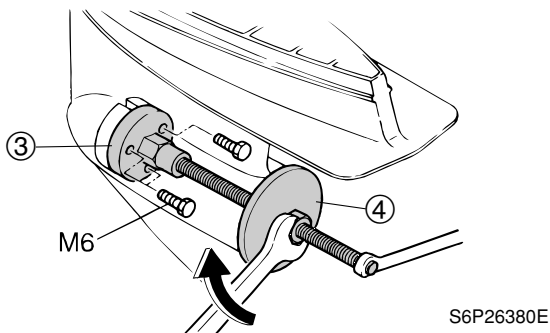
NOTE:

Since the diameter of the passage in the lower case and the diameter of the special service tool ① are both 40 mm (1.57 in), the special service tool may not fit into the lower case. In that case, use a special service tool with a smaller diameter.



Ball bearing attachment ①:
90890-06635
Driver rod LL ②: 90890-06605

2. Remove the retainer and shim(s).



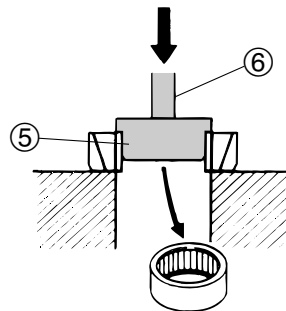
NOTE:

Install the M6 bolts as shown.



Flywheel puller ③: 90890-06521
Bearing outer race puller
assembly ④:
90890-06523

3. Remove the needle bearing from the retainer.



Needle bearing attachment ⑤:
90890-06654
Driver rod L3 ⑥: 90890-06652

Checking the pinion and reverse gear

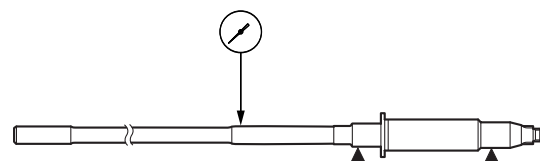
1. Check the teeth of the pinion, and the teeth and dogs of the reverse gear. Replace if cracked or worn.

Checking the bearing

1. Check the bearing. Replace if pitted or if there is rumbling.

Checking the drive shaft

1. Check the drive shaft. Replace if bent or worn.
2. Measure the drive shaft runout.



Runout limit: 0.2 mm (0.008 in)

6

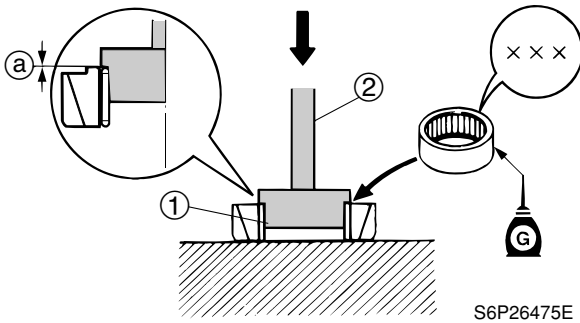


Checking the lower case

1. Check the skeg and torpedo. Replace the lower case if cracked or damaged.

Assembling the lower case

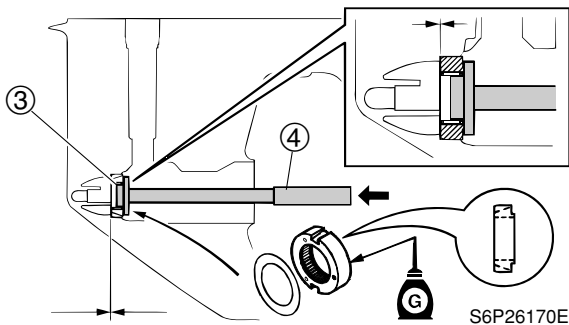
1. Install the needle bearing into the retainer to the specified depth.



	Needle bearing attachment ①: 90890-06654 Driver rod L3 ②: 90890-06652
--	---

	Depth (a): 0 – 0.25 mm (0–0.01 in)
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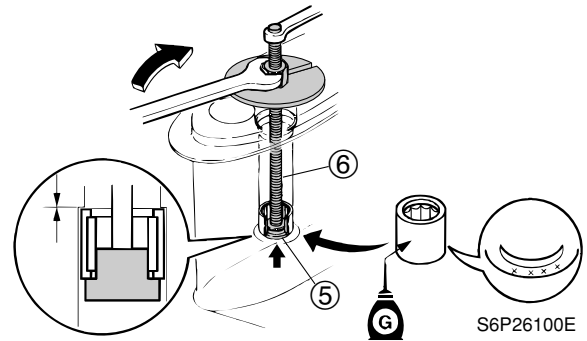
2. Install the original shim(s) and retainer into the lower case.



- NOTE:**
- Be sure to select the reverse gear shim(s) if replacing the thrust bearing, retainer or lower case.
 - To select the shim(s), see “Shimming (counter rotation model).”

	Ball bearing attachment ③: 90890-06657 Driver rod LL ④: 90890-06605
--	---

3. Install the needle bearing into the lower case.

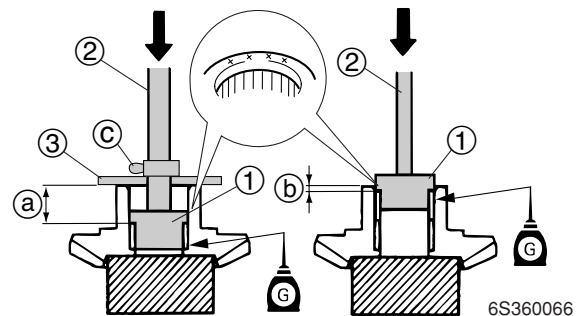


- NOTE:**
- Apply gear oil to the needle bearing before installation.
 - The needle bearing contains 24 rollers.

	Ball bearing attachment ⑤: 90890-06655 Bearing outer race puller assembly ⑥: 90890-06523
--	---

Assembling the reverse gear

1. Install new needle bearings into the reverse gear to the specified depth.



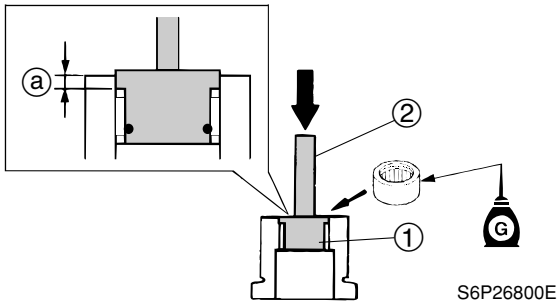
- NOTE:**
- Be careful not to let the stopper (c) get out of position when using the driver rod.

	Needle bearing attachment ①: 90890-06653 Driver rod SS ②: 90890-06604 Bearing depth plate ③: 90890-06603
--	--

	Depth (a): 20.75–21.25 mm (0.817–0.837 in) Depth (b): 4.25–4.75 mm (0.167–0.187 in)
--	--

Assembling the drive shaft housing

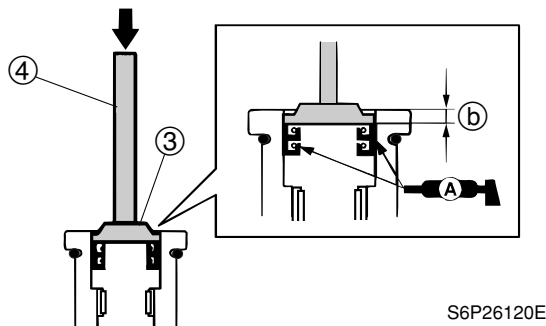
1. Install the needle bearing into the drive shaft housing to the specified depth.



	Needle bearing attachment ①: 90890-06610 Driver rod SS ②: 90890-06604
--	---

	Depth ①a): 4.25 – 4.75 mm (0.167 – 0.187 in)
--	---

2. Apply grease to new oil seals, new O-ring, and then install them into the drive shaft housing to the specified depth.



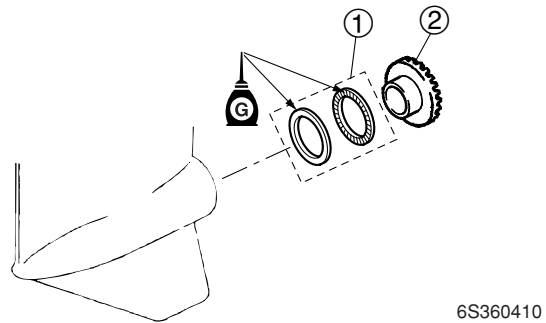
NOTE: _____
Install an oil seal halfway into the drive shaft housing, then the other oil seal.

	Bearing outer race attachment ③: 90890-06628 Driver rod LS ④: 90890-06606
--	---

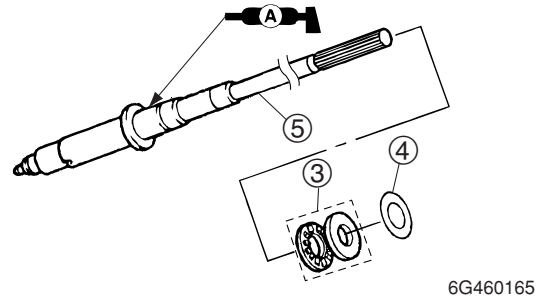
	Depth ①b): 0.25 – 0.75 mm (0.01–0.03 in)
--	---

Installing the drive shaft

1. Install the thrust bearing ① and reverse gear ② into the lower case.



2. Install the thrust bearing ③ and original shim(s) ④ onto the drive shaft ⑤.

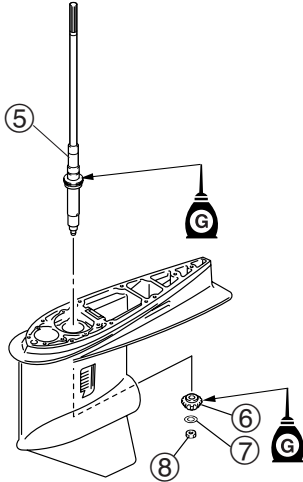


NOTE: _____

- Be sure to select the pinion shim(s) if replacing the thrust bearing, drive shaft housing, drive shaft or lower case.
- To select the shim(s), see “Shimming (counter rotation model).”

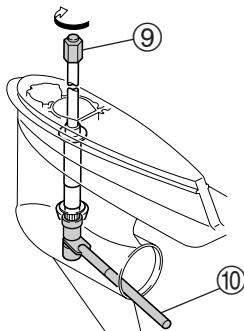


3. Install the drive shaft (5) into the lower case. Then install the pinion (6), washer (7) and pinion nut (8), and then tighten the nut (8) to the specified torque.



6S360107

NOTE: Install the drive shaft by lifting it up slightly, then aligning it with the pinion and the spline of the drive shaft.

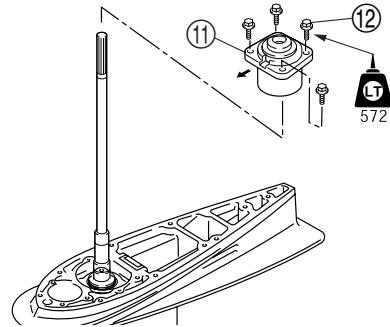


6F660315

	Drive shaft holder 6 (9): 90890-06520 Pinion nut holder (10): 90890-06715
--	--

	Pinion nut: 142 N·m (14.2 kgf·m, 104.7 ft·lb)
--	--

4. Install the drive shaft housing (11), and then tighten the drive shaft housing bolt (12).



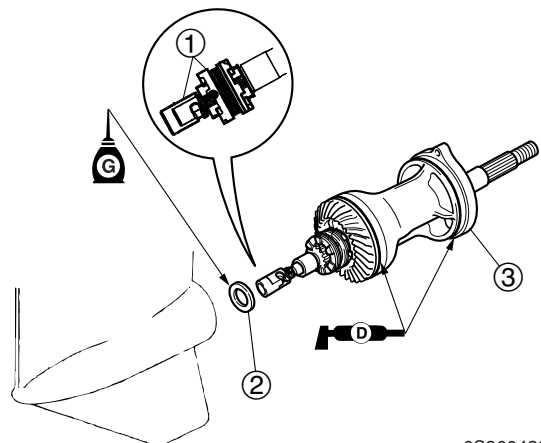
6S360108

NOTE: Apply LOCTITE 572 to the drive shaft housing bolts before installation.

	Drive shaft housing bolt (12): 18 N·m (1.8 kgf·m, 13.3 ft·lb)
--	--

Installing the propeller shaft housing

1. Set the shift rod joint and dog clutch (1) to the neutral position.
2. Apply grease to a new O-ring, and then install it onto the propeller shaft housing.
3. Install the washer (2) and propeller shaft assembly (3) into the lower case.

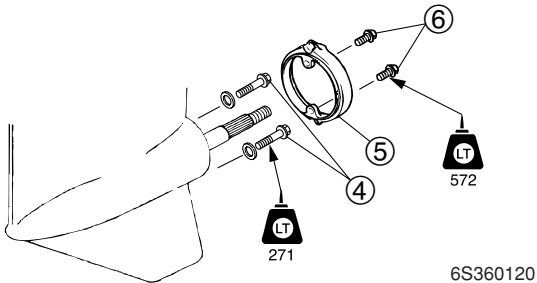


6S360420

NOTE: Face the shift plunger connect part to upward.

Drive shaft and lower case (counter rotation model)

4. Install the propeller shaft housing bolts (4), and then tighten the bolts to the specified torque.
5. Install the ring (5) and bolts (6).



NOTE:

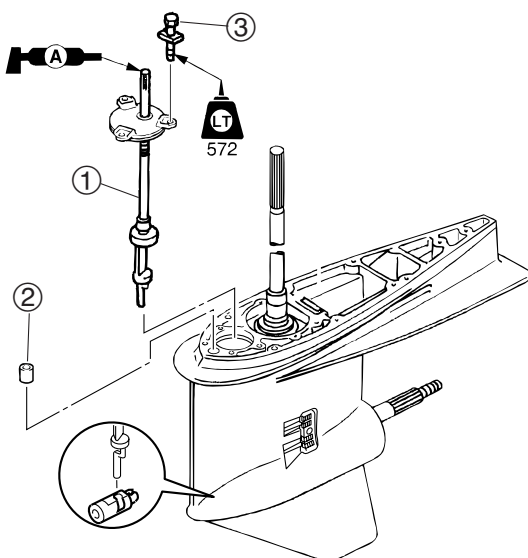
Apply LOCTITE 271 to the drive shaft housing bolts (4) and LOCTITE 572 to the bolts (6) before installation.



Propeller shaft housing bolt (4) :
30 N·m (3.0 kgf·m, 22.1 ft·lb)
Bolt (6) :
18 N·m (1.8 kgf·m, 13.3 ft·lb)

Installing the water pump and shift rod

1. Install the shift rod assembly (1) and seal (2).



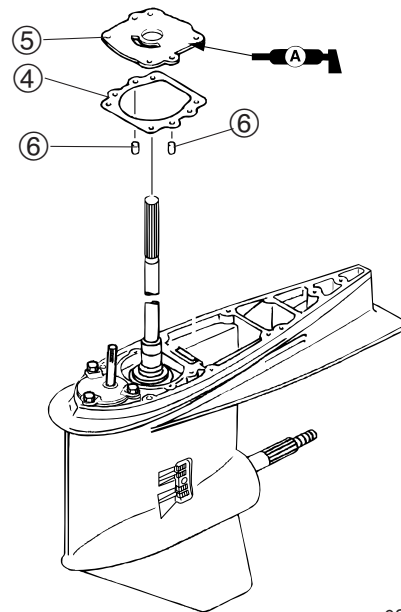
Shift rod cover bolt (3):
8 N·m (0.8 kgf·m, 5.9 ft·lb)

6S35H11

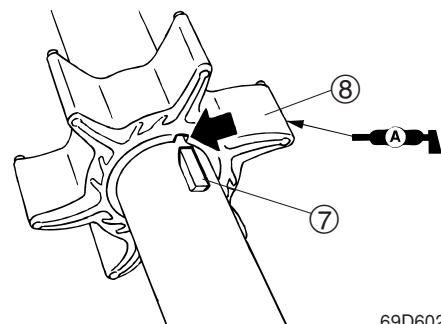
NOTE:

- Check the gear shift to the neutral position, when installing the shift rod.
- After assembling the lower unit, check that the shift rod operates smoothly, and check that the drive shaft and propeller shaft rotates smoothly.

2. Install a new gasket (4), the outer plate cartridge (5), and dowels (6).



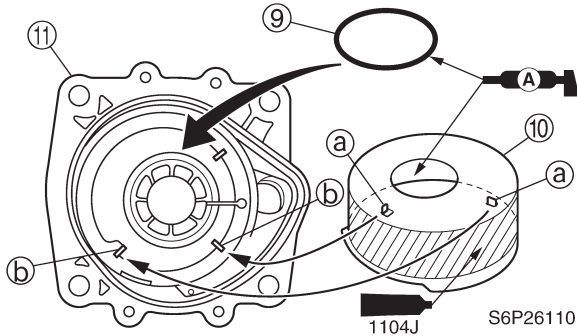
3. Install the Woodruff key (7) into the drive shaft.
4. Align the groove in the impeller (8) with the Woodruff key (7), and then install the impeller onto the drive shaft.



6

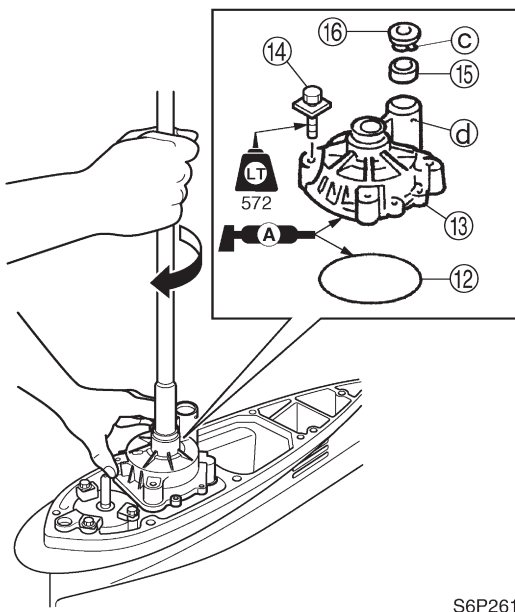


5. Install the new O-ring ⑨ and insert cartridge ⑩ into the pump housing ⑪.



NOTE: _____
Align the insert cartridge projections ① with the holes ② in the pump housing.

6. Install the new O-ring ⑫ and pump housing assembly ⑬ into the lower case, tighten the bolts ⑭, and then install the seal ⑮ and cover ⑯.



CAUTION: _____
Do not turn the drive shaft counterclockwise, otherwise the water pump impeller may be damaged.

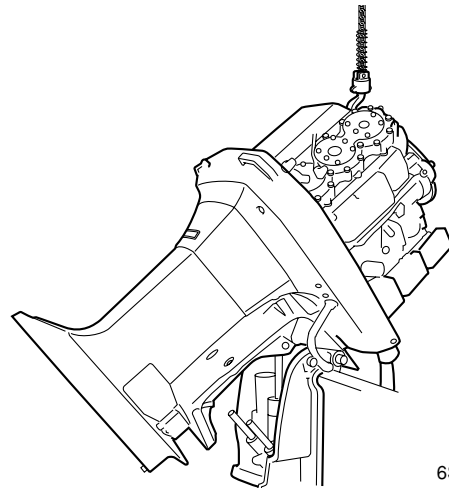
	Water pump housing bolt ⑭: 18 N·m (1.8 kgf·m, 13.3 ft·lb)
--	--

NOTE: _____

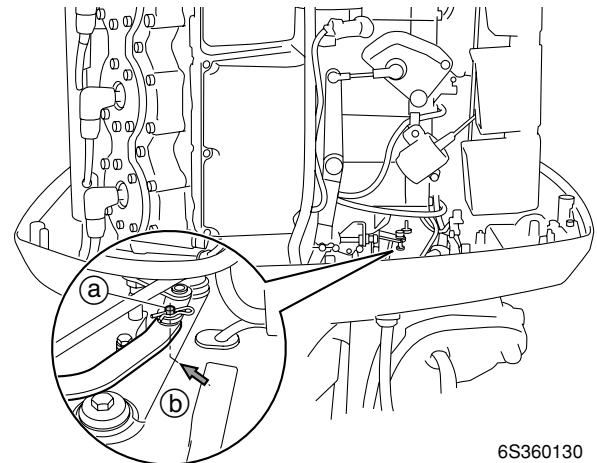
- When installing the pump housing, apply grease to the inside of the housing, and then turn the drive shaft clockwise while pushing down the pump housing.
- Align the cover projection ③ with the hole ④ in the pump housing.

Installing the lower unit

WARNING _____
When installing the lower unit without removing the power unit, be sure to suspend the outboard motor. Otherwise, the outboard motor could suddenly fall and result in injury.

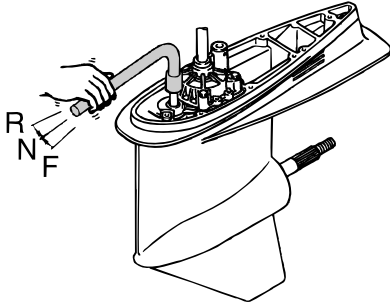


1. Align the center of the set pin ① with the alignment mark ② on the bottom cowling.



Drive shaft and lower case (counter rotation model)

- Set the gear shift to the neutral position at the lower unit. Make sure that the shift rod is in the neutral position using a special service tool.

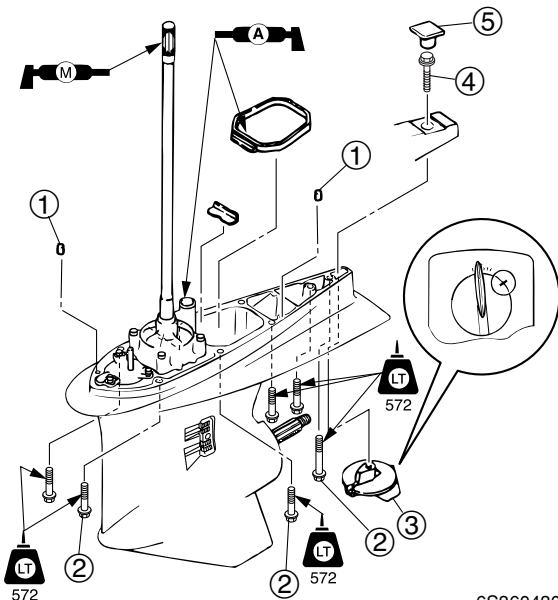


69D60036



Shift rod push arm:
90890-06052

- Install the 2 dowels ① into the lower unit.
- Install the lower unit into the upper case, and then tighten the lower case mounting bolts ② to the specified torque.
- Install the trim tab ③ to its original position, and then tighten the trim tab bolt ④ to the specified torque.

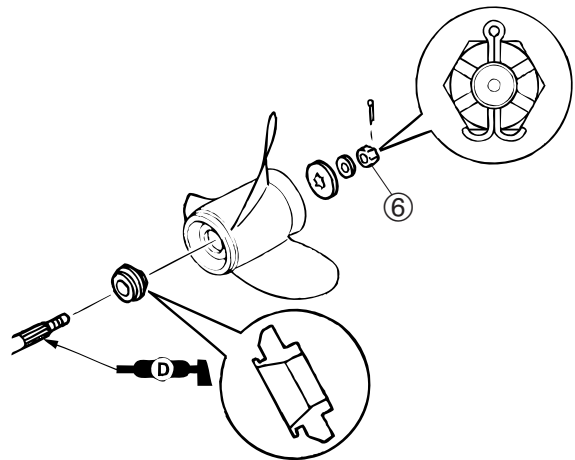


6S360430

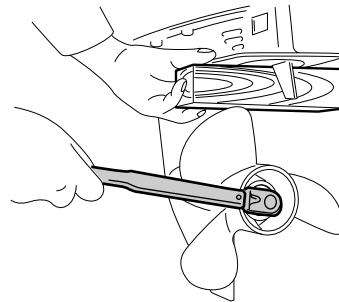


Lower case mount bolt ②:
47 N·m (4.7 kgf·m, 34.7 ft·lb)
Trim tab bolt ④:
42 N·m (4.2 kgf·m, 31.0 ft·lb)

- Install the grommet ⑤.
- Install the propeller and propeller nut ⑥, and then temporarily tighten the nut. Place a block of wood between the anti-cavitation plate and propeller to keep the propeller from turning, and then tighten the nut to the specified torque.



6G460560



6G460570

⚠ WARNING

- Do not hold the propeller with your hands when loosening or tightening it.
- Be sure to disconnect the battery cables from the battery and remove the lock plate from the engine stop lanyard switch.
- Put a block of wood between the anti-cavitation plate and propeller to keep the propeller from turning.

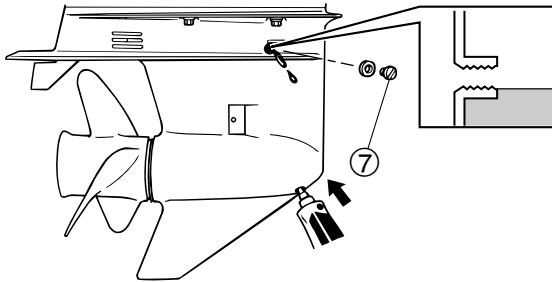
**NOTE:**

If the grooves in the propeller nut ⑥ do not align with the cotter pin hole, tighten the nut until they are aligned.



Propeller nut ⑥:
54 N·m (5.4 kgf·m, 39.8 ft·lb)

8. Insert a gear oil tube or gear oil pump into the drain hole and slowly fill the gear oil until oil flows out of the check hole and no air bubbles are visible.



69D10055



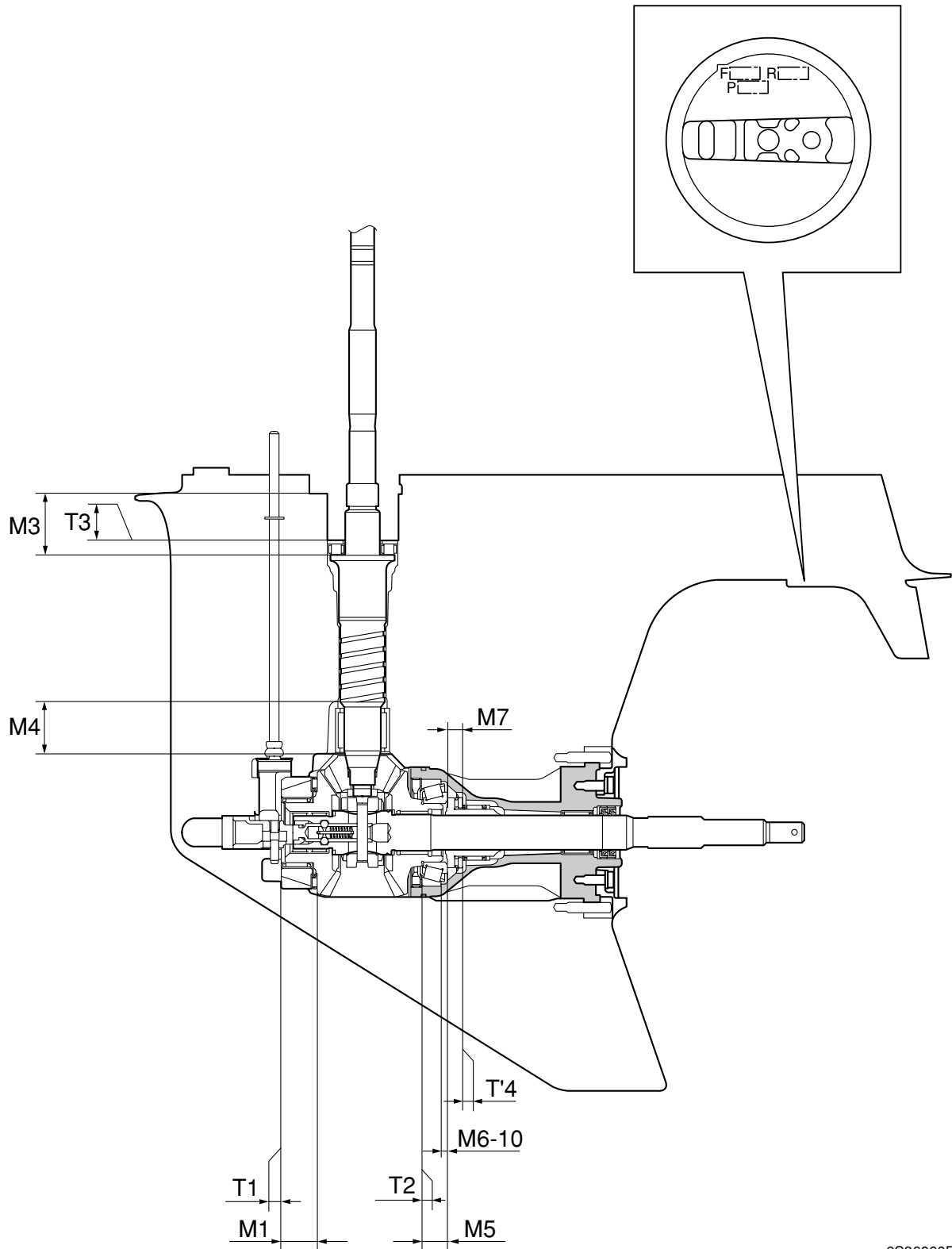
Recommended gear oil:
Hypoid gear oil
API: GL-4
SAE: 90
Gear oil quantity:
1,000 cm³
(33.81 US oz, 35.27 Imp oz)

9. Install the new gasket, check screw ⑦ and quickly install the drain screw, then tighten to specified torque.



Check screw ⑦ and drain screw:
9 N·m (0.9 kgf·m, 6.6 ft·lb)

Shimming (counter rotation model)



6

6S36060EL



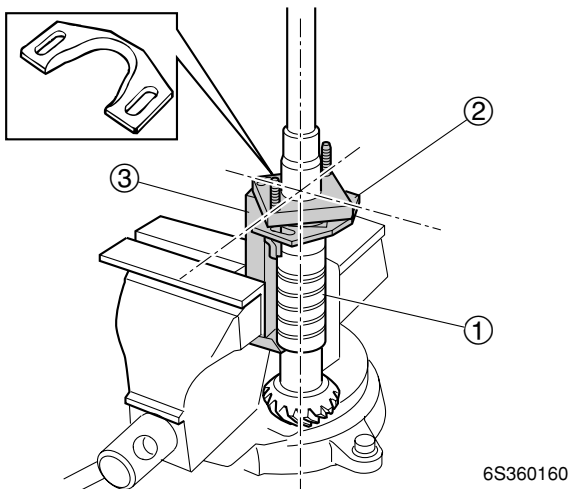
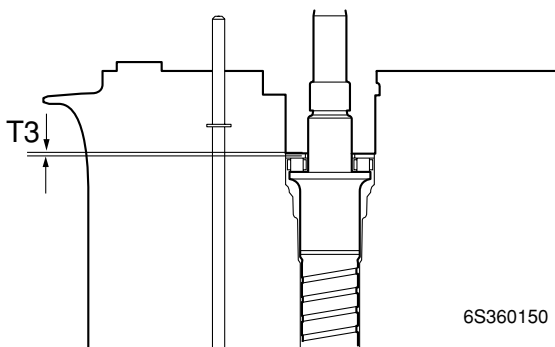
Shimming

NOTE:

- Shimming is not required when assembling the original lower case and inner parts.
- Shimming is required when assembling the original inner parts and a new lower case.
- Shimming is required when replacing the inner part(s).

Selecting the pinion shim

1. Install the special service tools onto the drive shaft ①.



NOTE:

- Select the shim thickness (T3) by using the specified measurement(s) and the calculation formula.
- Install the special service tools onto the drive shaft so that the shaft is at the center of the hole.
- Tighten the wing nuts another 1/4 of a turn after they contact the fixing plate ②.



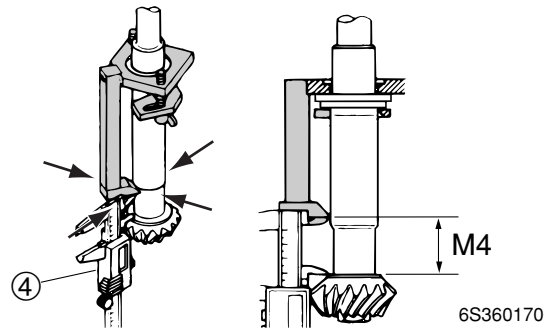
Pinion height gauge ③:
90890-06710

2. Install the pinion and pinion nut, and then tighten the nut to the specified torque.



Pinion nut:
142 N·m (14.2 kgf·m, 104.7 ft·lb)

3. Measure the distance (M4) between the special service tool and the pinion as shown.



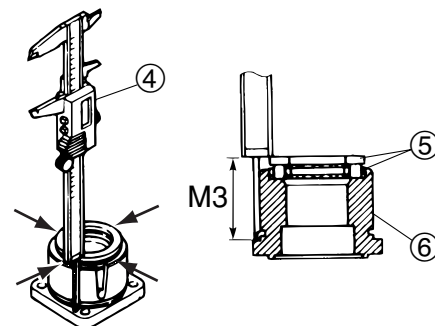
NOTE:

- Measure the pinion at 4 points to find the distance average.
- Make of note the each measurement numerical.



Digital caliper ④: 90890-06704

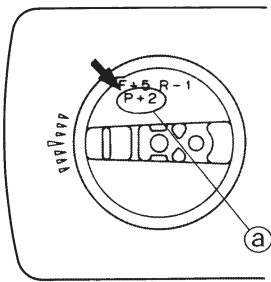
4. Turn the thrust bearing ⑤ 2 or 3 times to seat the drive shaft housing ⑥, and then measure the housing height (M3) as shown.



NOTE:

- Measure the pinion at 4 points to find the height average.
- Make of note the each measurement numerical.

5. Calculate the pinion shim thickness (T3) as shown in the examples below.



6G460340

NOTE:

“P” is the deviation of the lower case dimension from standard. The “P” mark (a) is stamped on the trim tab mounting surface of the lower case in 0.01 mm units. If the “P” mark is unreadable, assume that “P” is zero and check the backlash when the unit is assembled.

Calculation formula:

$$\text{Pinion shim thickness (T3)} = 82.00 + P/100 - M3 - M4$$

Example:

If “M3” is 50.75 mm and “M4” is 30.57 mm and “P” is (+ 2), then

$$\begin{aligned} T3 &= 82.00 + (+ 2)/100 - 50.75 - 30.57 \text{ mm} \\ &= 82.00 + 0.02 - 50.75 - 30.57 \text{ mm} \\ &= 0.70 \text{ mm} \end{aligned}$$

6. Select the pinion shim(s) (T3) as follows.

Calculated numeral at 1/100th place	Rounded numeral
1, 2	0
3, 4, 5	2
6, 7, 8	5
9, 10	8

Available shim thicknesses:

0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm

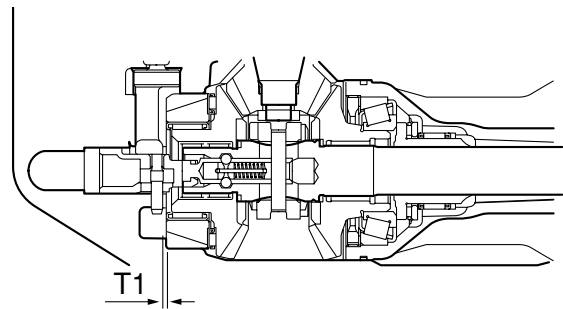
Example:

If “T3” is 0.70 mm, then the pinion shim is 0.68 mm.

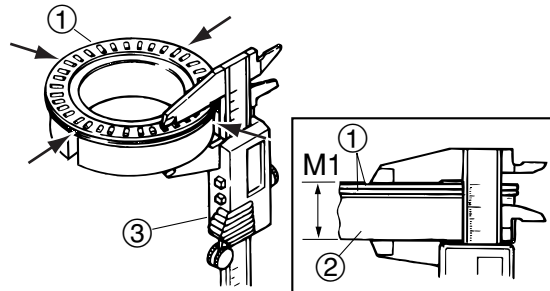
If “T3” is 0.74 mm, then the pinion shim is 0.72 mm.

Selecting the reverse gear shim

- Turn the thrust bearing ① 2 or 3 times to seat the bearing retainer ②, and then measure the bearing height (M1) as shown.



6S360440



6S360450

NOTE:

- Select the shim thickness (T1) by using the specified measurement(s) and the calculation formula.
- Measure the thrust bearing to seat the retainer at 4 points to find the height average.
- Make of note the each measurement numerical.

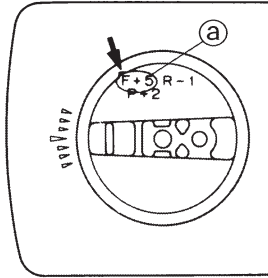


Digital caliper ③: 90890-06704



2. Calculate the reverse gear shim thickness (T1) as shown in the examples below.

Available shim thicknesses:
0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm



6G460360

Example:
If "T1" is 0.45 mm, then the reverse gear shim is 0.42 mm.
If "T1" is 0.40 mm, then the reverse gear shim is 0.38 mm.

NOTE: _____
"F" is the deviation of the lower case dimension from standard. The "F" mark (a) is stamped on the trim tab mounting surface of the lower case in 0.01 mm units. If the "F" mark is unreadable, assume that "F" is zero and check the backlash when the unit is assembled.

Calculation formula:
Reverse gear shim thickness (T1) =
 $30.60 + F/100 - M1$

Example:
If "M1" is 30.20 mm and "F" is (+5), then
 $T1 = 30.60 + (+5)/100 - 30.20 \text{ mm}$
 $= 30.60 + 0.05 - 30.20 \text{ mm}$
 $= 0.45 \text{ mm}$

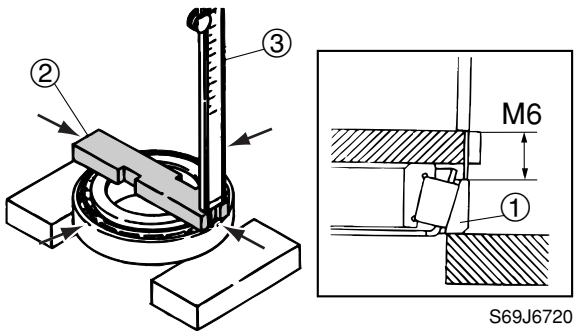
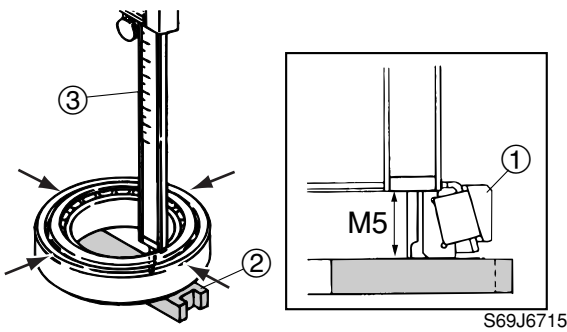
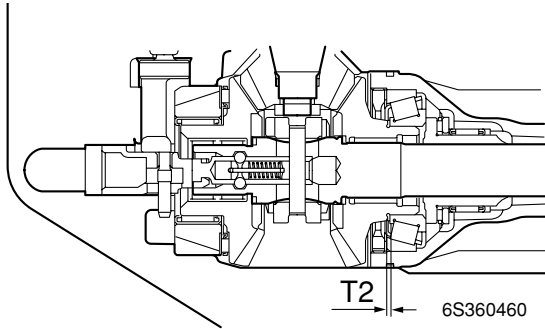
If "M1" is 30.20 mm and "F" is (0), then
 $T1 = 30.60 + (0)/100 - 30.20 \text{ mm}$
 $= 30.60 + 0 - 30.20 \text{ mm}$
 $= 0.40 \text{ mm}$

3. Select the reverse gear shim(s) (T1) as follows.

Calculated numeral at 1/100th place	Rounded numeral
1, 2	0
3, 4, 5	2
6, 7, 8	5
9, 10	8

Selecting the forward gear shim

1. Turn the taper roller bearing outer race ① 2 or 3 times to seat the rollers, and then measure the bearing height (M5) and (M6) as shown.

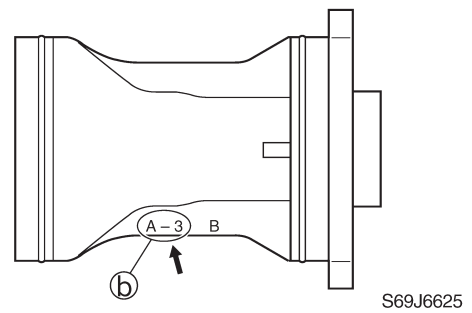
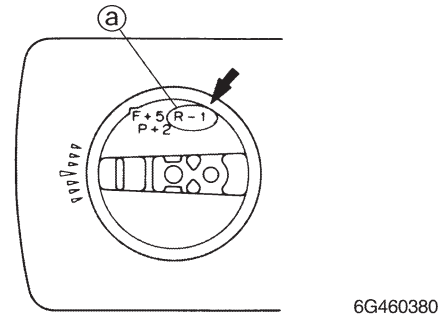


NOTE:

- Select the shim thickness (T2) by using the specified measurement(s) and the calculation formula.
- Measure the forward gear at 4 points to find the height average.
- Make of note the each measurement numerical.

	Shimming plate ②: 90890-06701
	Digital caliper ③: 90890-06704

2. Calculate the forward gear shim thickness (T2) as shown in the examples below.



NOTE:

“R” is the deviation of the lower case dimension from standard, and “A” is the deviation of the propeller shaft housing from standard. The “R” mark (a) is stamped on the trim tab mounting surface of the lower case, and the “A” mark (b) is stamped on the propeller shaft housing in 0.01 mm units. If the “R” mark or “A” mark is unreadable, assume that “R” and “A” are zero and check the backlash when the unit is assembled.

<p>Calculation formula: Forward gear shim thickness (T2) = $6.50 + R/100 - A/100 - M5 + M6$</p>
--

Example:
 If “M5” is 21.95 mm and “M6” is 16.78 mm and “R” is (– 1) and “A” is (– 3), then
 $T2 = 6.50 + (-1)/100 - (-3)/100 - 21.95 + 16.78 \text{ mm}$
 $= 6.50 - 0.01 + 0.03 - 21.95 + 16.78 \text{ mm}$
 $= 1.35 \text{ mm}$



If "M5" is 21.95 mm and "M6" is 16.78 mm and "R" is (- 1) and "A" is (+ 2), then
 $T2 = 6.50 + (- 1)/100 - (+ 2)/100$
 $= 6.50 - 0.01 - 0.02 - 21.95 + 16.78$ mm
 $= 1.30$ mm

3. Select the forward gear shim(s) (T2) as follows.

Calculated numeral at 1/100th place	Rounded numeral
1, 2	0
3, 4, 5	2
6, 7, 8	5
9, 10	8

Available shim thicknesses:
 0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm

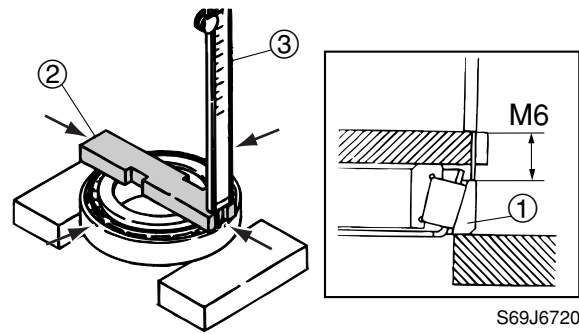
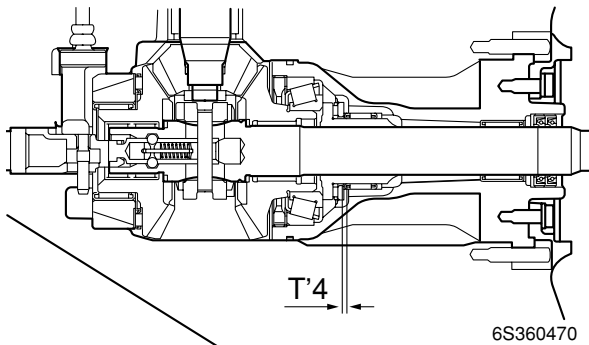
Example:

If "T2" is 1.35 mm, then the forward gear shim is 1.32 mm.

If "T2" is 1.30 mm, then the forward gear shim is 1.28 mm.

Selecting the propeller shaft shim

1. Turn the taper roller bearing outer race ① 2 or 3 times to seat the rollers, and then measure the bearing height (M6) as shown.



S69J6720

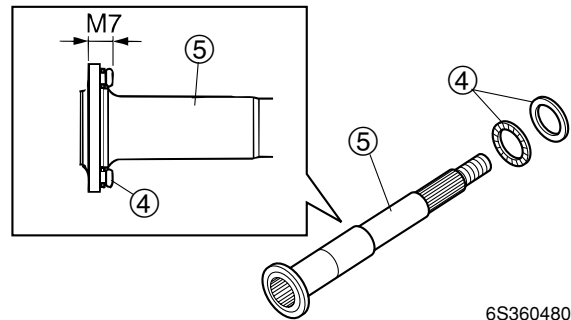
NOTE:

- Select the shim thickness (T'4) by using the specified measurement(s) and the calculation formula.
- Measure the taper roller bearing at 4 points to find the height average.
- Make of note the each measurement numerical.



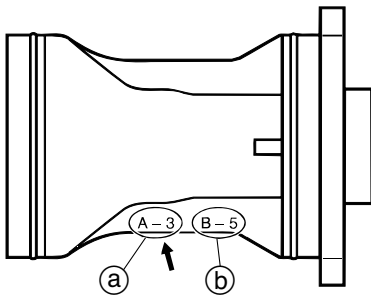
Shimming plate ②: 90890-06701
 Digital caliper ③: 90890-06704

2. Install the thrust bearing ④ onto the propeller shaft ⑤, and then measure the propeller shaft flange and thrust bearing thickness (M7) as shown.



6S360480

- Calculate the propeller shaft shim thickness (T4) as shown in the examples below.



S69J6626

NOTE:

“A” and “B” are the deviations of the propeller shaft housing dimensions from standard. The “A” mark (a) and “B” mark (b) are stamped on the propeller shaft housing in 0.01 mm units. If the “A” mark or “B” mark is unreadable, assume that “A” and “B” are zero and check the free play when the unit is assembled.

Calculation formula 1:

$$\text{Propeller shaft shim thickness (T4)} = 28.00 - A/100 - B/100 - M6 - M7$$

Example:

If “M6” is 14.75 mm and “M7” is 12.50 mm and “A” is (- 3) and “B” is (- 5), then
 $T4 = 28.00 + (-3)/100 - (-5)/100 - 14.75 - 12.50 \text{ mm}$
 $= 28.00 + 0.03 + 0.05 - 14.75 - 12.50 \text{ mm}$
 $= 0.83 \text{ mm}$

If “M6” is 14.75 mm and “M7” is 12.50 mm and “A” is (+ 7) and “B” is (- 6), then
 $T4 = 28.00 + (+7)/100 - (-6)/100 - 14.75 - 12.50 \text{ mm}$
 $= 28.00 + 0.07 + 0.06 - 14.75 - 12.50 \text{ mm}$
 $= 0.88 \text{ mm}$

- Round the numerals for the propeller shaft shim(s) (T4) as follows.

Calculated numeral at 1/100th place	Rounded numeral
1, 2	0
3, 4, 5	2
6, 7, 8	5
9, 10	8

Example:

If “T4” is 0.83 mm, then the propeller shaft shim is 0.82 mm.
 If “T4” is 0.88 mm, then the propeller shaft shim is 0.85 mm.

- Calculate and select the propeller shaft shim thickness (T'4) as shown in the examples below.

Calculation formula 2:

$$\text{Propeller shaft shim thickness (T'4)} = T4 - 0.30$$

Example:

If “T4” is 0.82 mm, then
 $T'4 = 0.82 - 0.30 \text{ mm}$
 $= 0.52 \text{ mm}$
 If “T4” is 0.85 mm, then
 $T'4 = 0.85 - 0.30 \text{ mm}$
 $= 0.55 \text{ mm}$

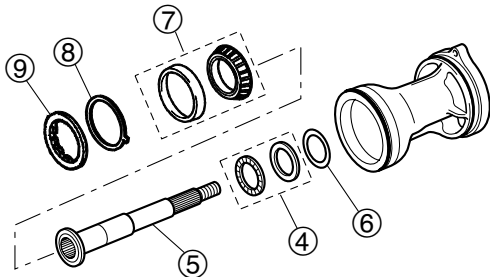
Available shim thicknesses:

0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm

- If the “A” mark or “B” mark is unreadable, measure the propeller shaft free play as shown.



- Install the shim(s) ⑥, thrust bearing ④, propeller shaft ⑤, taper roller bearing ⑦ and claw washer ⑧, and then tighten the ring nut ⑨ to the specified torque.



6S360490

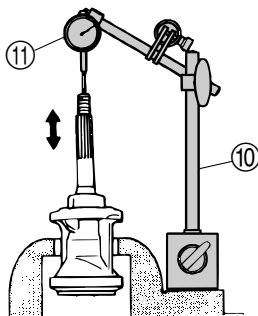


Ring nut wrench 4: 90890-06510
Ring nut wrench extension:
90890-06513



Ring nut ⑨:
108 N·m (10.8 kgf·m, 79.7 ft·lb)

- Measure the propeller shaft axial free play. Reselect the propeller shaft shim(s) (T'4), if out of specification.



S6S16440



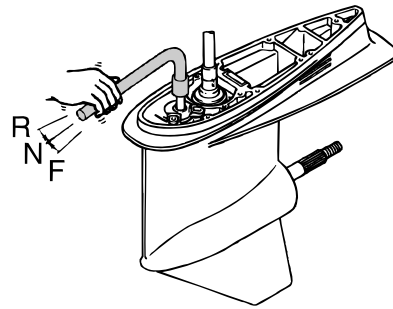
Propeller shaft free play:
0.25–0.35 mm (0.0098–0.0138 in)



Magnet base B ⑩: 90890-06844
Dial gauge set ⑪: 90890-01252

**Backlash
(counter rotation model)
Measuring the forward and reverse
gear backlash**

- Remove the water pump assembly.
- Set the gear shift to the neutral position at the lower unit.

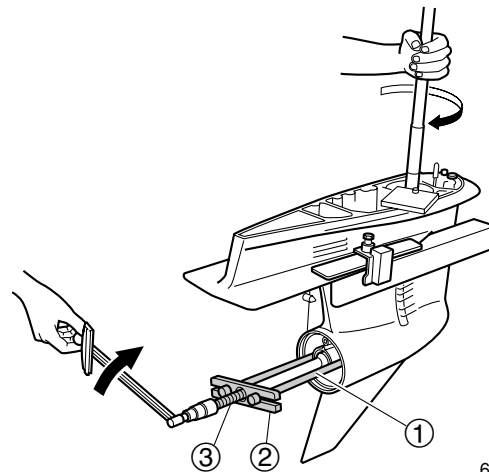


69D60035



Shift rod push arm:
90890-06052

- Install the special service tools so that it pushes against the propeller shaft.



6S360190

NOTE: While turning the drive shaft clockwise 5-6 times to contact the gear evenly it tightens center bolt ③ to specified torque.



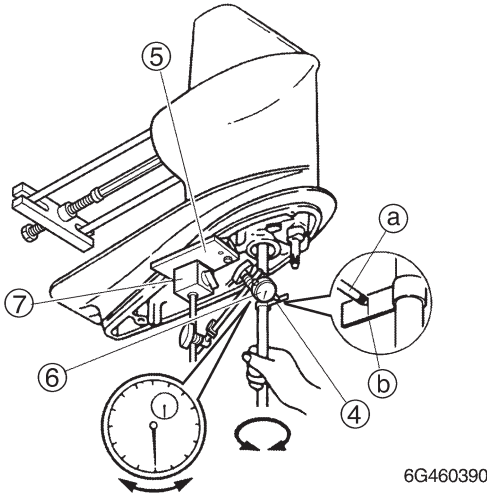
Center bolt ③:
5 N·m (0.5 kgf·m, 3.7 ft·lb)




Bearing housing puller claw L ①:
90890-06502
Stopper guide plate ②:
90890-06501
Center bolt ③: 90890-06504

Shimming (counter rotation model)/Backlash (counter rotation model)


4. Install the backlash indicator onto the drive shaft (22.4 mm [0.88 in] in diameter), then the dial gauge onto the lower unit.
5. Set the lower unit upside down.



NOTE: Install the dial gauge so that the plunger (a) contacts the mark (b) on the backlash indicator.

	Backlash indicator (4): 90890-06706
	Magnet base plate (5): 90890-07003
	Dial gauge set (6): 90890-01252
	Magnet base B (7): 90890-06844

6. Slowly turn the drive shaft clockwise and counterclockwise, and measure the backlash when the drive shaft stops in each direction.

	Forward gear backlash: 0.32 – 0.52 mm (0.0126–0.0205 in)
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7. Add or remove shim(s) if out of specification.

Forward gear backlash	Shim thickness
Less than 0.32 mm (0.0126 in)	To be decreased by $(0.42 - M) \times 0.78$
More than 0.52 mm (0.0205 in)	To be increased by $(M - 0.42) \times 0.78$

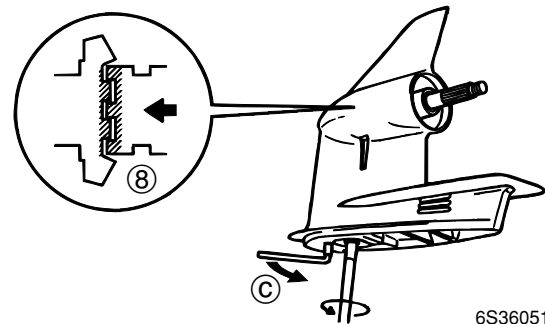
M: Measurement

Available shim thicknesses:
0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm

8. Remove the special service tools from the propeller shaft.
9. Turn the shift rod into the reverse position (C) with the shift rod push arm.

	Shift rod push arm: 90890-06052
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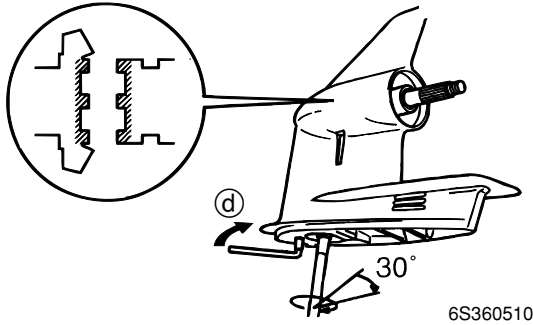
10. Turn the drive shaft clockwise until the dog clutch (8) is fully engaged.



6

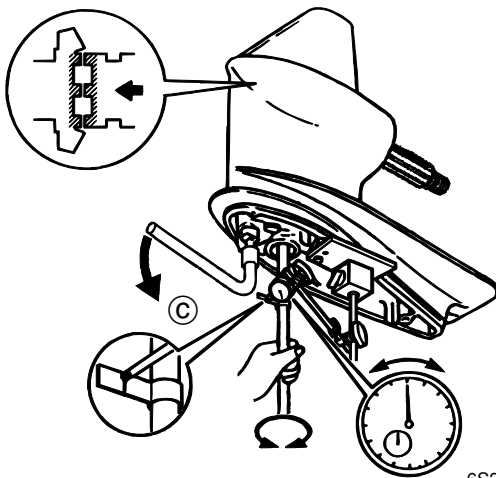


11. Turn the shift rod to the neutral position ④ with the shift rod push arm.
12. Turn the drive shaft counterclockwise approximately 30°.



6S360510

13. Turn the shift rod to the reverse position ③ with the shift rod push arm.
14. Slowly turn the drive shaft clockwise and counterclockwise and measure the backlash when the drive shaft stops in each direction.



6S360510

NOTE: _____
 When measuring the reverse gear backlash, turn the shift rod push arm towards the reverse position ③ with force.

	Reverse gear backlash: 0.64 – 0.93 mm (0.0252 – 0.0366 in)
--	--

15. Add or remove shim(s) if out of specification.

Reverse gear backlash	Shim thickness
Less than 0.64 mm (0.0252 in)	To be decreased by $(0.79 - M) \times 0.78$
More than 0.93 mm (0.0366 in)	To be increased by $(M - 0.79) \times 0.78$

M: Measurement

Available shim thicknesses: 0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm

16. Remove the special service tools, and then install the water pump assembly.

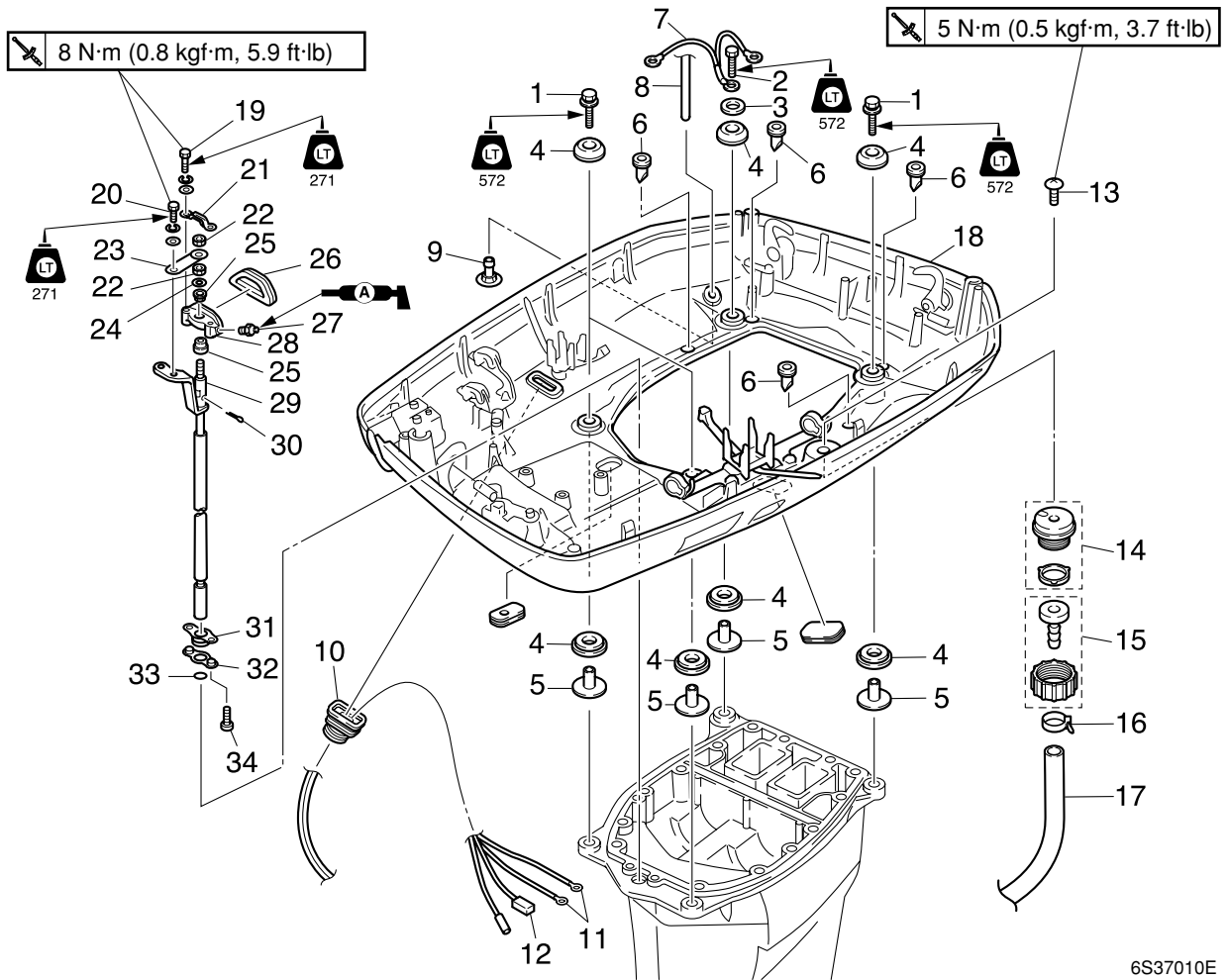
— MEMO —

Bracket unit

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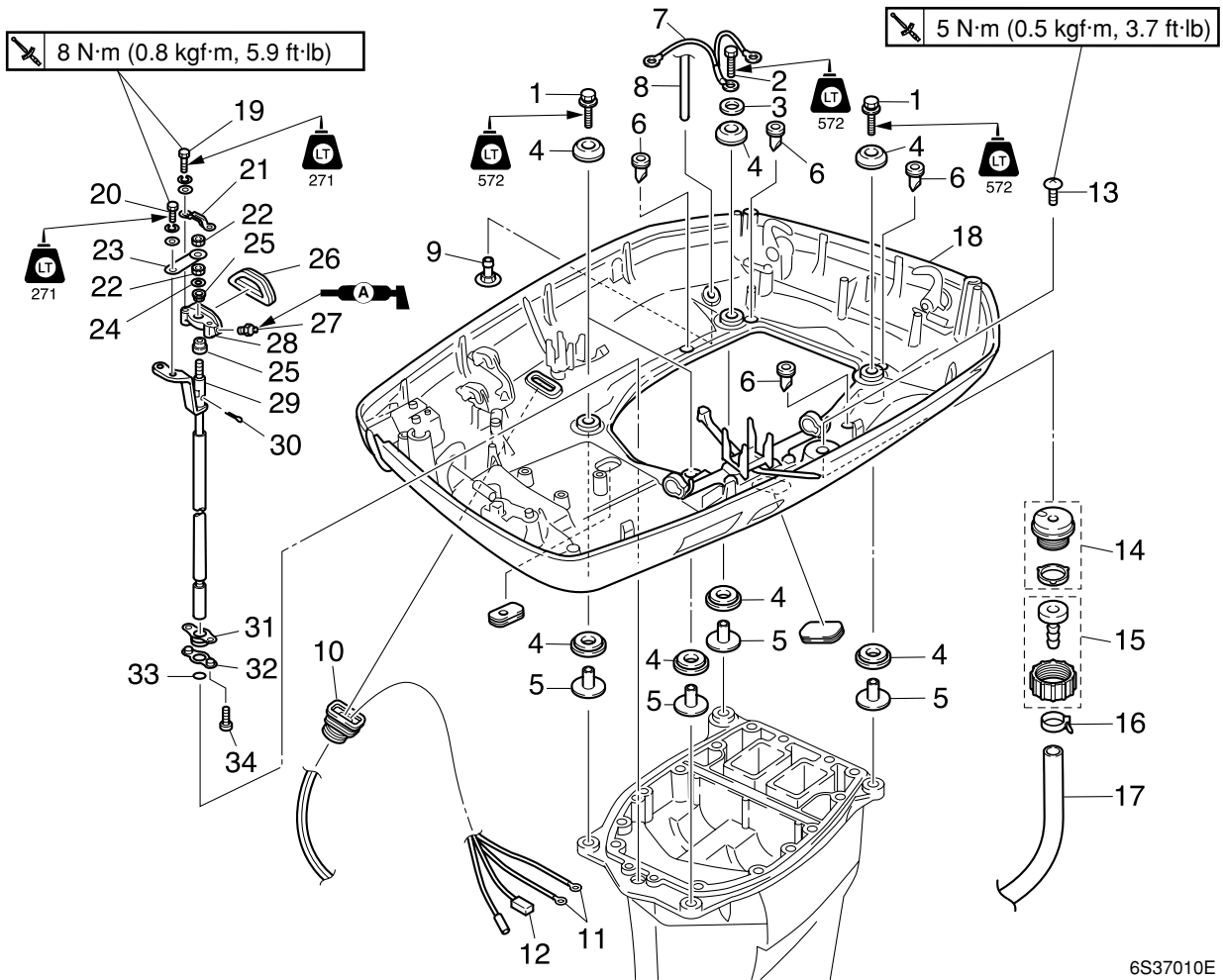
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Bottom cowling



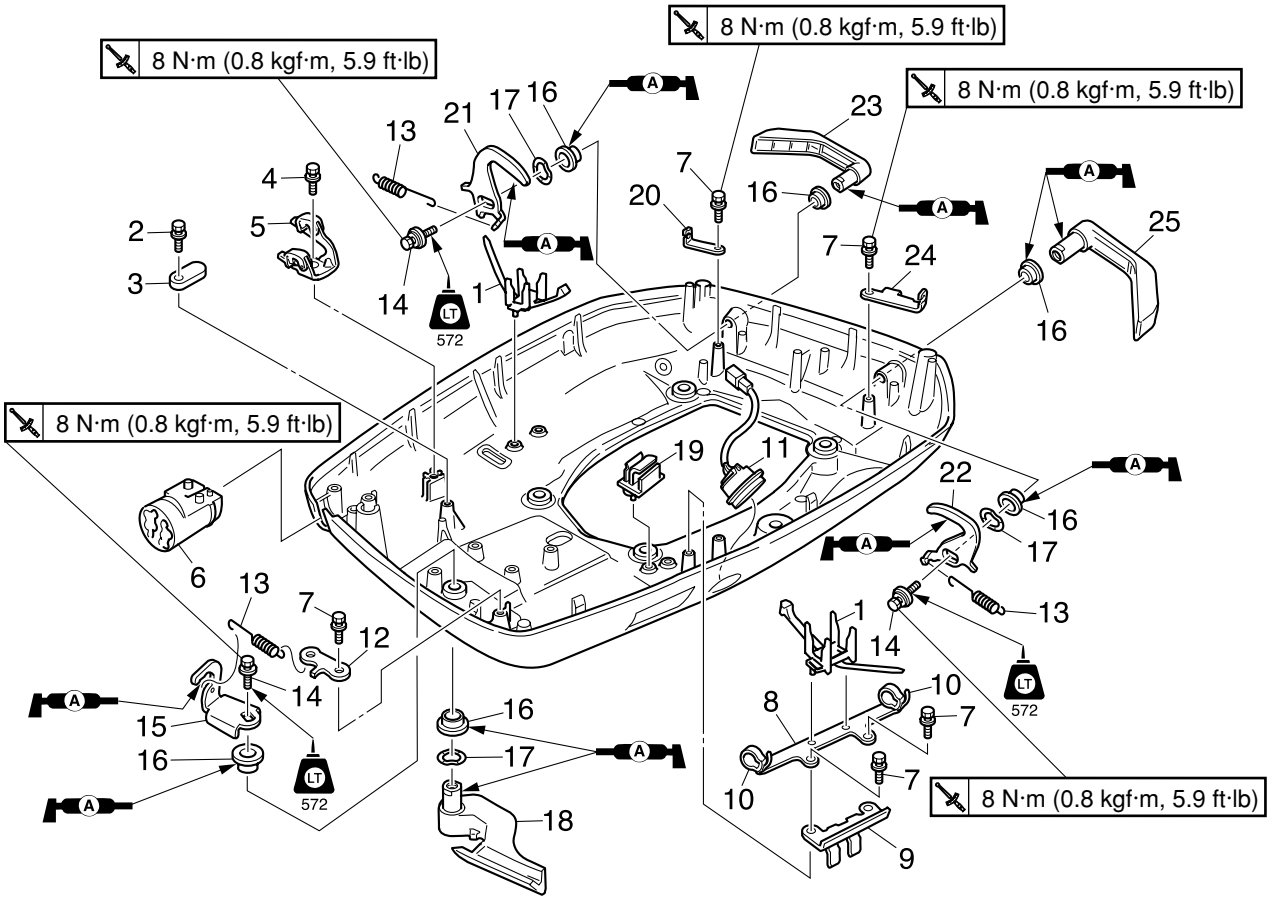
6S37010E

No.	Part name	Q'ty	Remarks
1	Bolt	3	M8 × 45 mm
2	Bolt	1	M8 × 45 mm
3	Washer	1	
4	Grommet	8	
5	Collar	4	
6	Seal	4	
7	Ground lead	1	
8	Hose	1	
9	Cooling water pilot hole	1	
10	Grommet	1	
11	PTT motor lead	1	
12	Trim sensor coupler	1	
13	Screw	1	ø5 × 20 mm
14	Adapter	1	
15	Hose joint	1	
16	Lock tie	1	Not reusable
17	Flushing hose	1	



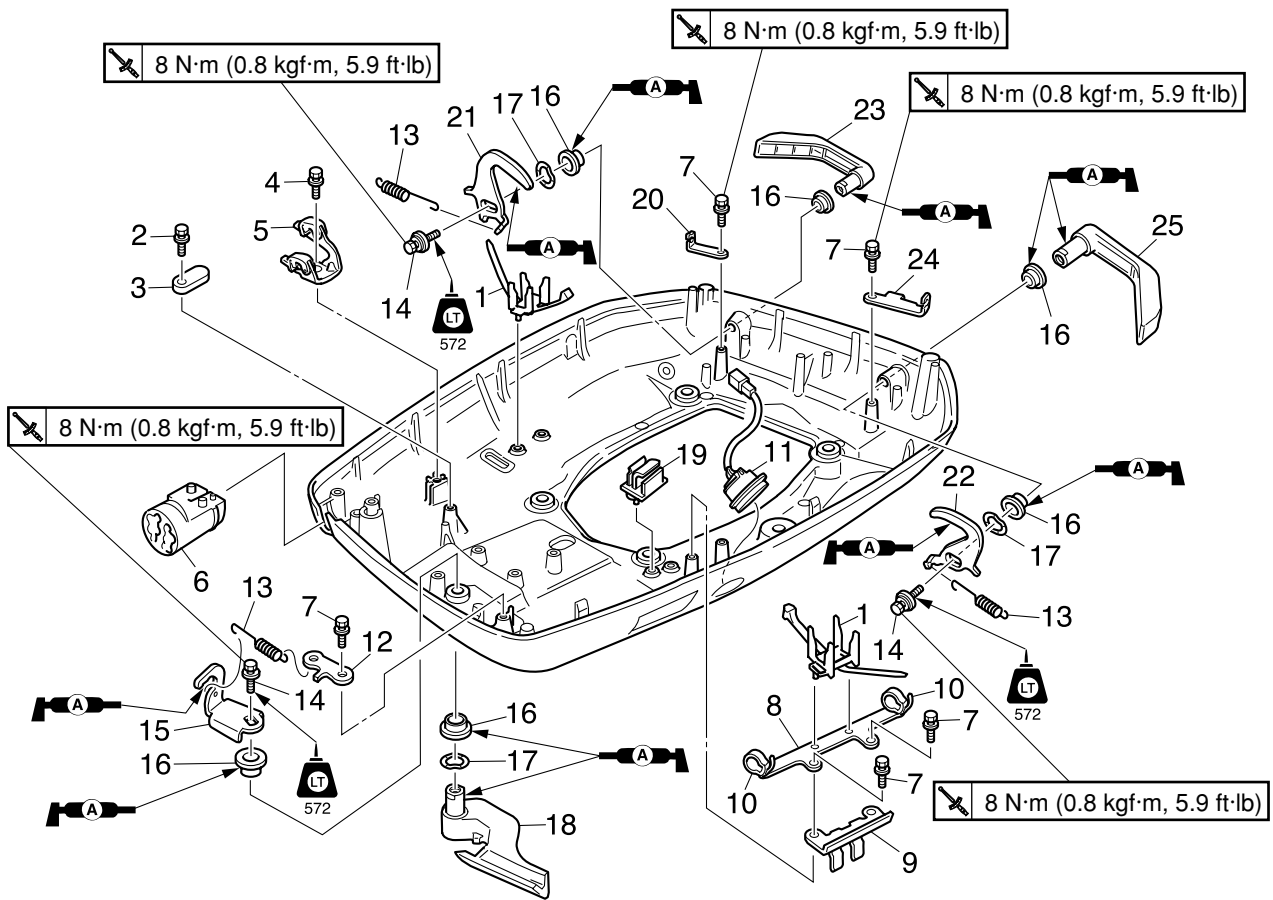
6S37010E

No.	Part name	Q'ty	Remarks
18	Bottom cowling	1	
19	Bolt	2	M6 × 30 mm
20	Bolt	1	M6 × 12 mm
21	Spring	1	
22	Nut	2	
23	Stay	1	
24	Washer	1	
25	Bushing	2	
26	Seal	1	
27	Grease nipple	1	
28	Bracket	1	
29	Shift rod	1	
30	Cotter pin	1	
31	Grommet	1	
32	Plate	1	
33	O-ring	1	Not reusable
34	Screw	2	ø6 × 8 mm



6S37020E

No.	Part name	Q'ty	Remarks
1	Clamp	2	
2	Bolt	1	M6 × 20 mm
3	Plate	1	
4	Bolt	1	M8 × 20 mm
5	Holder	1	
6	Grommet	1	
7	Bolt	6	M6 × 16 mm
8	Bracket	1	
9	Plate	1	
10	Clamp	2	
11	PTT switch	1	
12	Spring hook	1	
13	Spring	3	
14	Bolt	3	M8 × 17 mm
15	Hook	1	
16	Bushing	6	
17	Wave washer	3	



6S37020E

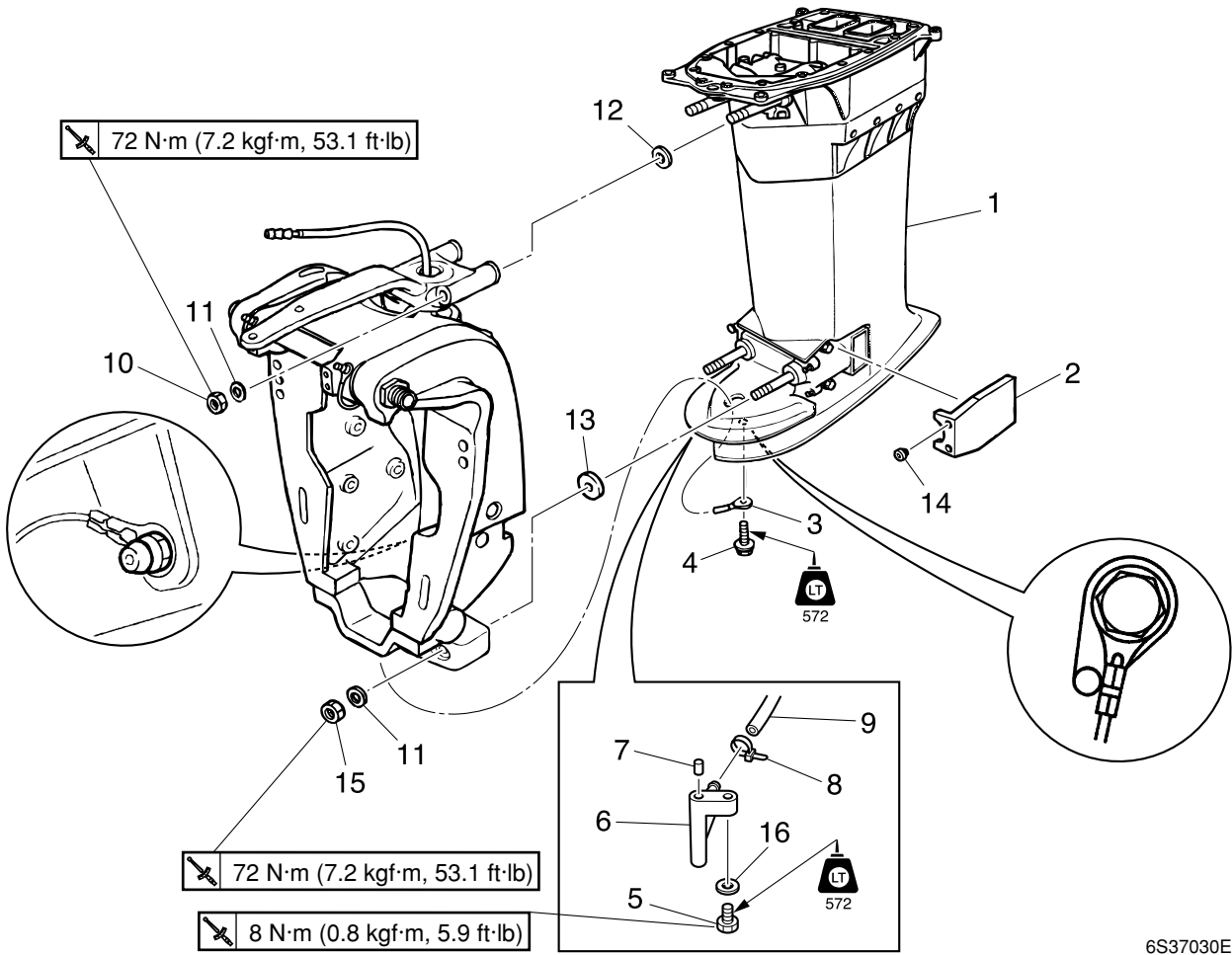
No.	Part name	Q'ty	Remarks
18	Clamp lever	1	
19	Holder	1	
20	Spring hook	1	
21	Hook	1	
22	Hook	1	
23	Clamp lever	1	
24	Spring hook	1	
25	Clamp lever	1	





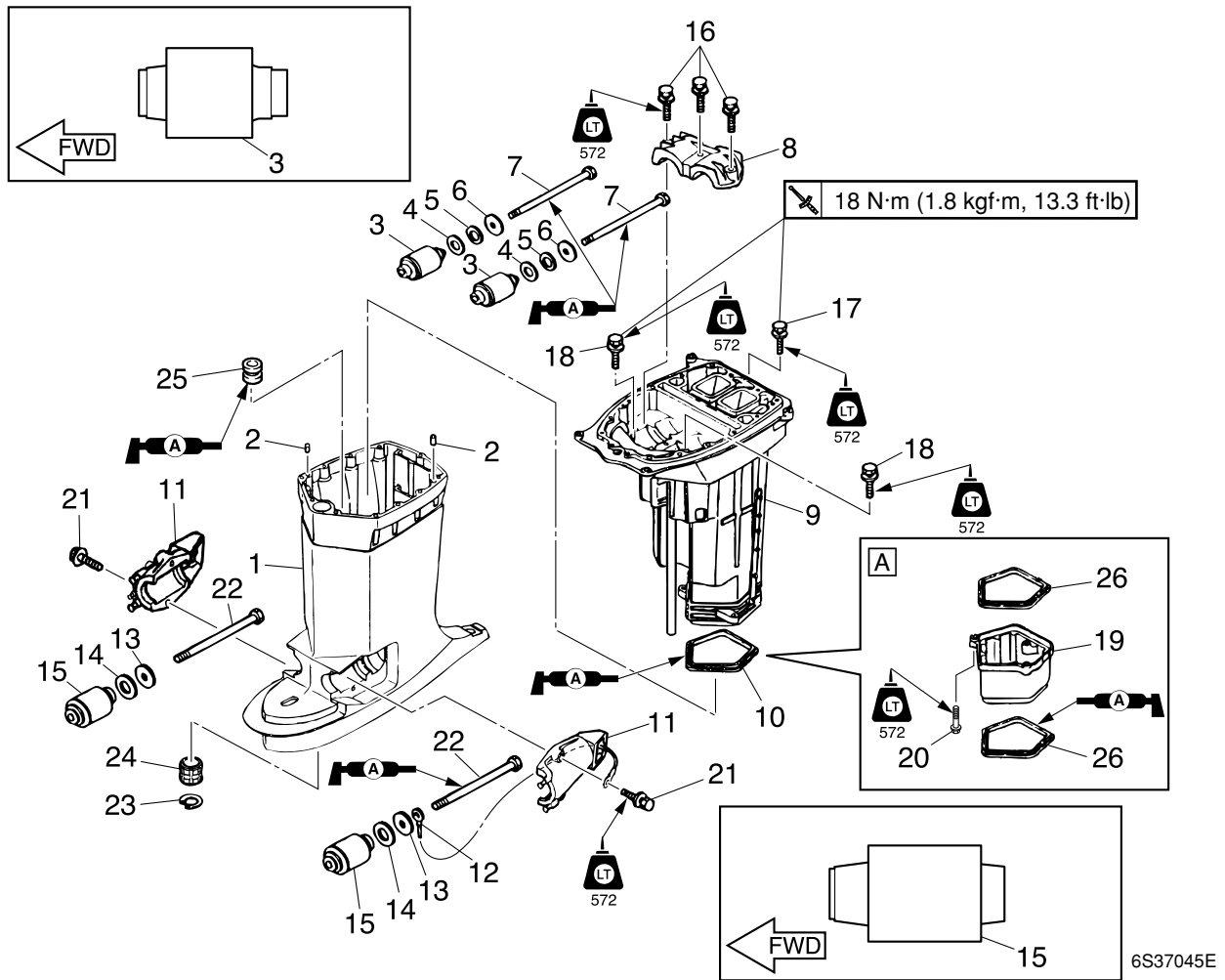
Bracket unit

Upper case, steering arm



6S37030E

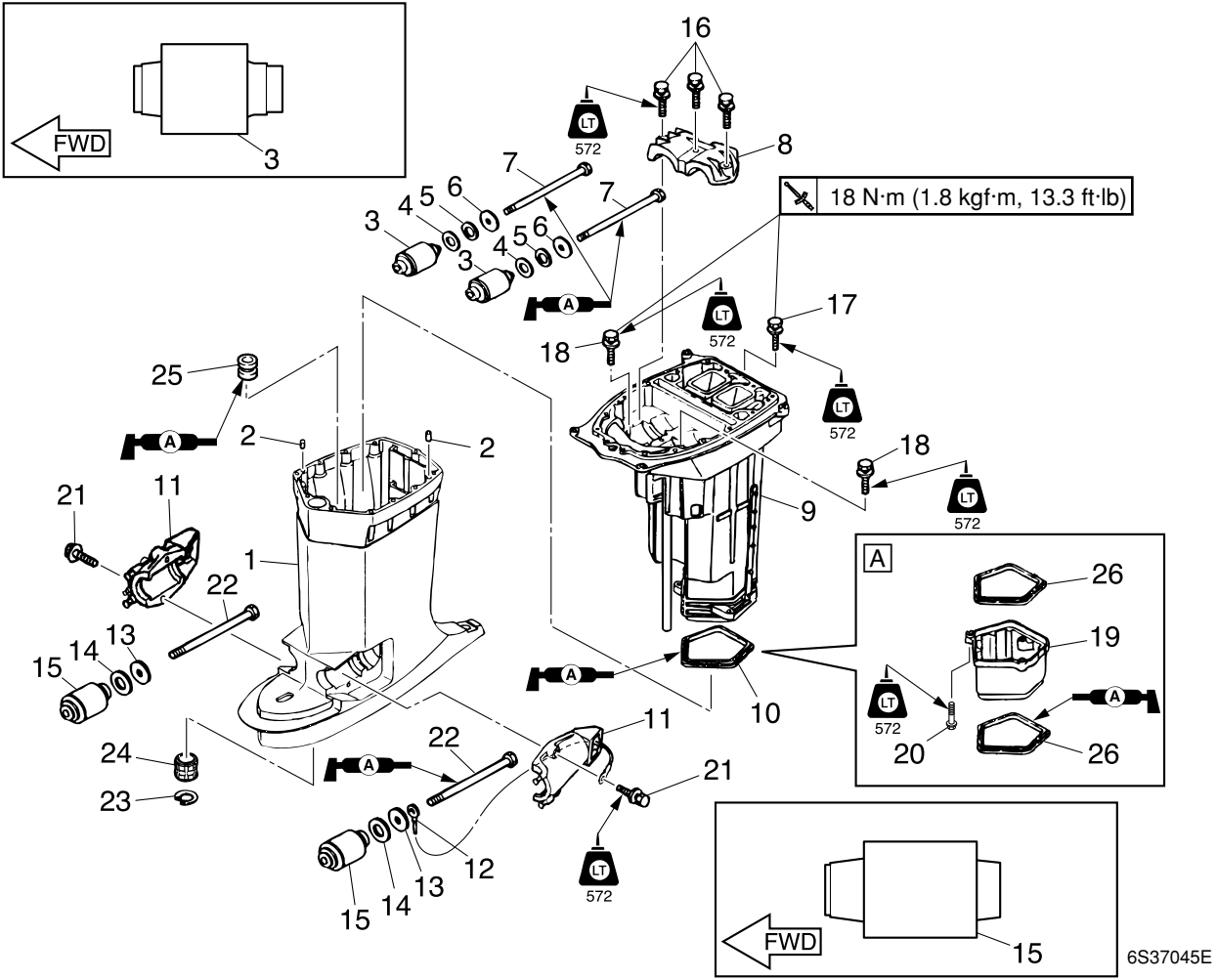
No.	Part name	Q'ty	Remarks
1	Upper case assembly	1	
2	Cover	2	
3	Ground lead	1	
4	Bolt	1	M6 × 10 mm
5	Bolt	1	M6 × 17 mm
6	Speed sensor adapter	1	
7	Dowel	1	
8	Lock tie	1	Not reusable
9	Hose	1	
10	Nut	2	
11	Washer	2	
12	Washer	2	
13	Washer	2	
14	Grommet	4	
15	Nut	2	
16	Washer	1	



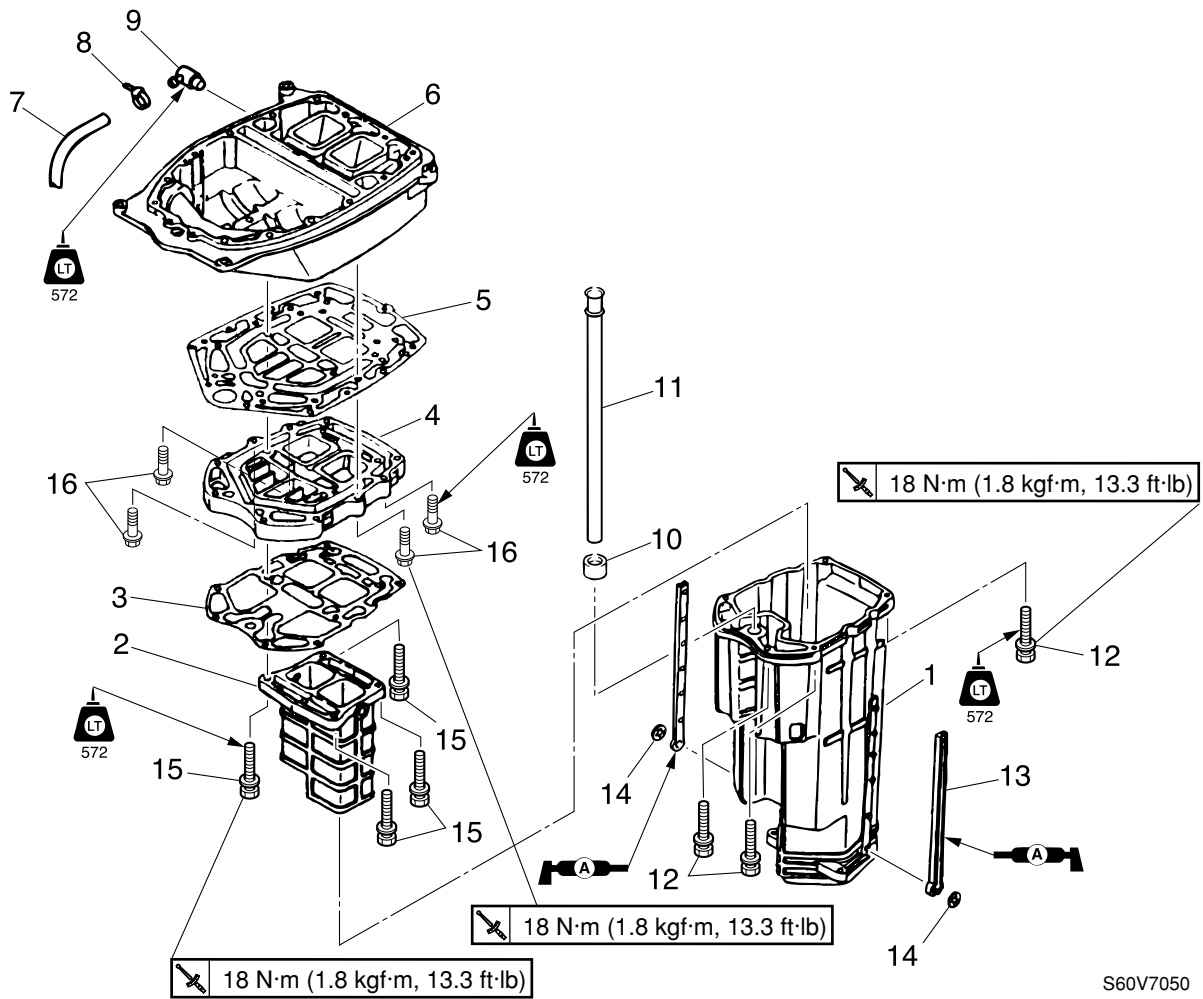
6S37045E

No.	Part name	Q'ty	Remarks
1	Upper case	1	
2	Dowel	2	
3	Upper mount	2	
4	Washer	2	
5	Rubber washer	2	
6	Washer	2	
7	Bolt	2	M14 × 190 mm
8	Bracket	1	
9	Muffler assembly	1	
10	Rubber seal	1	Not reusable
11	Mount housing	2	
12	Ground lead	1	
13	Washer	2	
14	Rubber washer	2	
15	Lower mount	2	
16	Bolt	3	M10 × 45 mm
17	Bolt	1	M8 × 45 mm

A U-transom



No.	Part name	Q'ty	Remarks
18	Bolt	2	M8 × 30 mm
19	Extension	1	U-transom
20	Bolt	3	M6 × 35 mm
21	Bolt	4	M10 × 45 mm
22	Bolt	2	M14 × 205 mm
23	Circlip	1	
24	Bushing	1	
25	Grommet	1	
26	Rubber seal	2	Not reusable

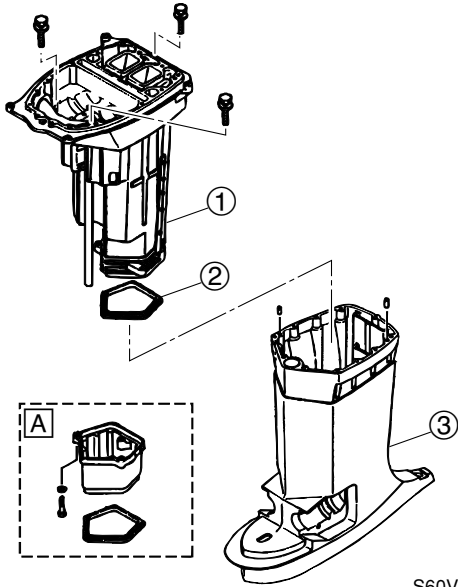


S60V7050

No.	Part name	Q'ty	Remarks
1	Muffler	1	
2	Exhaust manifold	1	
3	Gasket	1	Not reusable
4	Lower exhaust guide	1	
5	Gasket	1	Not reusable
6	Upper exhaust guide	1	
7	Flushing hose	1	
8	Lock tie	1	Not reusable
9	Joint	1	
10	Rubber seal	1	
11	Pipe	1	
12	Bolt	6	M8 × 50 mm
13	Rubber damper	2	
14	Clip	2	
15	Bolt	4	M8 × 50 mm
16	Bolt	4	M8 × 35 mm

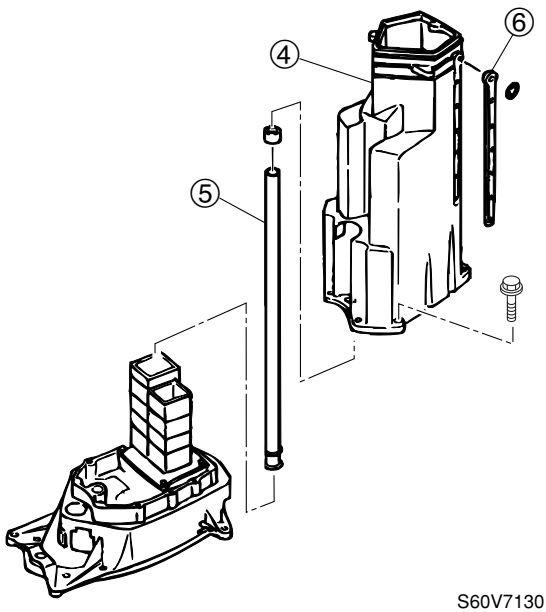
Disassembling the upper case

1. Remove the muffler assembly ① and rubber seal ② from the upper case ③.

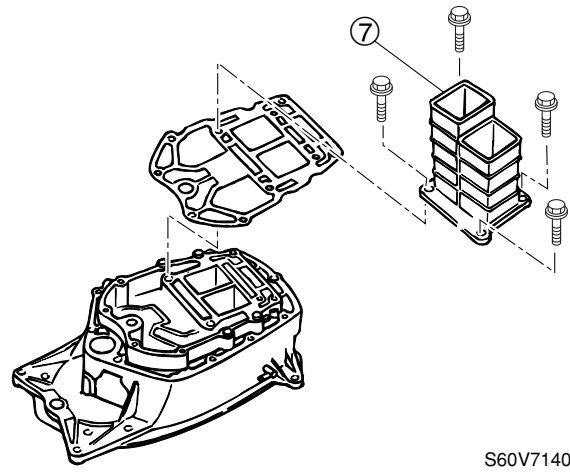


A U-transom

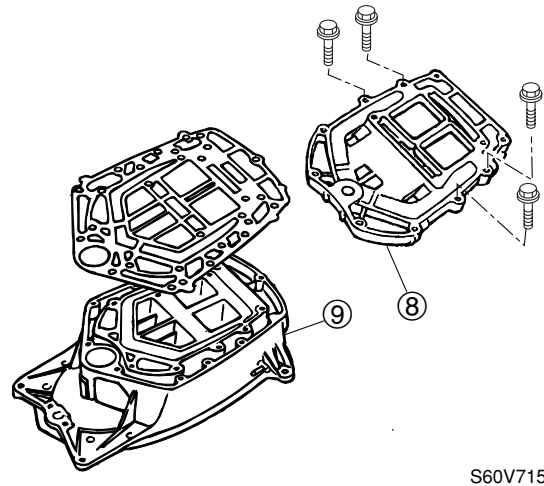
2. Remove the muffler ④, cooling water pipe ⑤, and rubber dampers ⑥.



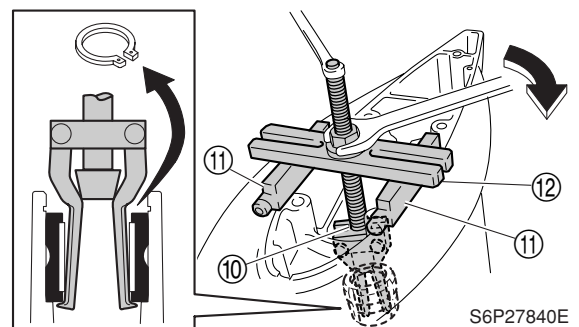
3. Remove the exhaust manifold ⑦.




4. Remove the lower exhaust guide ⑧ from the upper exhaust guide ⑨.



5. Remove the circlip, and then remove drive shaft bushing.



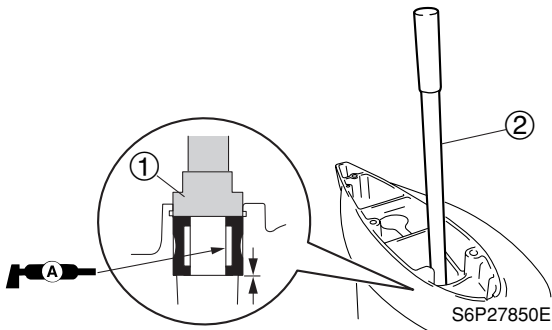
 Bearing puller assembly ⑩:
90890-06535
Stopper guide stand ⑪:
90890-06538
Stopper guide plate ⑫:
90890-06501

Checking the upper case

1. Check the rubber dampers. Replace if deterioration or cracks.
2. Check the cooling water pipe. Replace if deformation or corrosion.
3. Check the exhaust guide, exhaust manifold, and muffler. Replace if deformation or corrosion.


Assembling the upper case

1. Install the drive shaft bushing into the upper case, and then install the circlip.

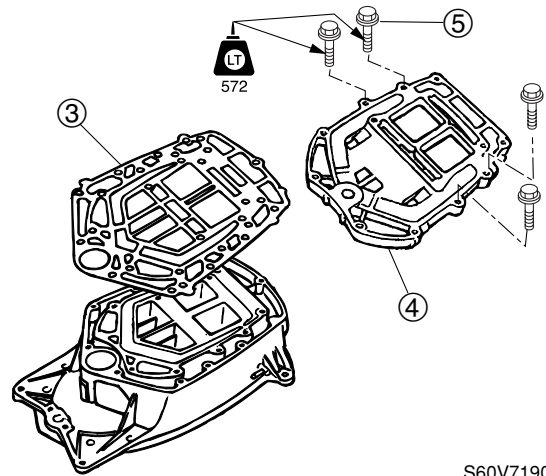



NOTE:

After installing the drive shaft bushing, apply grease to the inside of the bushing.

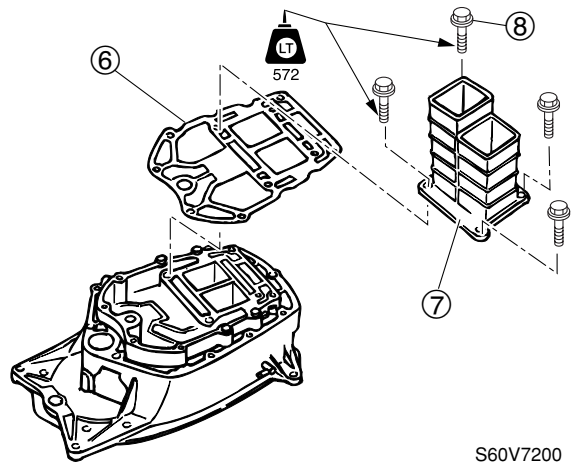
	Needle bearing attachment ①: 90890-06653
	Driver rod L3 ②: 90890-06652


2. Install a new gasket ③, the lower exhaust guide ④, and bolts ⑤, and then tighten the bolts to the specified torque.



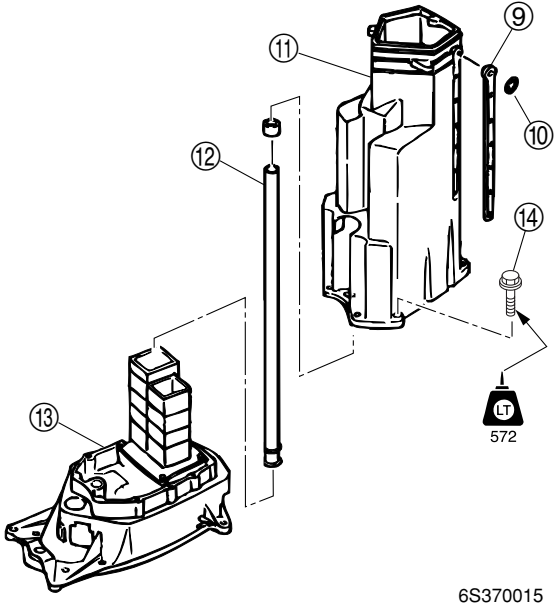
	Exhaust guide bolt ⑤: 18 N·m (1.8 kgf·m, 13.3 ft·lb)
---	---

3. Install a new gasket ⑥, the exhaust manifold ⑦, and bolts, and then tighten the bolts to the specified torque.




	Exhaust manifold bolt ⑧: 18 N·m (1.8 kgf·m, 13.3 ft·lb)
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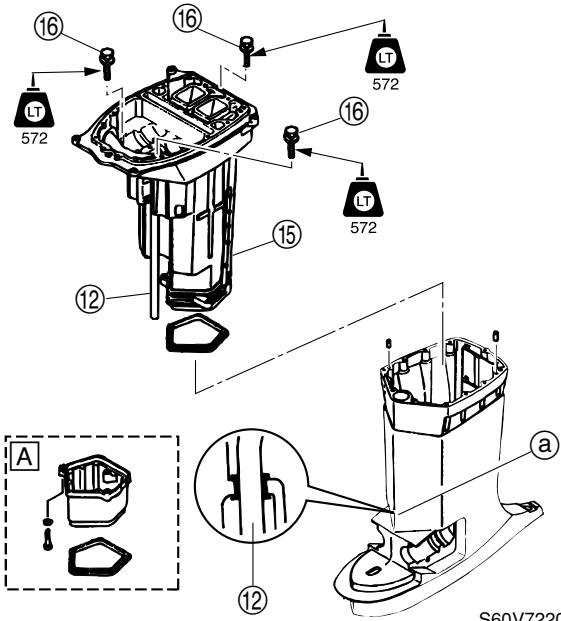
4. Install the rubber damper ⑨ and clip ⑩ onto the muffler ⑪.
5. Install the cooling water pipe ⑫ onto the muffler ⑪.
6. Install the muffler ⑪ onto the exhaust guide assembly ⑬, and then tighten the bolts ⑭ to the specified torque.



6S370015


 Muffler bolt ⑭:
18 N·m (1.8 kgf·m, 13.3 ft·lb)

7. Install the muffler assembly ⑮ during inserting the tip of the cooling water pipe ⑫ into the joint hole ① of the upper case.
8. Tighten the muffler assembly bolts ⑯ to the specified torque.

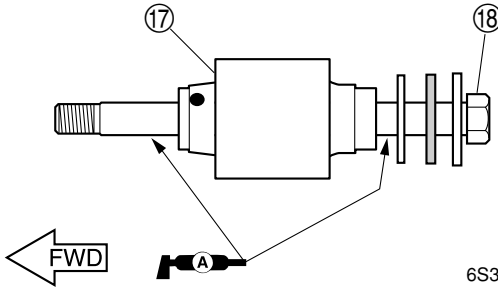


S60V7220

A U-transom

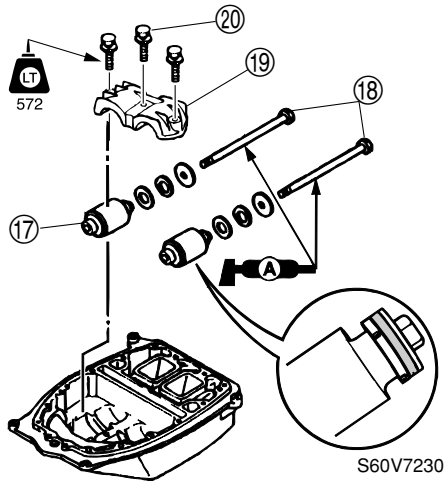
 Muffler assembly bolt ⑯:
18 N·m (1.8 kgf·m, 13.3 ft·lb)

9. Install the upper mounts ⑰ and bolts ⑱ into the upper case assembly.



6S370016

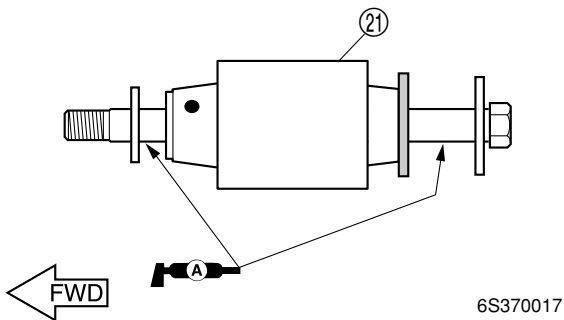
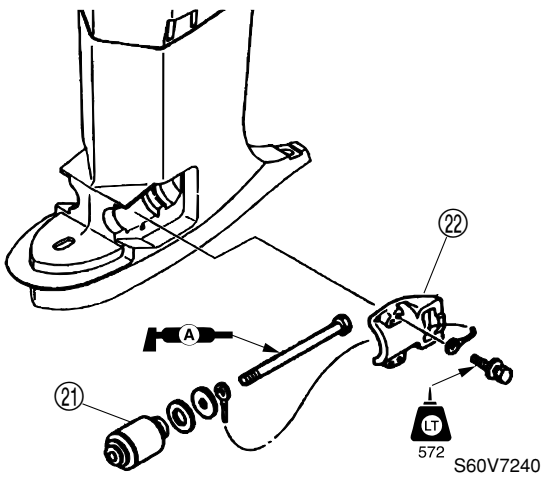
10. Install the bracket (19), and then tighten the bolts (20).

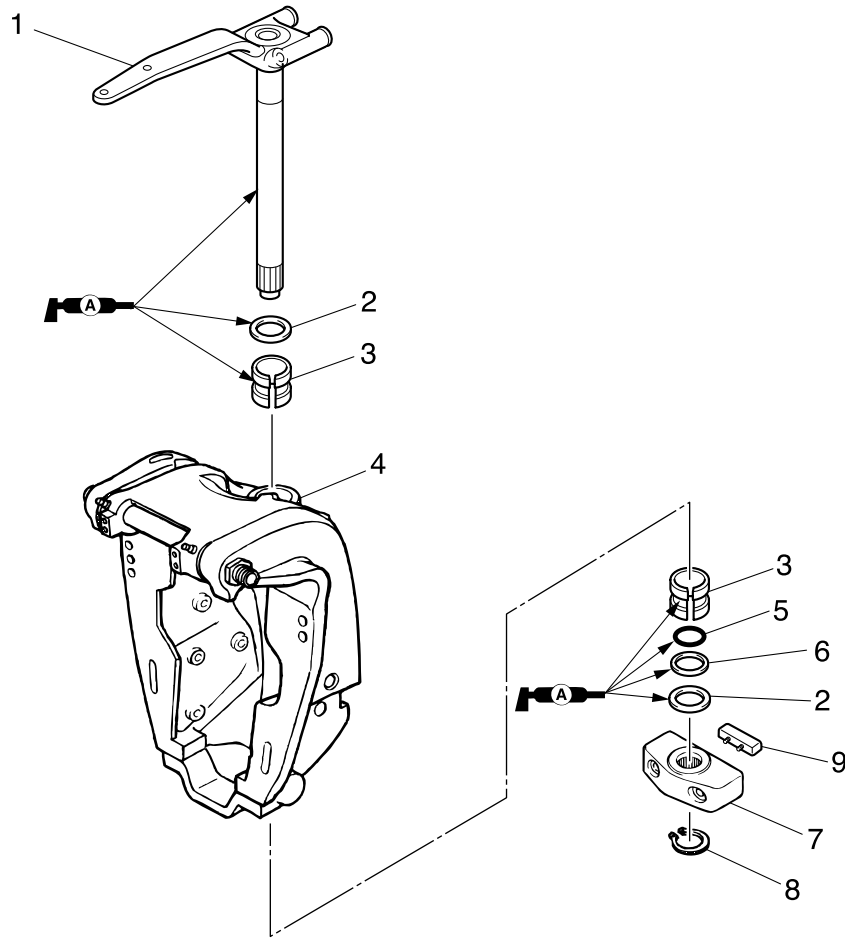


NOTE:

First tighten the center located, when tighten the bolts (21).

11. Install the lower mounts (21) and mount housings (22).



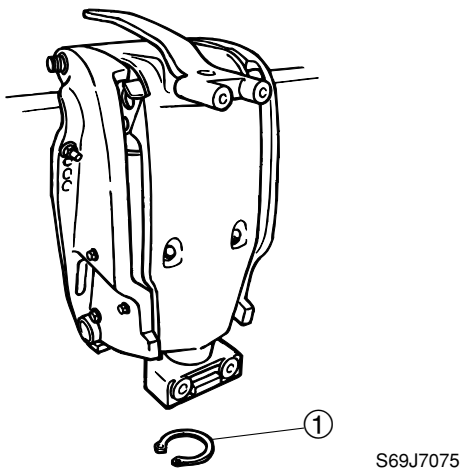


6S37040E

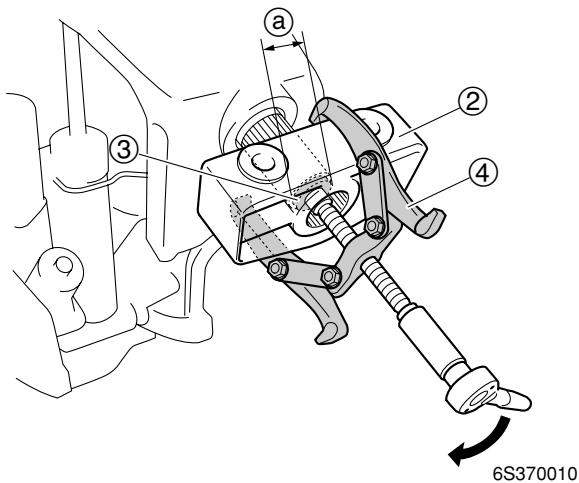
No.	Part name	Q'ty	Remarks
1	Steering arm	1	
2	Washer	2	
3	Bushing	2	
4	Bracket assembly	1	
5	O-ring	1	Not reusable
6	Bushing	1	
7	Steering yoke	1	
8	Circlip	1	
9	Damper	1	

Removing the steering arm

1. Remove the circlip ①.



2. Remove the steering yoke ② as shown.

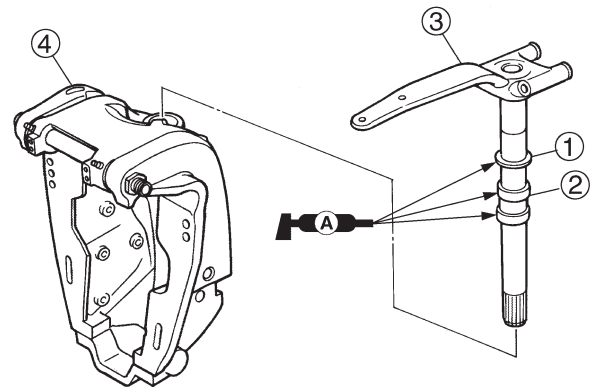


NOTE: _____
 Use a spacer ③ (a= 30 mm) and gear puller ④ (commercially available).

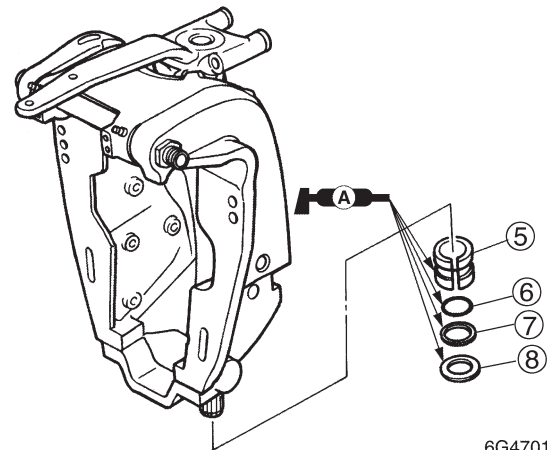
3. Remove the steering arm from the swivel bracket by pulling the arm off the bracket.

Installing the steering arm

1. Install the washer ① and bushing ② onto the steering arm ③.
2. Place the swivel bracket ④ in an upright position, and then install the steering arm onto the swivel bracket assembly



3. Install the bushing ⑤, new O-ring ⑥, bushing ⑦, and washer ⑧ onto the swivel bracket assembly.

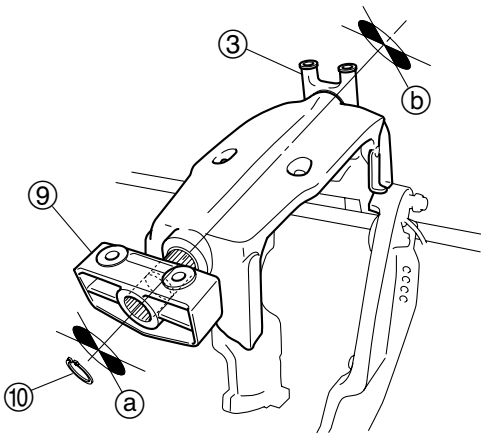


4. Install the steering yoke (9) to the steering arm (3) by aligning the center (a) of the yoke with the center (b) of the steering arm.

NOTE:

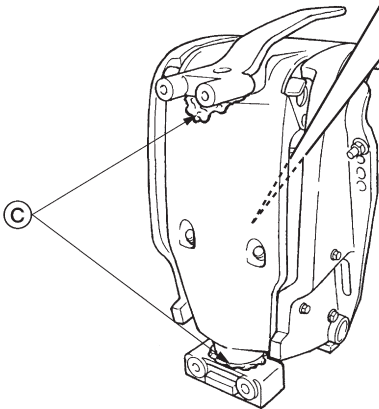
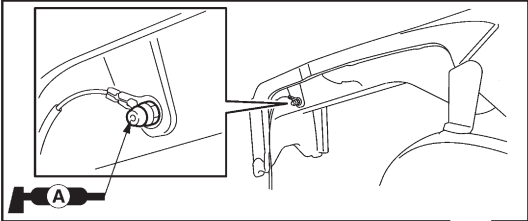
Hold the steering arm after tilt up the swivel bracket, and then strike the steering yoke until the circlip installing slot visible.

5. Install the circlip (10).



6S370020

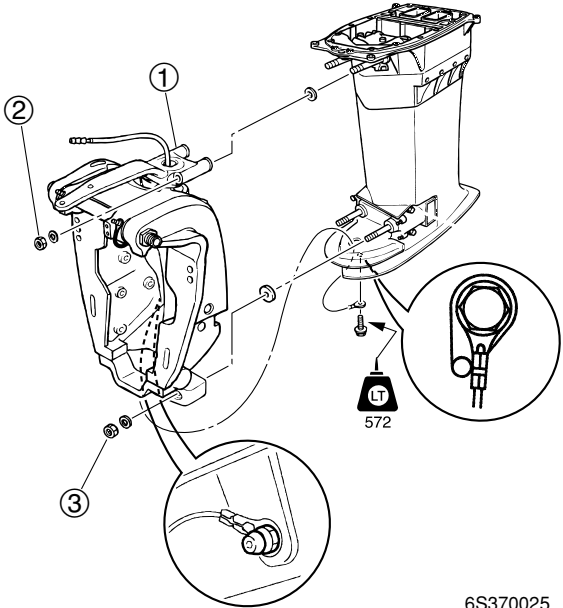
6. Inject grease into the grease nipple until grease comes out from both the upper and lower bushings (C).



S6P27090

Installing the upper case


1. Install the upper and lower mount bolts into the bracket assembly (1) simultaneously.
2. Install the upper mount nuts (2) and lower mount nuts (3), and then tighten them to the specified torques.



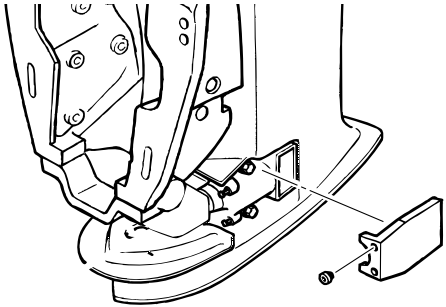
6S370025

NOTE:

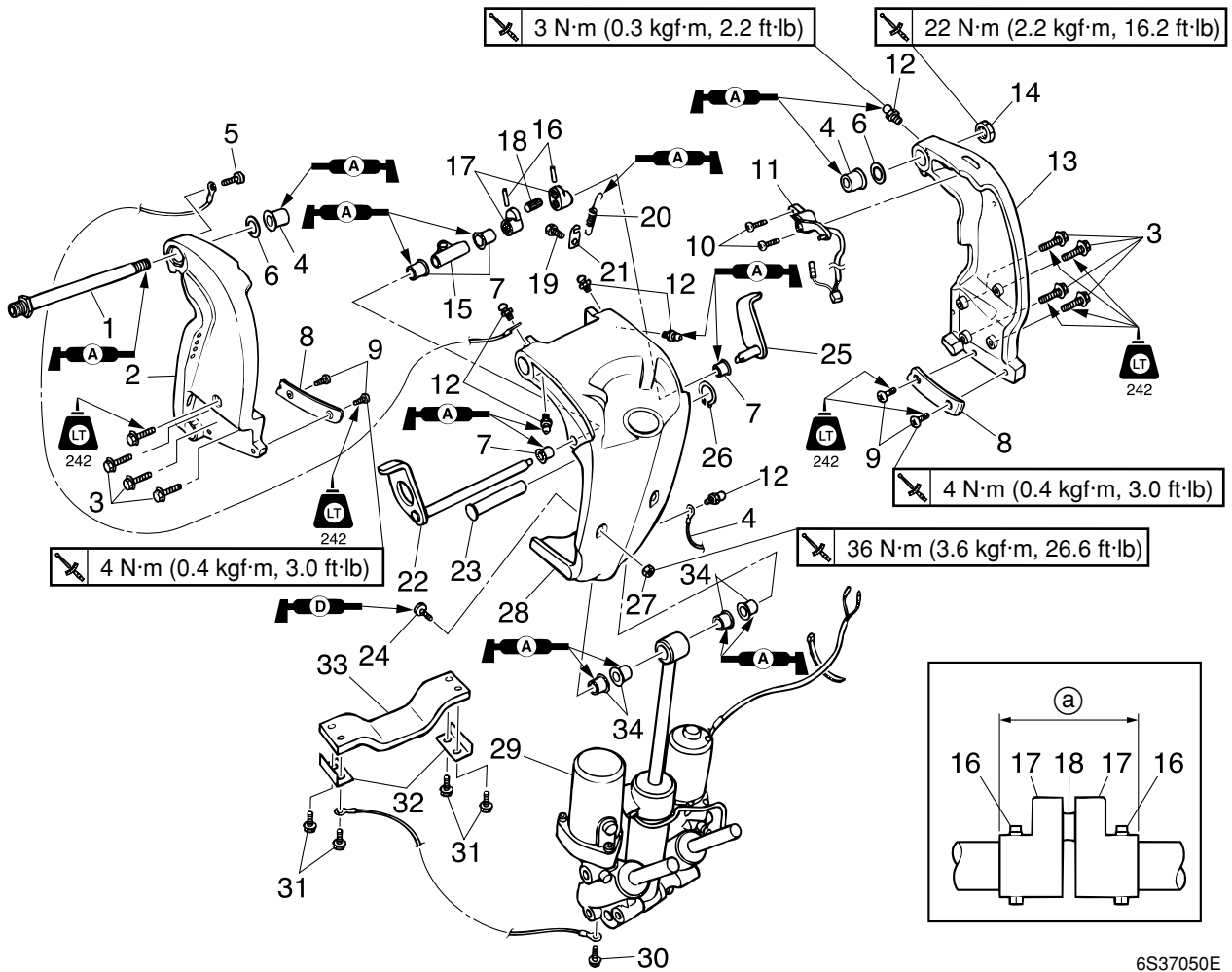
Before tight the uppercase, wiring the ground lead.

	Upper mount nut (2):
	72 N·m (7.2 kgf·m, 53.1 ft·lb)
	Lower mount nut (3):
	72 N·m (7.2 kgf·m, 53.1 ft·lb)

3. Install the covers.

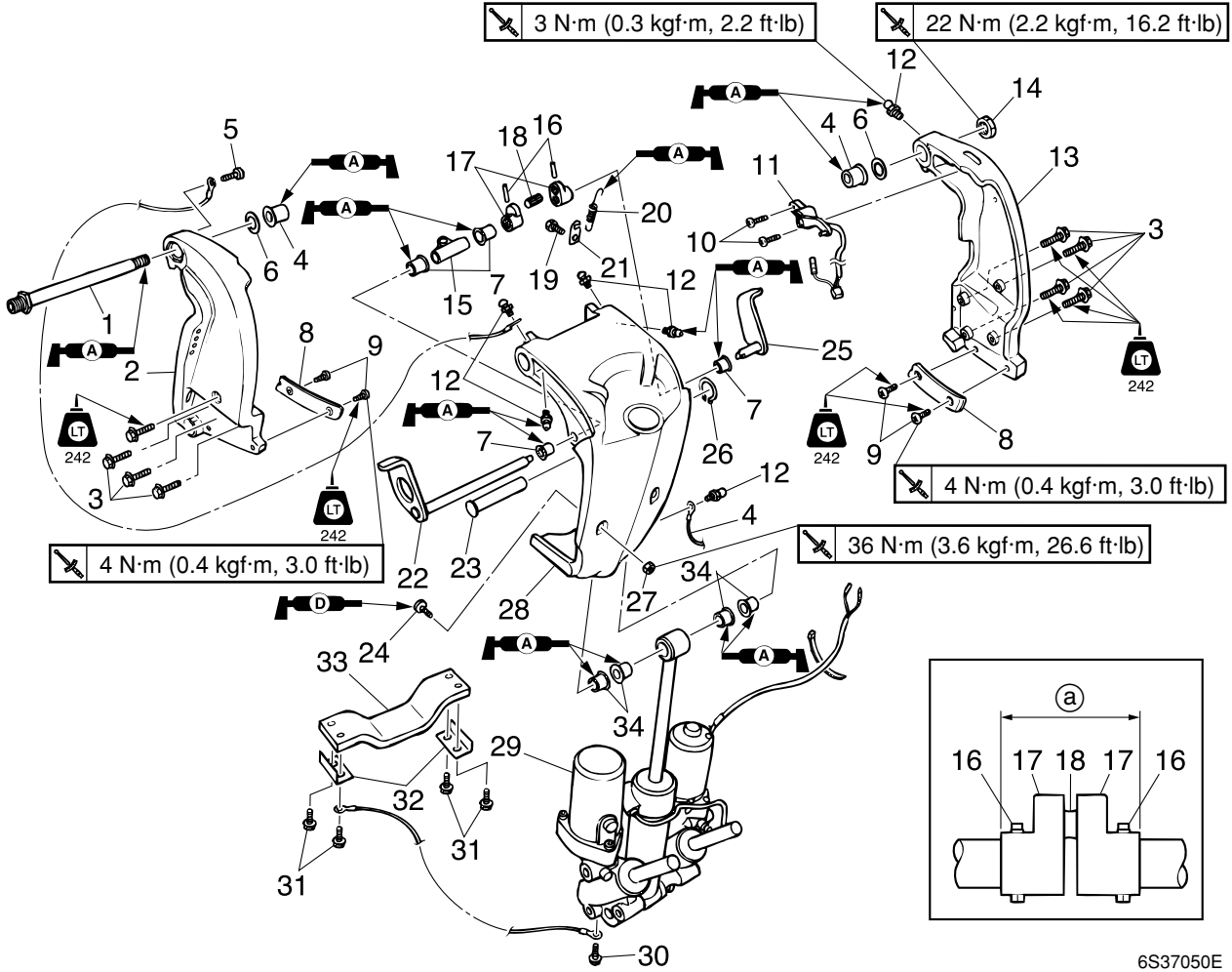


Clamp bracket and swivel bracket



6S37050E

No.	Part name	Q'ty	Remarks
1	Through tube	1	
2	Port clamp bracket	1	
3	Bolt	8	M10 × 45 mm
4	Bushing	2	
5	Screw	1	∅6 × 10 mm
6	Washer	2	
7	Bushing	4	
8	Friction plate	2	
9	Screw	4	∅6 × 10 mm
10	Screw	2	∅6 × 15 mm
11	Trim sensor	1	
12	Grease nipple	6	
13	Starboard clamp bracket	1	
14	Self-locking nut	1	
15	Collar	1	
16	Pin	2	
17	Tilt lever joint	2	@: 30.3–30.4 mm (1.19 – 1.20 in)



6S37050E

No.	Part name	Q'ty	Remarks
18	Pin	1	
19	Bolt	1	M6 × 10 mm
20	Spring	1	
21	Spring holder	1	
22	Port tilt stop lever	1	
23	Shaft	1	
24	Trim stopper	2	
25	Starboard tilt stop lever	1	
26	Circlip	1	
27	Nut	2	
28	Swivel bracket	1	
29	PTT unit	1	
30	Bolt	1	M6 × 10 mm
31	Bolt	4	M6 × 25 mm
32	Bracket	2	
33	Anode	1	
34	Bushing	4	

Removing the PTT unit

1. Fully tilt the outboard motor up, and then support it with the tilt stop lever ①.



⚠WARNING

- After tilting up the outboard motor, be sure to support it with the tilt stop lever. Otherwise, the outboard motor could suddenly lower if the PTT unit should lose fluid pressure.
- When removing the PTT unit without removing the power unit, be sure to suspend the outboard motor. Otherwise, the outboard motor could suddenly fall and result in injury.

NOTE:

If the PTT does not operate, turn the manual valve counterclockwise and tilt the outboard motor up manually.

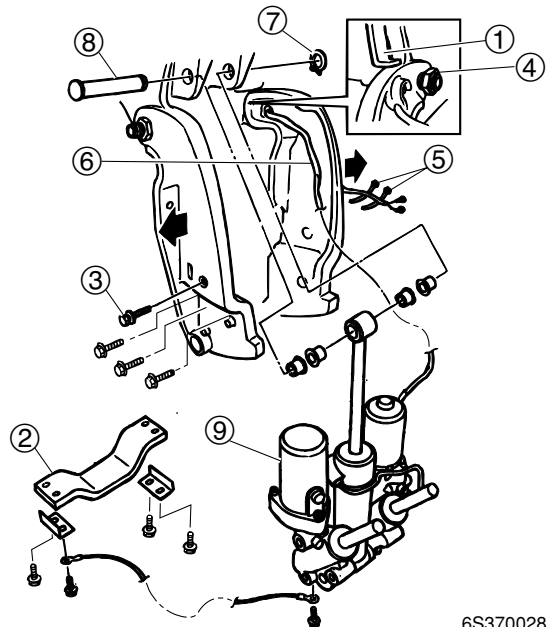
2. Remove the anode ② and PTT mount bolts ③.
3. Loosen the self-locking nut ④, and then move the clamp brackets slightly in the direction of the arrows.

⚠WARNING

Do not remove the tilt stop lever ① from the clamp brackets.

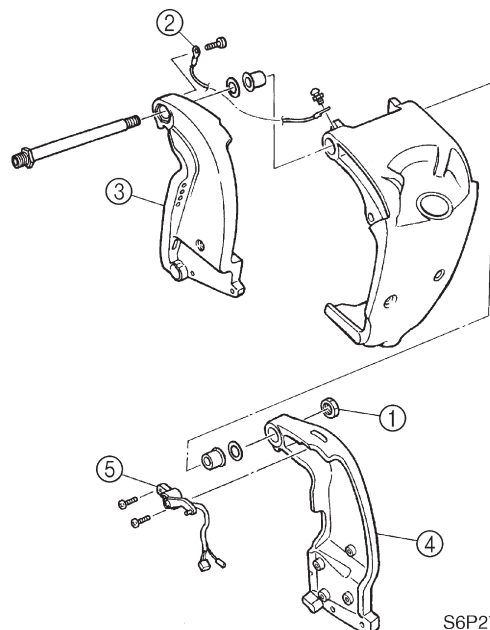
4. Remove the lock ties ⑤, and then pull out the PTT motor lead ⑥.

5. Remove the circlip ⑦, and then remove the shaft ⑧.
6. Remove the PTT unit ⑨.



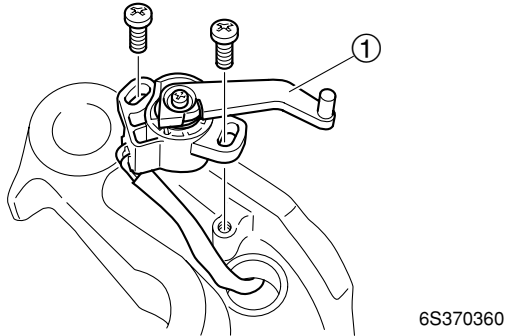
Removing the clamp bracket

1. Remove the self-locking nut ① and ground lead ②, then remove the clamp brackets ③ and ④.
2. Remove the trim sensor ⑤.



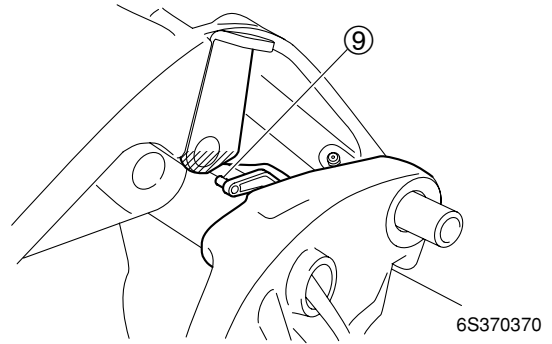
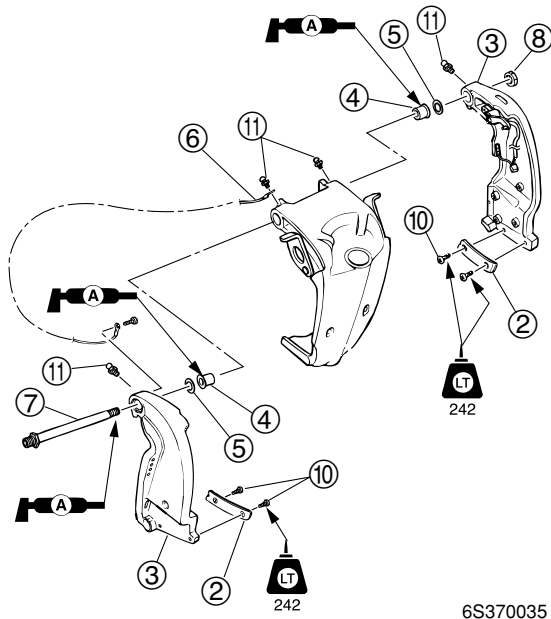
Installing the clamp bracket

1. Install the tilt stop levers and spring onto the swivel bracket assembly.
2. Install the trim sensor ① onto the star-board clamp bracket.




NOTE: _____
Adjust the trim sensor after installing the PTT unit.

3. Install the friction plate ② onto the clamp bracket ③, and then install the bushings ④, washers ⑤, and then assemble the clamp brackets and the swivel bracket.
4. Connecting the ground lead ⑥, installing the through tube ⑦, and then tightening the self-locking nut ⑧ temporary.

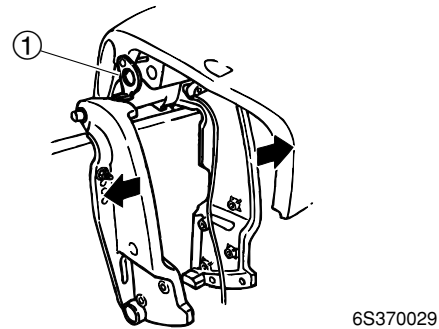


CAUTION: _____
Do not pinch the trim sensor pin ⑨ when down the swivel bracket.

	Friction plate screw ⑩: 4 N·m (0.4 kgf·m, 3.0 ft·lb)
	Grease nipple ⑪: 3 N·m (0.3 kgf·m, 2.2 ft·lb)

Installing the PTT unit

1. Fully tilt the outboard motor up, and then support it with the tilt stop lever ①.



WARNING _____

- When installing the PTT unit without removing the power unit, be sure to suspend the outboard motor. Otherwise, the outboard motor could suddenly fall and result in injury.
- After tilting the outboard motor up, be sure to support it with the tilt stop lever.

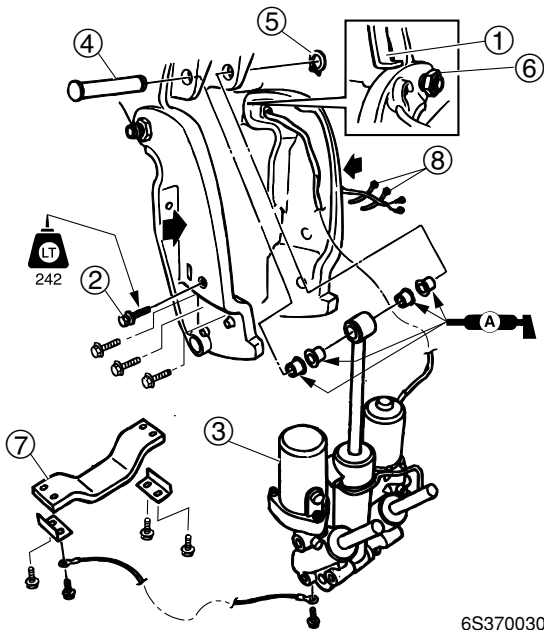
Clamp bracket and swivel bracket

2. Install the PTT unit mount bolts ② onto both clamp brackets together with the PTT unit ③, and then tighten them.
3. Install the tilt ram upper end into the swivel bracket with the shaft ④ and circlip ⑤.
4. Tighten the self-locking nut ⑥ to the specified torque.



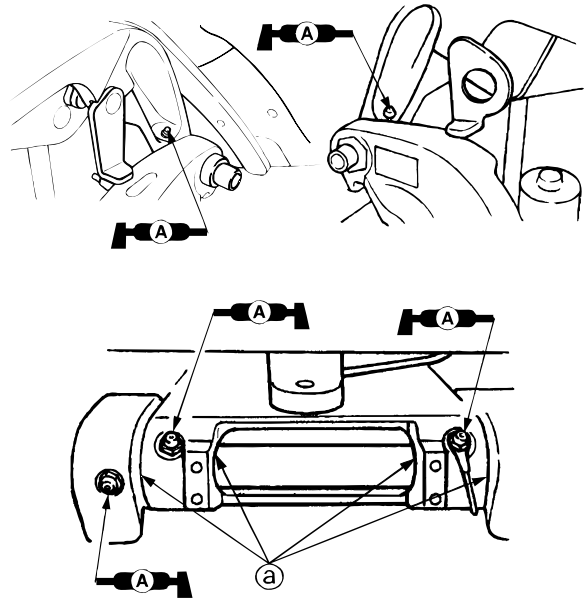
Self-locking nut ⑥:
22 N·m (2.2 kgf·m, 16.2 ft·lb)

5. Install the anode ⑦.
6. Pass the PTT motor lead and trim sensor lead through the hole of the starboard clamp bracket.
7. Fasten the PTT motor lead and trim sensor lead with the lockties ⑧.



6S370030

8. Inject grease into all grease nipples until grease comes out from the bushings ⑨.



S69J7145

Adjusting the trim sensor

1. Fully tilt the outboard motor up, and then support it with the tilt stop lever ①.



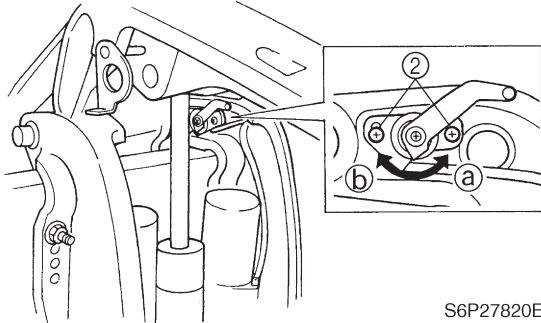
S60V3310

⚠WARNING

After tilting up the outboard motor, be sure to support it with the tilt stop lever. Otherwise, the outboard motor could suddenly lower if the PTT unit should lose fluid pressure.

7

2. Loosen the screws ②.
3. Adjust the position of the trim sensor, and then tighten the screws ② temporary.

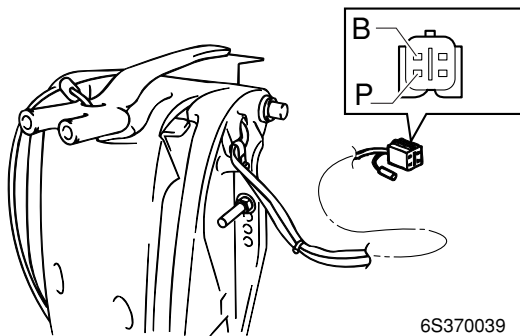


S6P27820E


NOTE:

- To decrease the resistance, turn the trim sensor in direction ①.
- To increase the resistance, turn the trim sensor in direction ②.

4. Fully tilt the outboard motor down.
5. Measure the trim sensor resistance. Repeat steps 1– 4 if out of specification.



6S370039

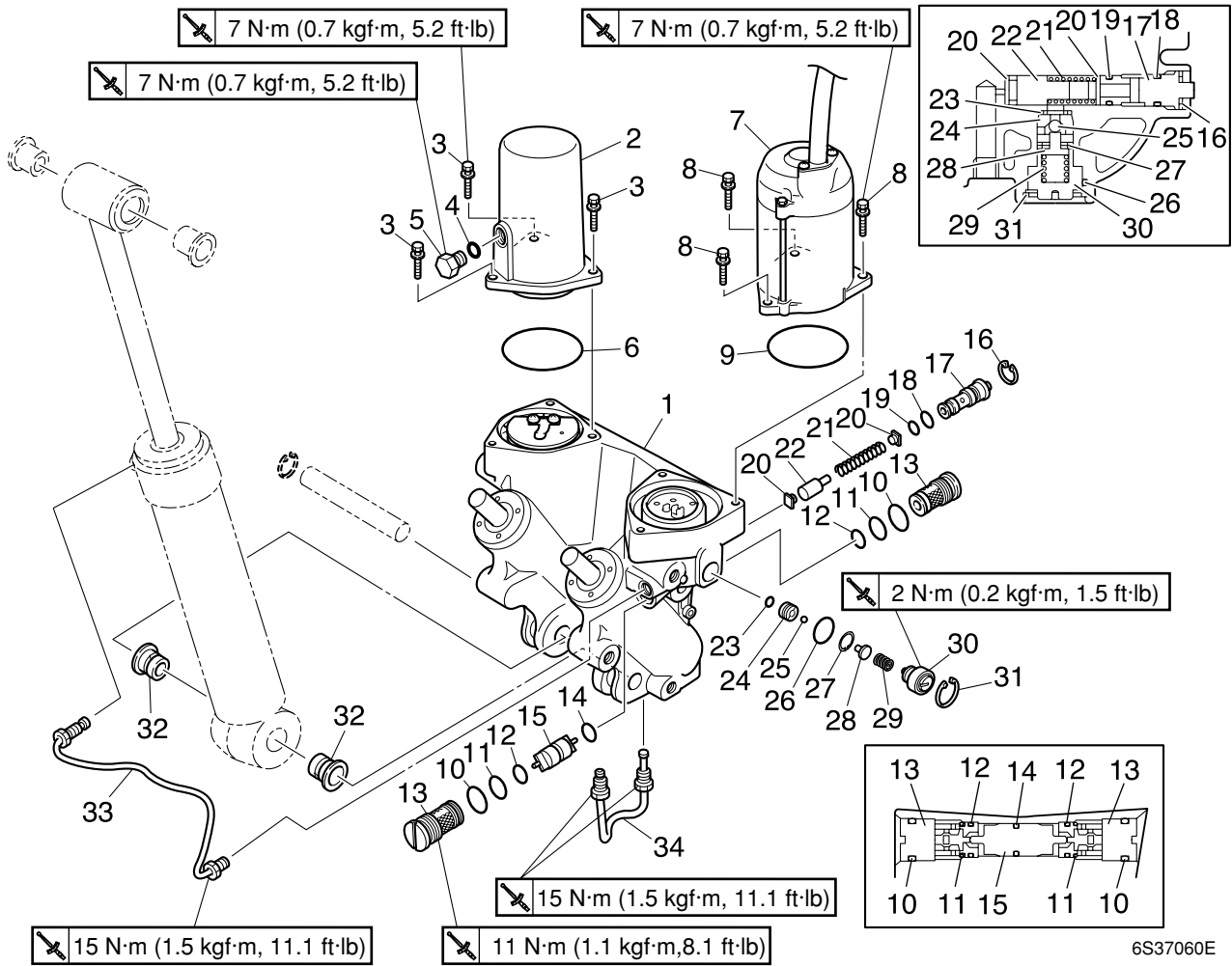
	<p>Trim sensor resistance: Pink (P)–Black (B) 9–11 Ω at 20°C (68°F)</p>
---	---

6. Tighten the screws ②.
7. Fully tilt the outboard motor down.

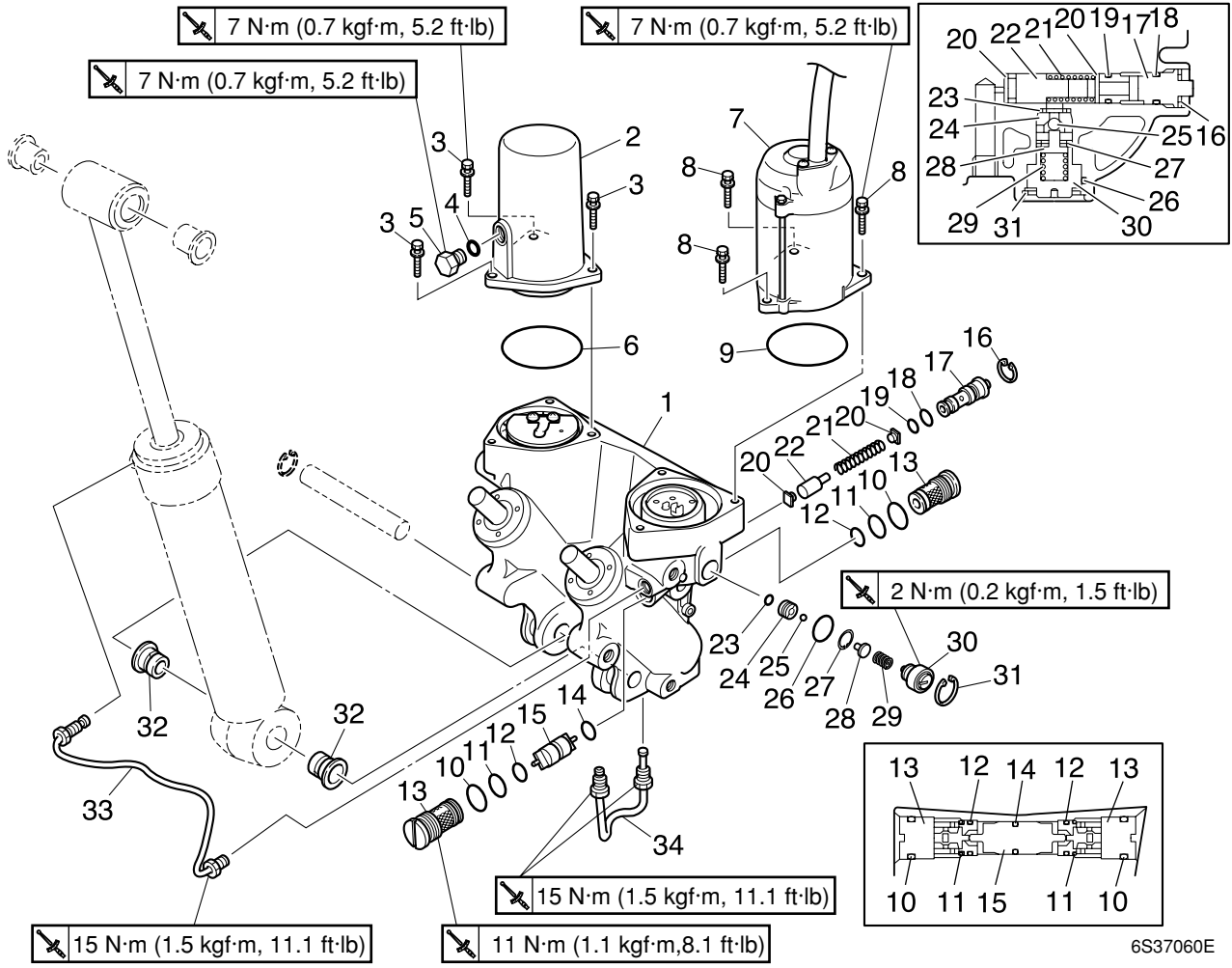
NOTE:

Check the trim sensor resistance after tighten the screws and fully tilt the outboard motor down.

PTT unit



No.	Part name	Q'ty	Remarks
1	PTT body	1	
2	Reservoir	1	
3	Bolt	3	M3 × 30 mm
4	O-ring	1	Not reusable
5	Reservoir cap	1	
6	O-ring	1	Not reusable
7	PTT motor	1	
8	Bolt	3	M3 × 30 mm
9	O-ring	1	Not reusable
10	O-ring	2	Not reusable
11	O-ring	2	Not reusable
12	O-ring	2	Not reusable
13	Main valve	2	
14	O-ring	1	Not reusable
15	Piston	1	
16	Circlip	1	
17	Valve support	1	

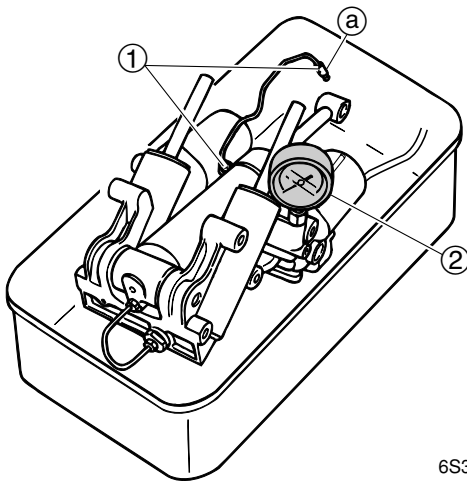


6S37060E

No.	Part name	Q'ty	Remarks
18	O-ring	1	Not reusable
19	O-ring	1	Not reusable
20	Main valve seat	2	
21	Spring	1	
22	Adopter	1	
23	O-ring	1	Not reusable
24	Valve seat	1	
25	Ball	1	
26	O-ring	1	Not reusable
27	Circlip	1	
28	Manual release rod	1	
29	Spring	1	
30	Manual valve	1	
31	Circlip	1	
32	Bushing	2	
33	Pipe	1	
34	Pipe	1	

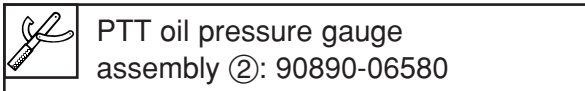
Checking the hydraulic pressure

1. Check the hydraulic pressure. Check the internal parts if out of specification.
2. Fully extend the PTT rams.
3. Loosen the pipe joints ①, and then remove the pipe joint ②.
4. Install the special service tools.

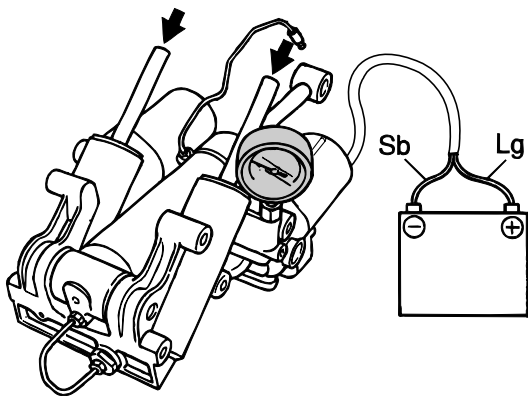


NOTE:

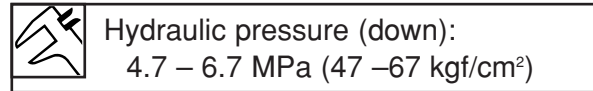
Put the PTT unit in the drain pan.



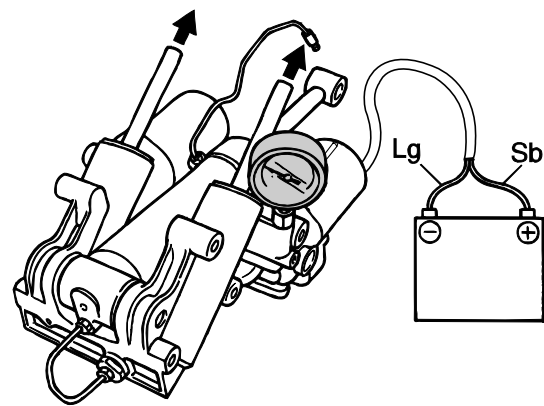
5. Connect the PTT motor leads to the battery terminals to retract the trim rams, and then measure the hydraulic pressure.



Rams	PTT motor lead	Battery terminal
Down	Light green (Lg)	⊕
	Sky blue (Sb)	⊖



6. Reverse the PTT motor leads between the battery terminals to fully extend the rams.



Rams	PTT motor lead	Battery terminal
Up	Sky blue (Sb)	⊕
	Light green (Lg)	⊖

7. Remove the special service tools.
8. Install the pipe joints, and then tightening them to the specified torque.

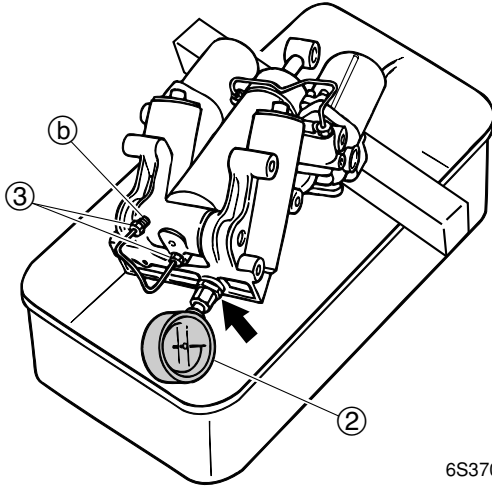


9. Connect the PTT motor leads to the battery terminals to fully retract the trim and tilt rams.




10. Loosen the pipe joints ③, and then remove the pipe joint ②.

11. Install the special service tools as shown.

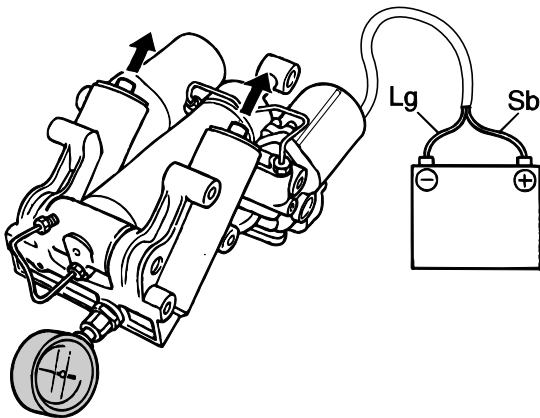



NOTE:

Put the PTT unit in the drain pan.

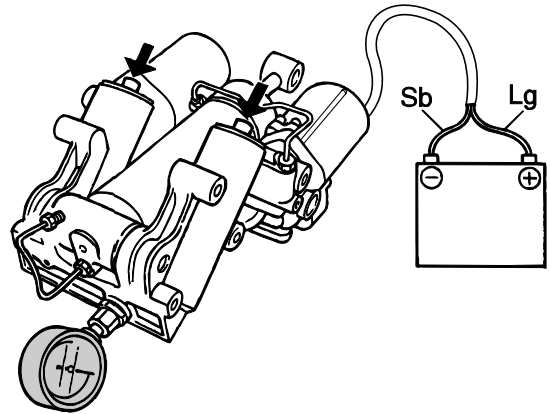
	PTT oil pressure gauge assembly ②: 90890-06580
---	--

12. Connect the PTT motor leads to the battery terminals to extend the trim rams, and then measure the hydraulic pressure.




	Hydraulic pressure (up): 11.3 – 13.3 MPa (113 – 133 kgf/cm ²)
---	--

13. Reverse the PTT motor leads between the battery terminals to fully retract the rams.

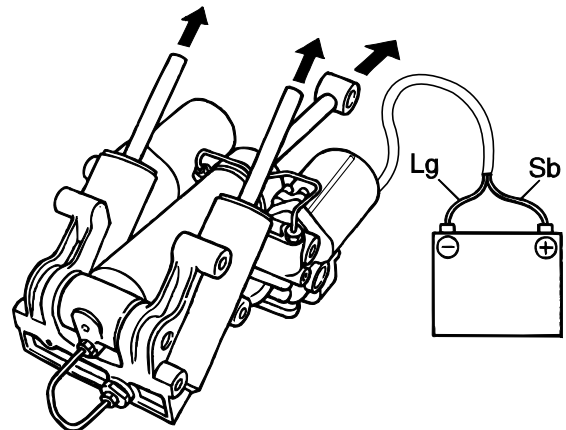


14. Remove the special service tool.

15. Install the pipe joints, and then tightening them to the specified torque.

	Pipe joint: 15 N·m (1.5 kgf·m, 11.1 ft·lb)
---	---

16. After measuring the hydraulic pressure, connect the PTT motor leads to the battery terminals to fully extend the trim and tilt rams.



17. Place the PTT unit in an upright position.
18. Remove the reservoir cap ④, and then check the fluid level in the reservoir.

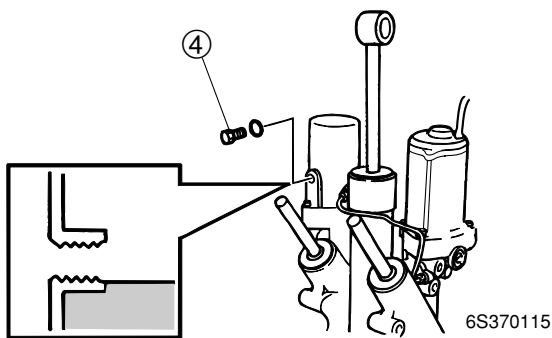
⚠WARNING

Make sure that the trim and tilt rams are fully extended when removing the reservoir cap, otherwise fluid can spurt out from the unit due to internal pressure.

NOTE:

If the fluid is at the correct level, the fluid should overflow out of the filler hole when the cap is removed.

19. If necessary, add sufficient fluid of the recommended type to the correct level.



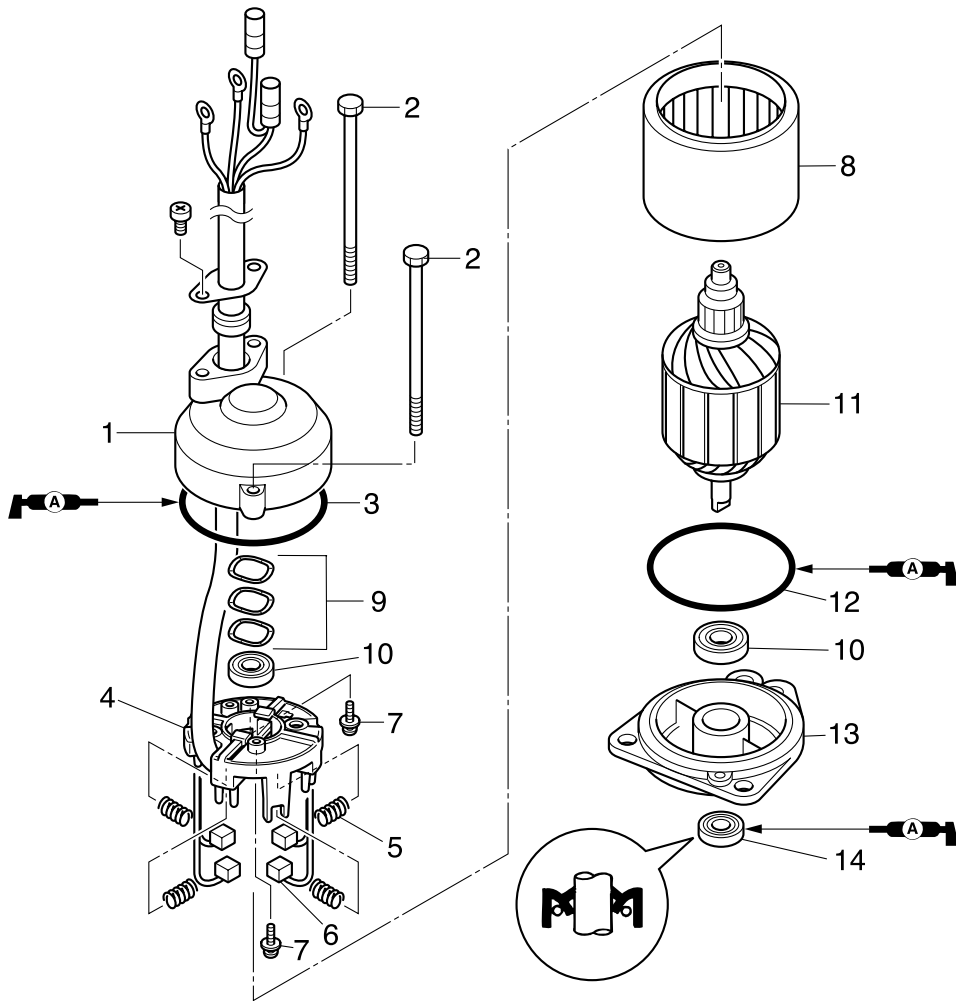
Recommended PTT fluid:
ATF Dexron II

20. Install the new O-ring and reservoir cap ④, then tighten it to the specified torque.



Reservoir cap ④:
7 N·m (0.7 kgf·m, 5.2 ft·lb)

PTT motor



6S37080E

No.	Part name	Q'ty	Remarks
1	Frame	1	
2	Bolt	2	M5 × 100 mm
3	O-ring	1	Not reusable
4	Brush holder assembly	1	
5	Spring	4	
6	Brush	2	
7	Screw	5	ø4 × 10 mm
8	Stator assembly	1	
9	Wave washer	3	
10	Bearing	2	
11	Armature	1	
12	O-ring	1	
13	PTT motor base	1	
14	Oil seal	1	Not reusable

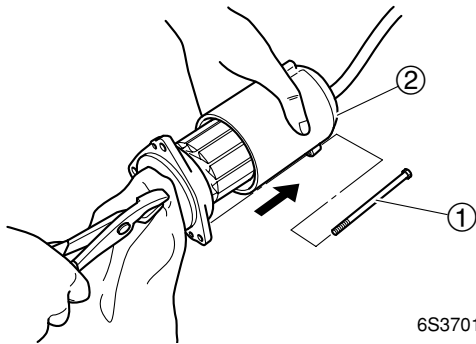
Disassembling the PTT motor

1. Remove the PTT motor, O-ring, and joint from the PTT unit.

⚠ WARNING

- Make sure that the trim and tilt rams are fully extended when removing the PTT motor, otherwise fluid can spurt out from the unit due to internal pressure.
- Do not push the trim and tilt rams down while the PTT motor is removed from the PTT unit, otherwise fluid can spurt out.

2. Remove the PTT motor bolts ①, then the stator ②.



6S370120

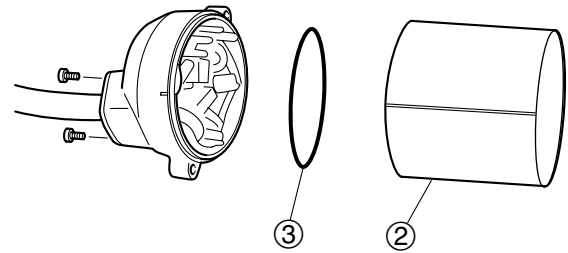
CAUTION:

Do not allow grease or oil to contact the commutator.

NOTE:

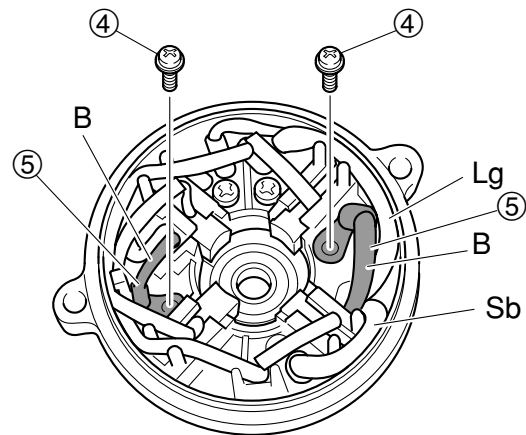
Place a clean cloth over the end of the armature shaft, hold it with a pair of pliers, and then carefully slide the stator off of the armature.

3. Remove the stator ② and O-ring ③.



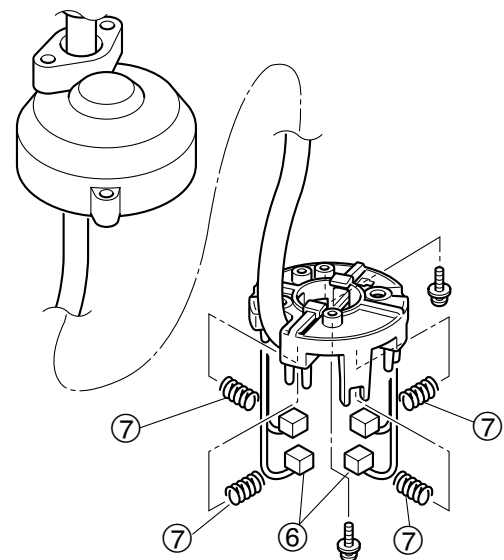
6S370130

4. Remove the screws ④ and slide the holder, and then disconnect the PTT motor leads ⑤.



6S370135

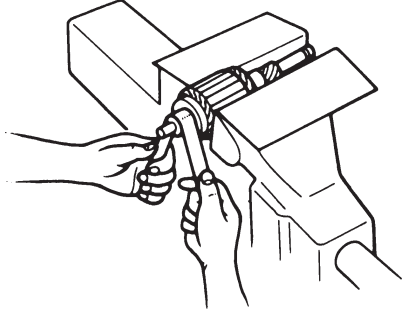
5. Remove the brushes ⑥ and springs ⑦.



6S370145

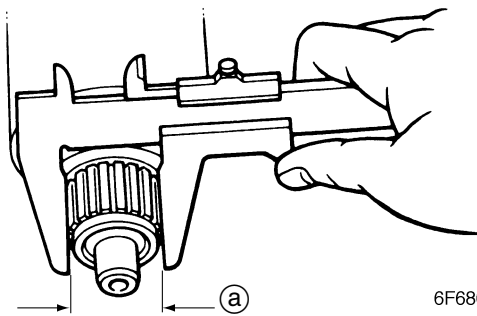
Checking the PTT motor

1. Check the commutator. Clean with 600-grit sandpaper and compressed air if dirty.




6G480220

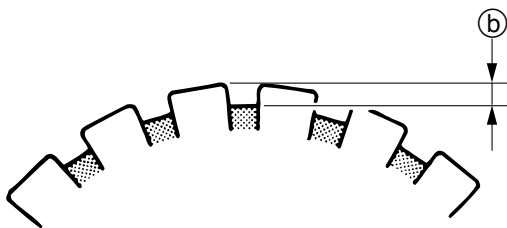
2. Measure the commutator diameter. Replace the armature if below specification.




6F680175

 Motor commutator standard diameter (a):
 25.0 mm (0.98 in)
 Wear limit:
 24.0 mm (0.95 in)

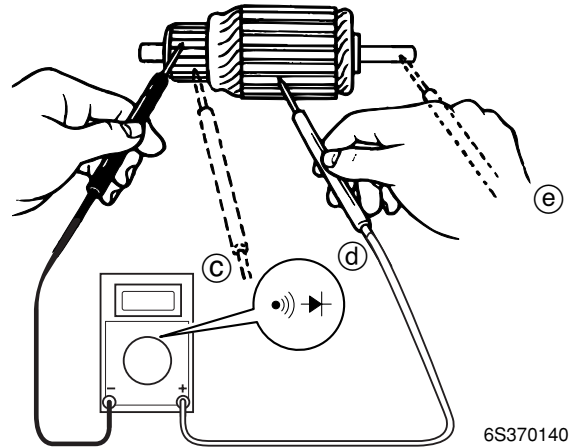
3. Measure the commutator undercut (b). Replace the armature if below specification.




6F680180

 Motor commutator standard undercut (b):
 1.8 mm (0.07 in)
 Wear limit: 1.2 mm (0.05 in)

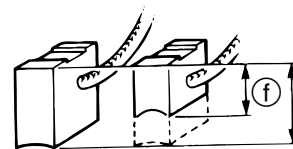
4. Check the armature for continuity. Replace if out of specifications.




6S370140

 Armature continuity	
Commutator segments (c)	Continuity
Segment (c) – Armature core (d)	No continuity
Segment (c) – Armature shaft (e)	No continuity

5. Measure the brush length. Replace if below specification.



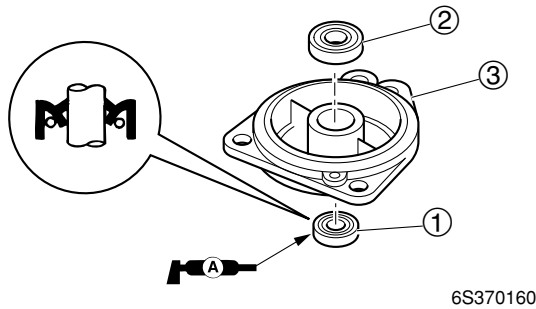
6S370150

 Motor brush standard length:
 12.0 mm (0.47 in)
 Wear limit (f):
 4.0 mm (0.16 in)

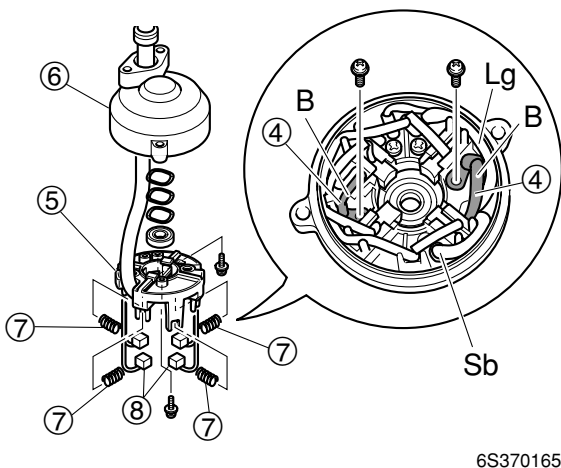
6. Check the base. Replace if cracked or damaged.
7. Check the bearing and oil seal. Replace if damaged or worn.

Assembling the PTT motor

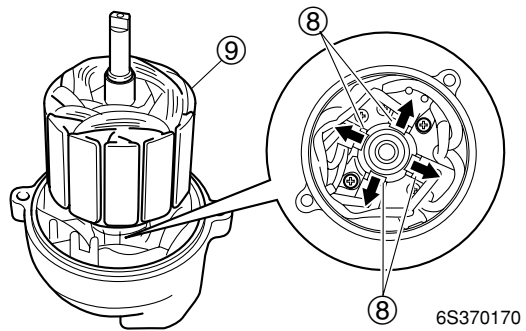
1. Install the new oil seal ① and bearing ② into the motor base ③ as shown.



2. Install the wave washer and bearing into the frame.
3. Connect the PTT motor leads ④ to the brush holder ⑤, and then install the brush holder ⑤ to the frame ⑥.
4. Install the springs ⑦ and brushes ⑧ to the brush holder.



5. Push the brushes ⑧ into the holders, and then install the armature ⑨.



6. Install a new O-ring, and align the line with mating mark and then install the stator.

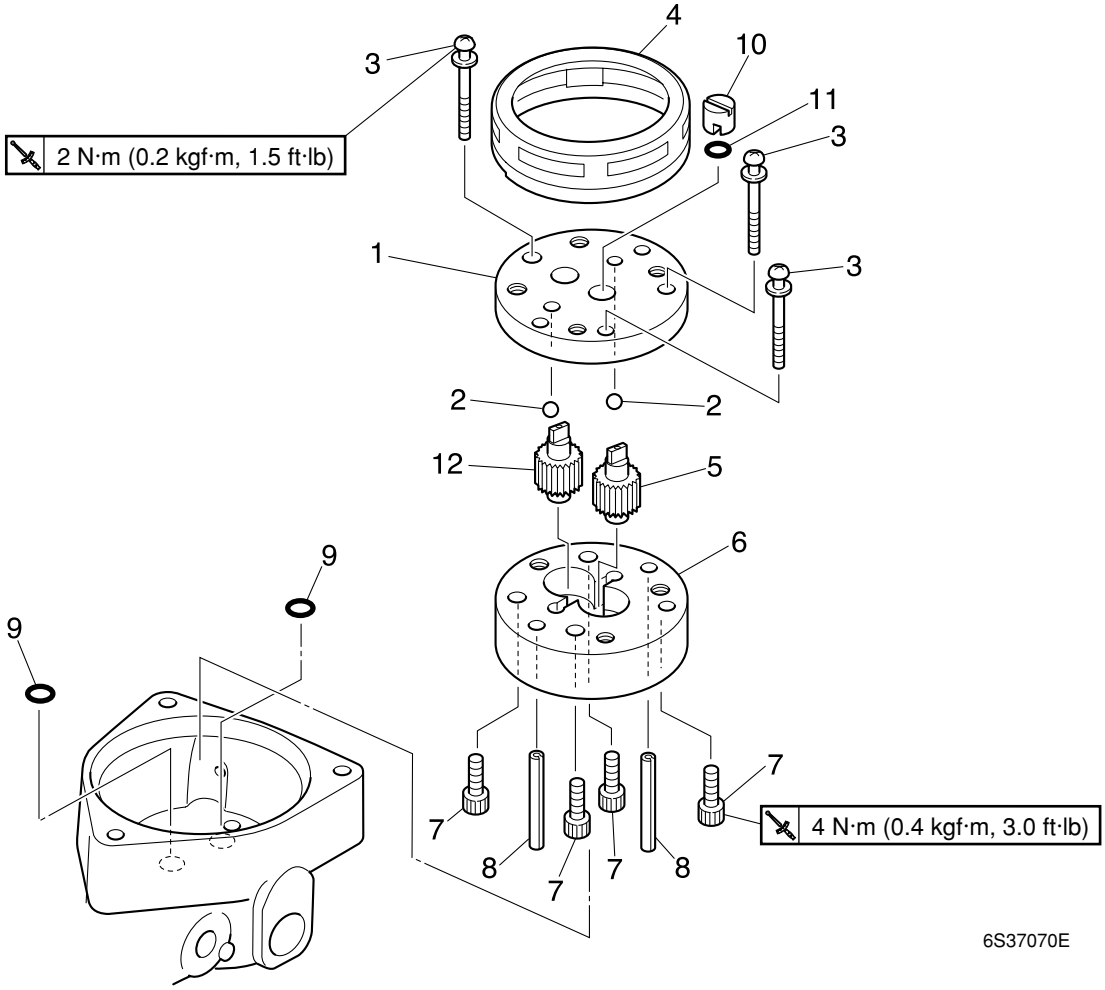


NOTE: _____
Align the line on the frame with the mating on the flame.

7. Install the PTT motor base.

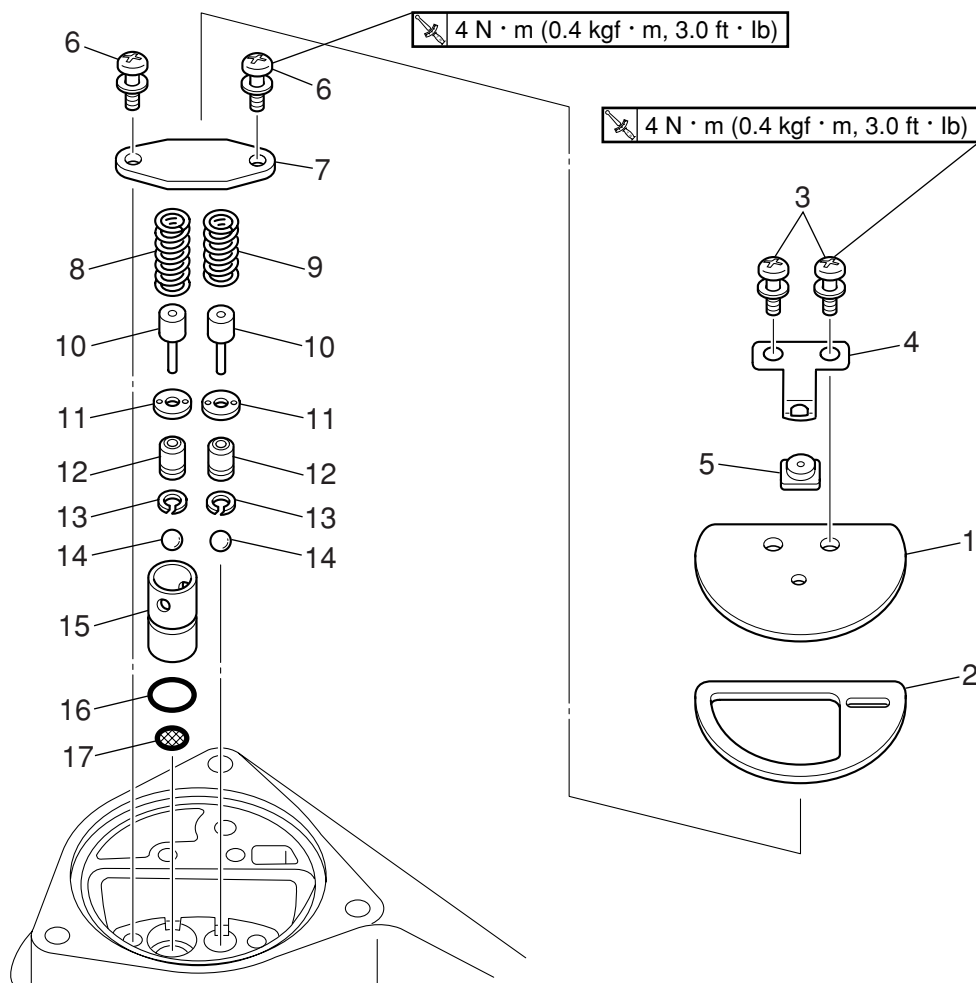


Gear pump



6S37070E

No.	Part name	Q'ty	Remarks
1	Gear housing 1	1	
2	Ball	2	
3	Screw	3	ø4 × 30 mm
4	Gear pump filter	1	
5	Drive gear	1	
6	Gear housing 2	1	
7	Bolt	4	M5 × 12 mm
8	Pin	2	
9	O-ring	2	Not reusable
10	Joint	1	
11	O-ring	1	Not reusable
12	Driven gear	1	

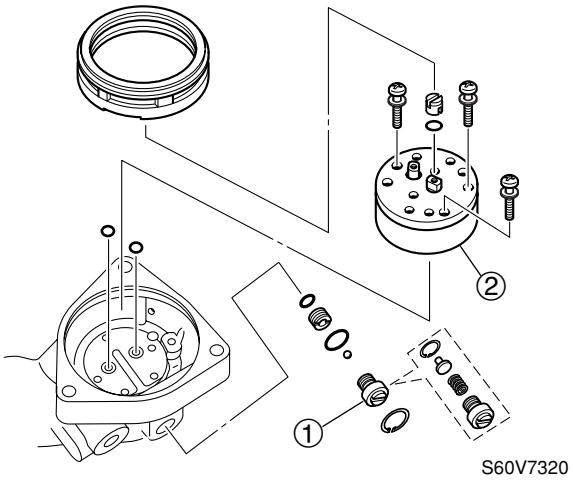


S60V7110

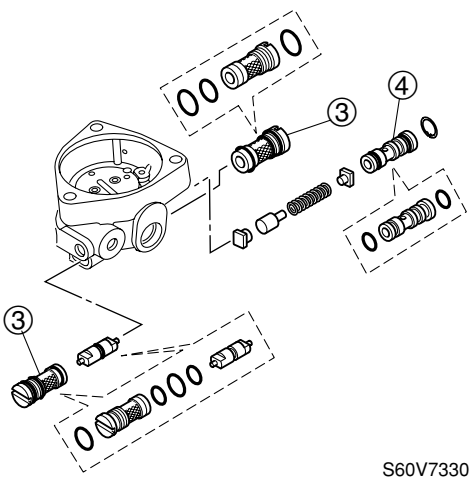
No.	Part name	Q'ty	Remarks
1	Trim down plate	1	
2	Seal	1	
3	Screw	2	ø5 × 10 mm
4	Trim down spring	1	
5	Main valve seal	1	
6	Screw	2	ø5 × 10 mm
7	Relief valve plate	1	
8	Up-relief valve spring	1	
9	Down-relief valve spring	1	
10	Pin	2	
11	Washer	2	
12	Valve seat	2	
13	Valve seal	2	
14	Ball	2	
15	Relief valve seat	1	
16	O-ring	1	Not reusable
17	Filter	1	

Disassembling the gear pump and main valve

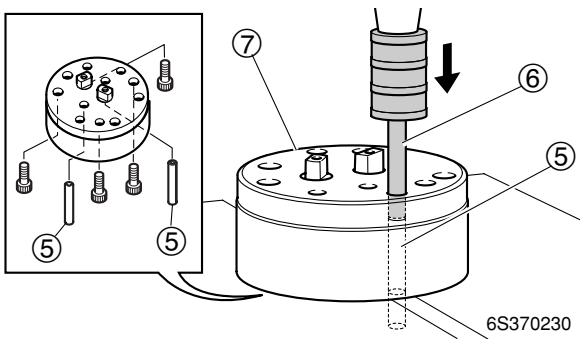
1. Remove the manual valve ① and gear pump ②.



2. Remove the main valves ③ and valve support ④.

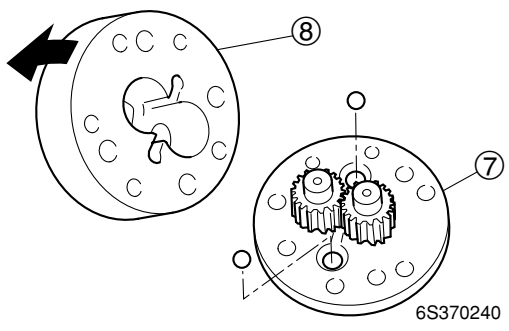


3. Remove the pins ⑤, and then remove the bolts.



NOTE: Use the 4 mm pin punch ⑥, until remove the gear pump housing 1 ⑦ press the pins ⑤.

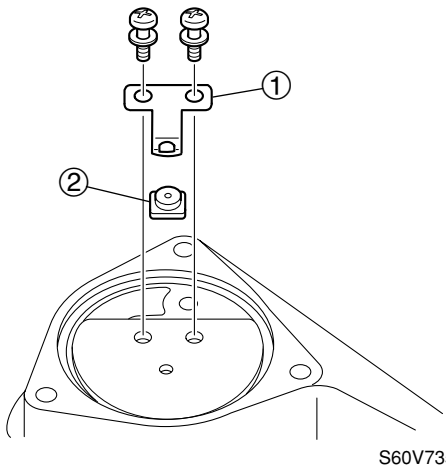
4. Separate the gear pump housing 2 ⑧ from the gear pump as shown.



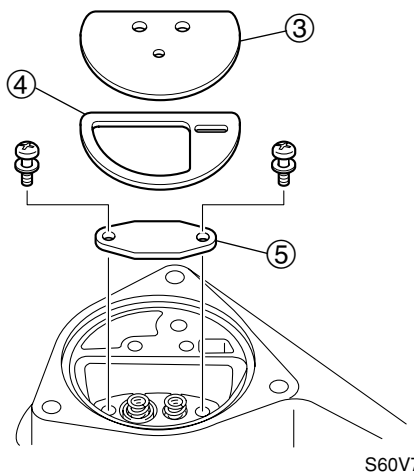
NOTE: Upside down the gear pump housing, and then remove the gear pump housing 2 ⑧.

Disassembling the relief valve

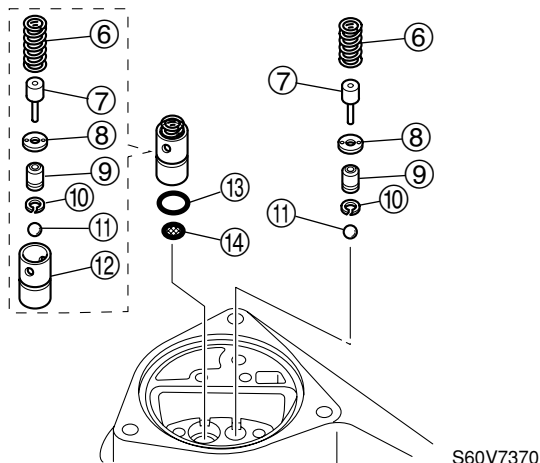
1. Remove the trim down spring ① and main valve seal ②.



2. Remove the trim down plate ③ and seal ④, then the relief valve plate ⑤.



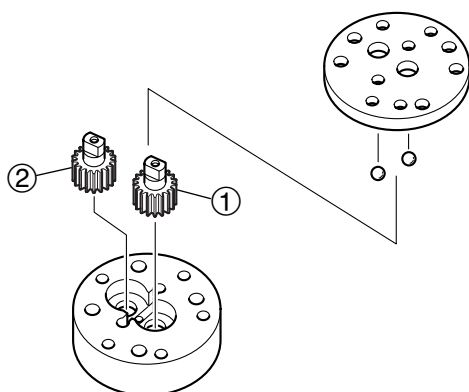
- Remove the springs ⑥ pins ⑦, washers ⑧, valve seats ⑨, valve seats ⑩, balls ⑪, relief valve seat ⑫, O-ring ⑬ and filter ⑭.



S60V7370

Checking the gear pump

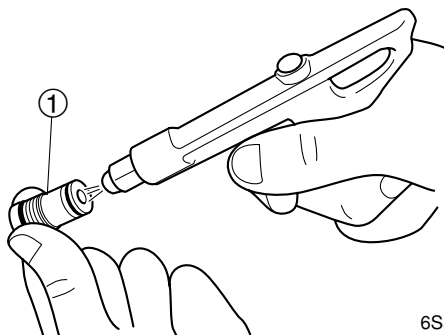
- Check the drive gear ① and driven gear ②. Replace if damaged, scratched or excessive worn.



6S370235

Checking the main valve

- Check the main valve ①. Clean if there is dirt or residue.



6S370250

Checking the gear pump housing

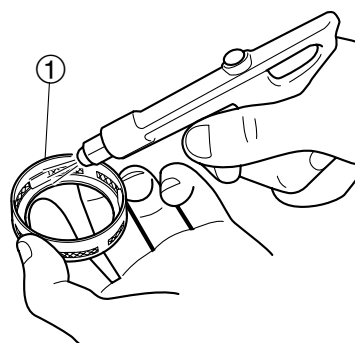
- Check the inside of the gear pump housing. Replace if scratched or worn.

Checking the reservoir

- Check the reservoir and O-ring. Replace if deterioration and corrosion.

Checking the filter

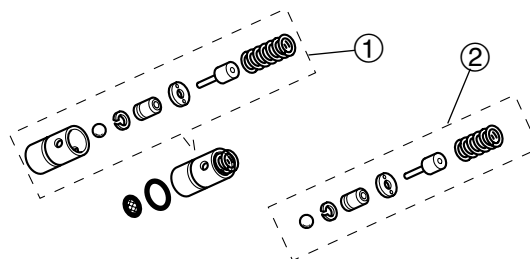
- Check gear pump filter ①. Clean if there is dirt or residue.



6S370260

Checking relief valve

- Check the up-relief valve ① and down-relief valve ②. Clean if there is dirt or residue.



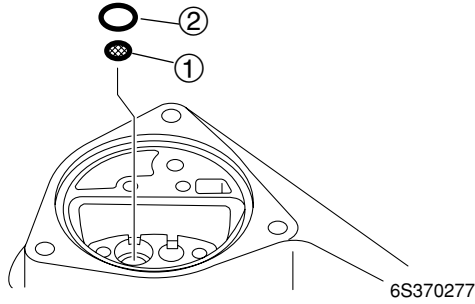
6S370276

- Check the valve seal and valve seat. Clean if there is dirt or residue. Replace if for damage or worn.

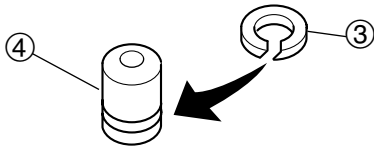


Assembling the relief valve

1. Install the relief valve filter ① and new O-ring ② into the PTT body.

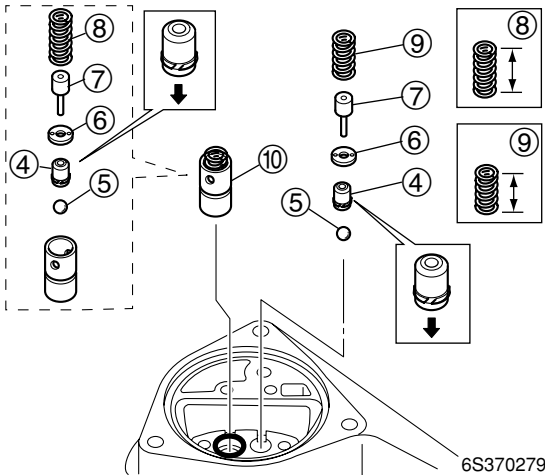


2. Assemble the valve seal ③ onto the valve seat ④ first.



6S370278

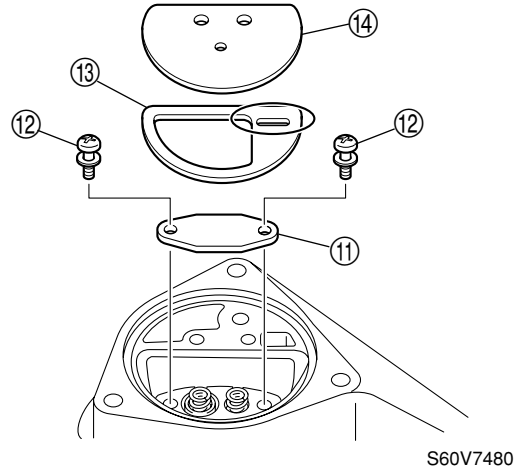
3. Install the balls ⑤, valve seats ④, washers ⑥, pins ⑦, springs (long length ⑧, short length ⑨), and relief valve seat ⑩ into the PTT body.



NOTE: _____
 The valve spring (long length ⑧) to install into the relief valve seat ⑩.

4. Install the relief valve plate ⑪ by installing the screws ⑫, then tighten them to the specified torque.

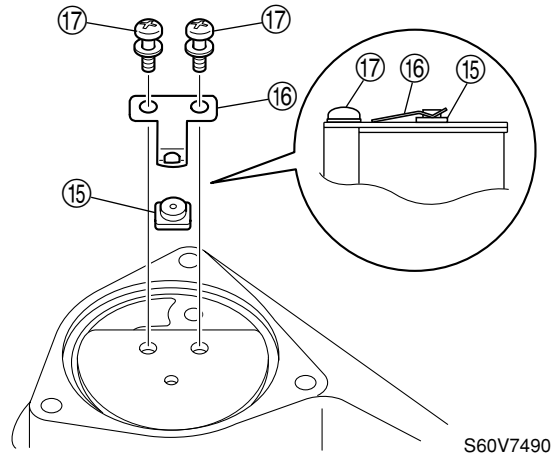
5. Install the seal ⑬ and tilt down plate ⑭.




NOTE: _____
 Install the seal ⑬ as shown direction.

 Relief valve plate screw ⑫:
 4 N·m (0.4 kgf·m, 3.0 ft·lb)

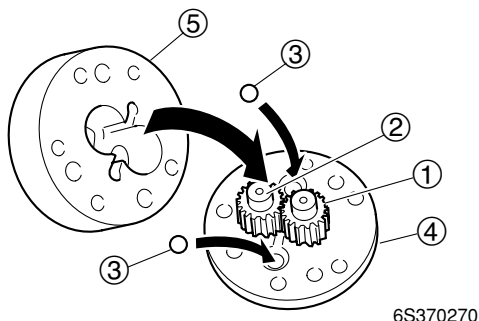
6. Install the main valve seal ⑮ and trim down spring ⑯, and then tighten the screws ⑰ to the specified torque.



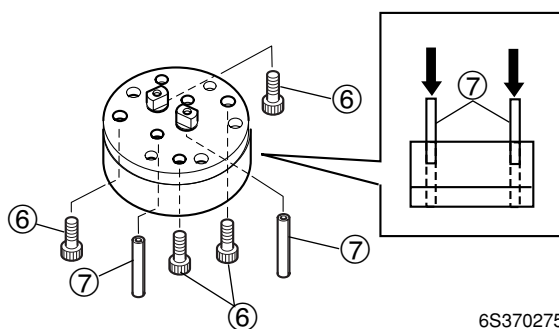
 Trim down spring screw ⑰:
 4 N·m (0.4 kgf·m, 3.0 ft·lb)

Assembling the gear pump


1. Install the drive gear ① and driven gear ② and balls ③ into the gear housing 1 ④, and then install the gear housing 2 ⑤.



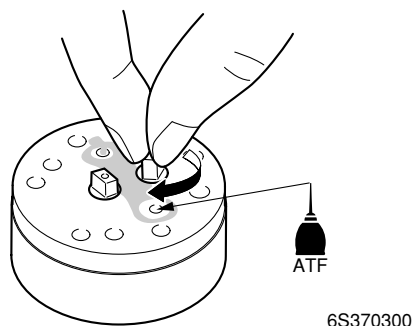
2. Install the bolts ⑥, and then tighten to temporary.



NOTE: _____
When assembling the gear pump, press the pins ⑦ first, and then tighten the bolts ⑥.

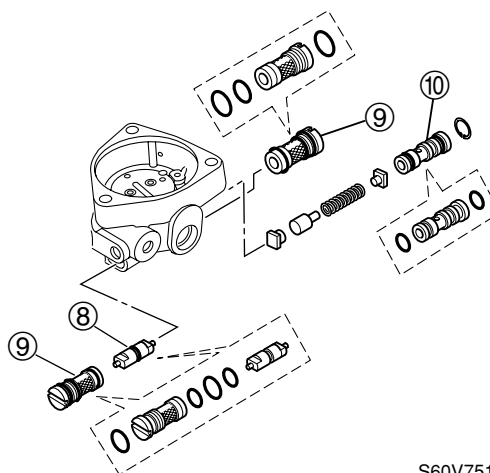
	Gear pump bolt ⑥: 4 N·m (0.4 kgf·m, 3.0 ft·lb)
---	--


3. Check the gear pump operation.



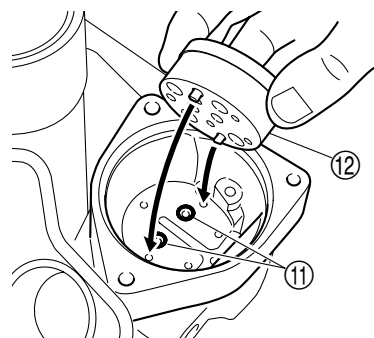
NOTE: _____
Inject a small amount fluid to the gear pump, and then rotate the drive gear direction shown.

4. Install the new O-rings, piston ⑧, main valves ⑨ and valve support ⑩.

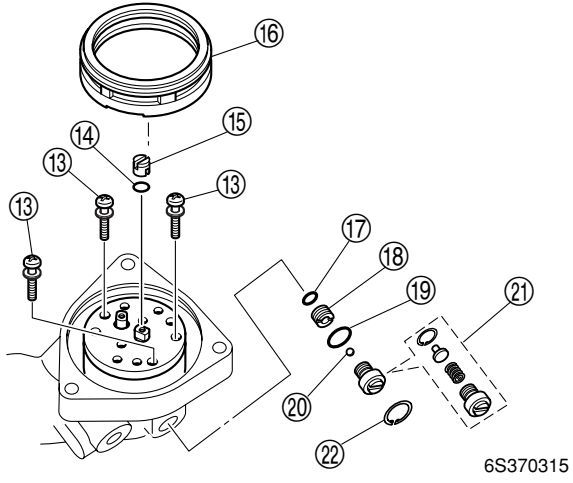



	Main valve ⑨: 11 N·m (1.1 kgf·m, 8.1 ft·lb)
---	---

5. Install the new O-rings ⑪, gear pump ⑫ by installing the screws ⑬, then tightening them to the specified torque.

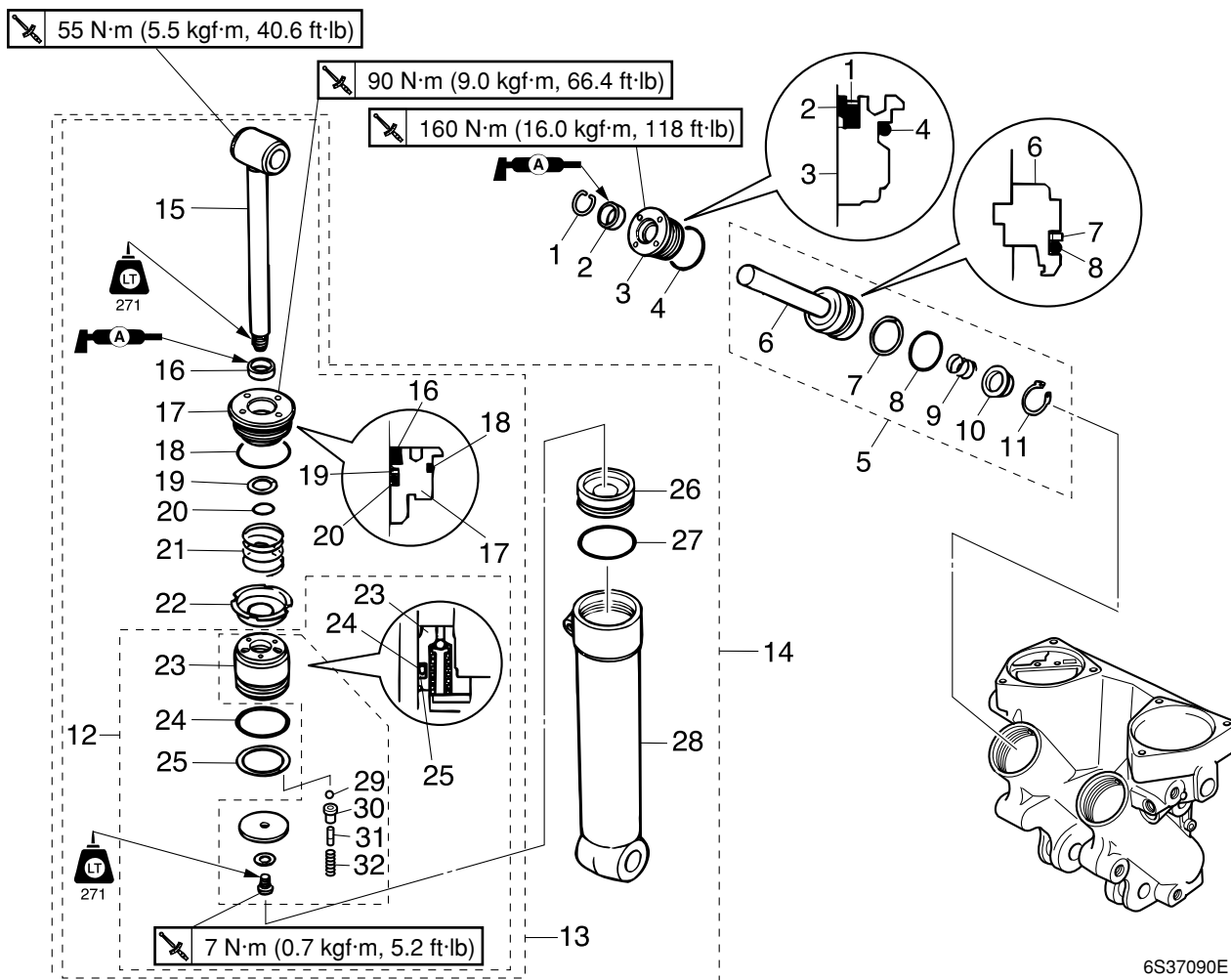


6. Install the new O-rings (14), joint (15), gear pump filter (16), and then install the new O-ring (17), valve seat (18), new O-ring (19), ball (20), manual valve assembly (21) and circlip (22).



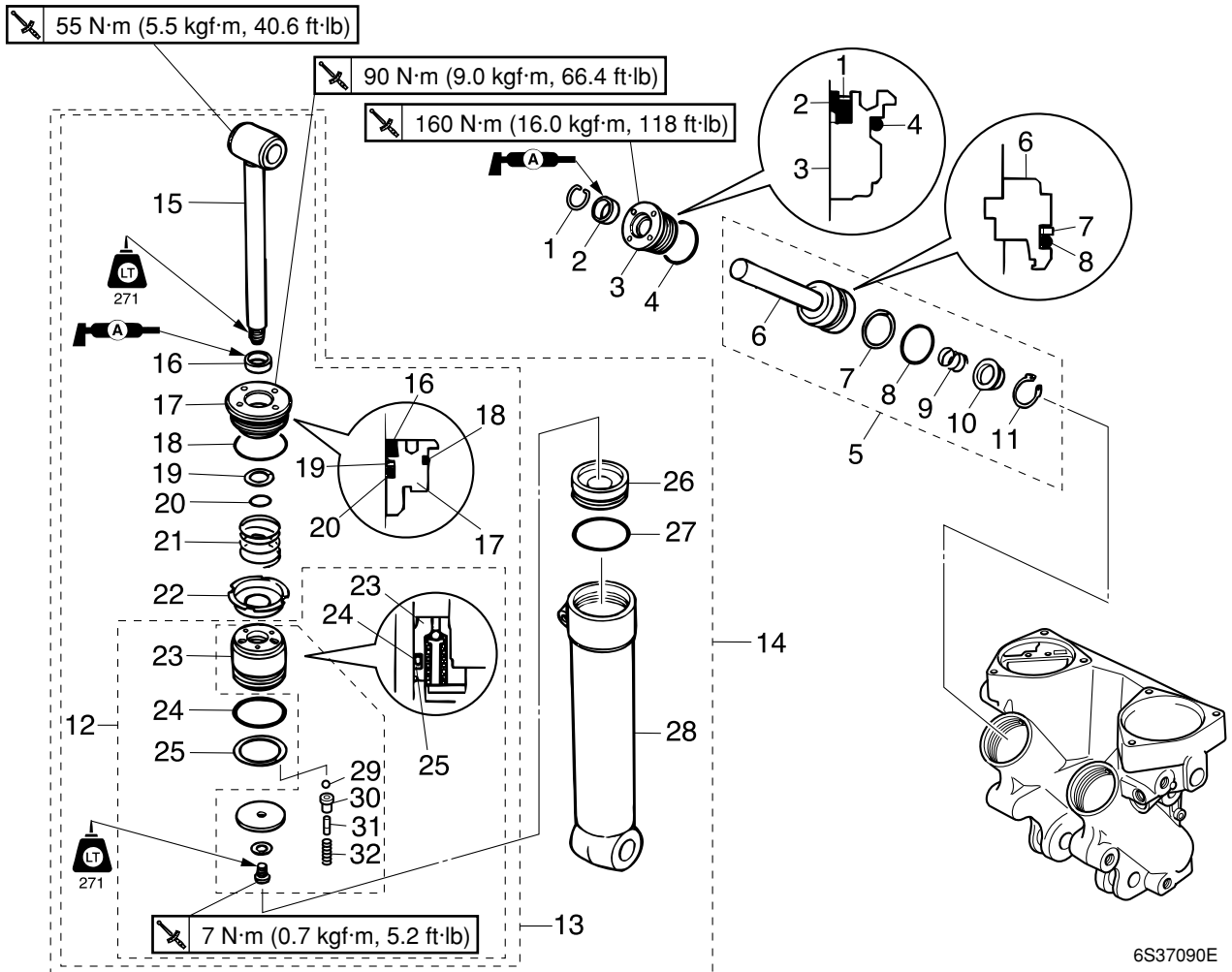
	<p>Gear pump screw (13): 2 N·m (0.2 kgf·m, 1.5 ft·lb)</p>
	<p>Manual valve (21): 2 N·m (0.2 kgf·m, 1.5 ft·lb)</p>

Tilt cylinder and trim cylinder



6S37090E

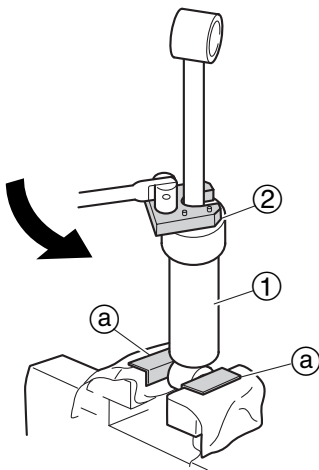
No.	Part name	Q'ty	Remarks
1	Circlip	2	
2	Dust seal	2	Not reusable
3	Trim cylinder end screw	2	
4	O-ring	2	Not reusable
5	Trim ram assembly	2	
6	Trim piston	2	
7	Backup ring	2	
8	O-ring	2	Not reusable
9	Spring	2	
10	Adapter	2	
11	Circlip	2	
12	Tilt piston assembly	1	
13	Tilt ram assembly	1	
14	Power tilt assembly	1	
15	Tilt ram	1	
16	Dust seal	1	Not reusable
17	Tilt cylinder end screw	1	



No.	Part name	Q'ty	Remarks
18	O-ring	1	Not reusable
19	Backup ring	1	
20	O-ring	1	Not reusable
21	Spring	1	
22	Adapter	1	
23	Tilt piston	1	
24	O-ring	1	Not reusable
25	Backup ring	1	
26	Free piston	1	
27	O-ring	1	Not reusable
28	Tilt cylinder	1	
29	Ball	5	
30	Absorber valve pin	5	
31	Pin	5	
32	Spring	5	

Disassembling the tilt cylinder and trim cylinder

1. Remove the tilt cylinder from PTT unit.
2. Hold the tilt cylinder ① in a vice using aluminum plates ② on both sides.
3. Loosen the tilt cylinder end screw, and then remove the tilt ram assembly.



S6S17110

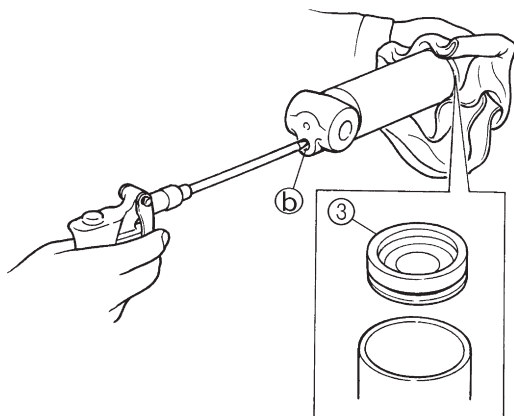
⚠WARNING

Make sure that the ram are fully extended before removing the end screw.



Cylinder-end screw wrench ②:
90890-06568

4. Drain the PTT fluid.
5. Blow compressed air through the hole ⑥ to remove the free piston ③.



S69J7305

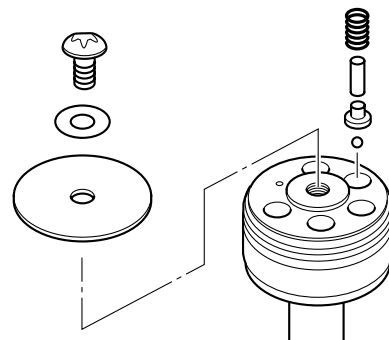
⚠WARNING

Never look into the tilt cylinder opening when removing the free piston. The free piston and PTT fluid can be forcefully expelled out.

NOTE:

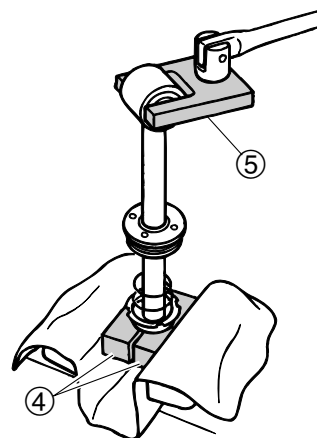
Be sure to cover the opposite end of the tilt cylinder with a rag.

6. Hold the tilt ram end in a vice using aluminum plates on both sides.
7. Remove the piston absorber valves.



S6P27740

8. Hold the tilt piston in a vice using the special service tool on both sides.
9. Remove the tilt ram.



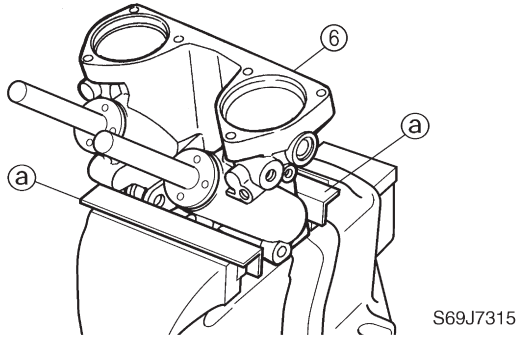
S69J7310



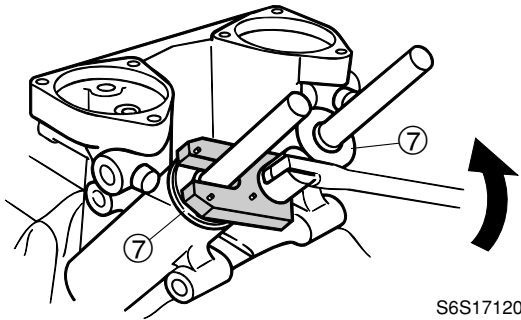
PTT piston vice attachment ④:
90890-06572


Tilt rod wrench ⑤: 90890-06569

10. Hold the PTT body ⑥ in a vice using aluminum plates ① on both sides.

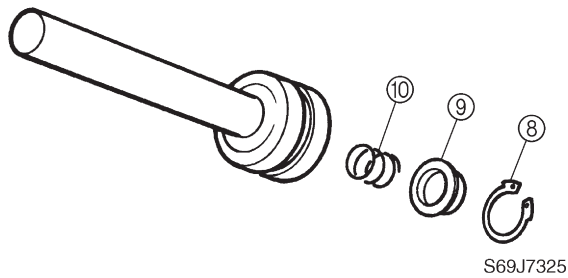


11. Loosen the trim cylinder end screws ⑦, and then remove them.



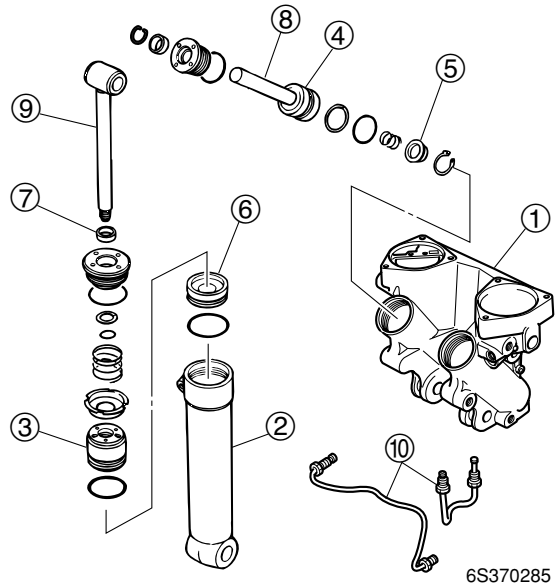
 Cylinder-end screw wrench:
90890-06568

12. Remove the trim ram assemblies.
13. Drain the PTT fluid.
14. Remove the circlip ⑧, adapter ⑨, and spring ⑩ from the trim pistons.



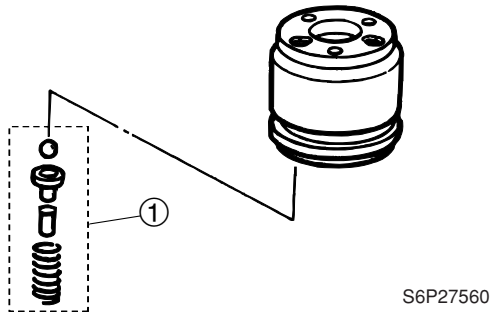
Checking the tilt cylinder and trim cylinder

1. Check the PTT body ① and tilt cylinder ②. Replace if cracked or if there is corrosion.
2. Check the inner walls of the PTT body ① and tilt cylinder ②. Replace if scratched.
3. Check the outer surface of the tilt piston ③, trim piston ④, adapter ⑤, free piston ⑥, and dust seal ⑦ of end screw. Replace if scratched.
4. Check the trim rams ⑧ and tilt ram ⑨. Polish with 400 – 600 grit sandpaper if there is light rust or replace if bent or if there is excessive corrosion.
5. Check the pipes ⑩. Replace if cracked or if there is corrosion.



Checking the valve

1. Check the tilt piston absorber valves ①. Clean if there is dirt or residue.

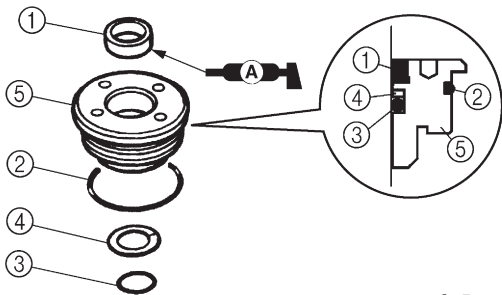


Assembling the tilt ram

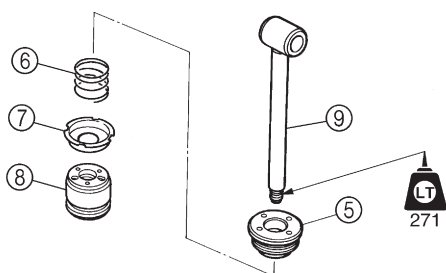
CAUTION:

Do not use a rag when assembling the PTT unit as dust and particles on the PTT unit components can lead to poor performance.

1. Install the new dust seal ①, new O-rings ② and ③, and backup ring ④ into the tilt cylinder end screw ⑤.

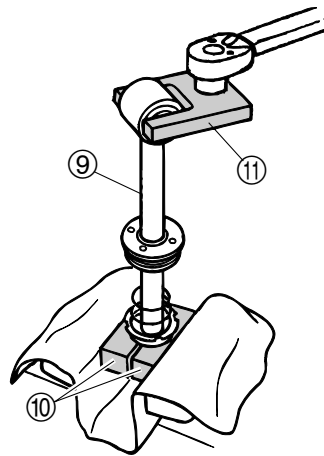


2. Install the tilt cylinder end screw ⑤, spring ⑥, adapter ⑦, and tilt piston ⑧ to the tilt ram ⑨.



3. Hold the tilt piston in a vice using the special service tool on both sides.

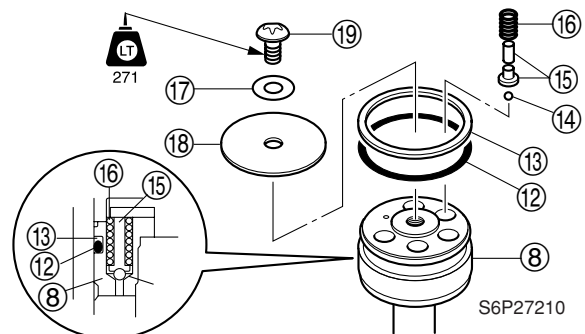
4. Tighten the tilt ram ⑨ to the specified torque.



	PTT piston vice attachment ⑩: 90890-06572 Tilt rod wrench ⑪: 90890-06569
--	--

	Tilt ram ⑨: 55 N·m (5.5 kgf·m, 40.6 ft·lb)
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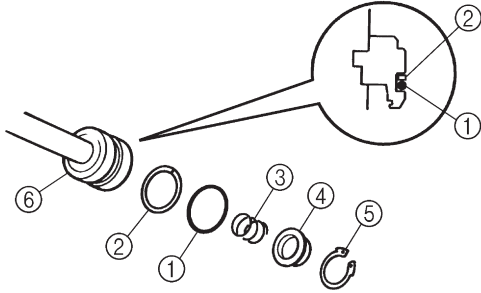
5. Install the new O-ring ⑫ and backup ring ⑬ onto the tilt piston ⑧.
6. Install the balls ⑭, absorber valve pins ⑮, and springs ⑯ as shown.
7. Install the washers ⑰, plate ⑱, and bolt ⑲ to the tilt piston ⑧, and then tighten the bolt to the specified torque.



	Tilt piston bolt ⑲: 7 N·m (0.7 kgf·m, 5.2 ft·lb)
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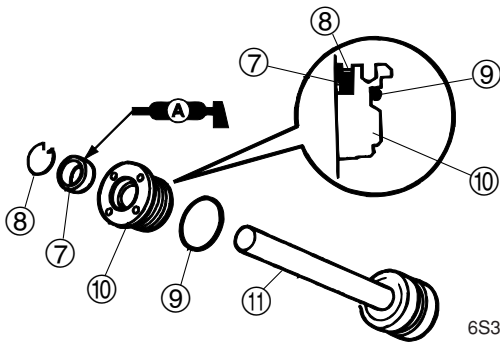
Assembling the trim ram

1. Install the new O-ring (1), backup ring (2), spring (3), adapter (4), and circlip (5) to the trim piston (6).



S6P27230

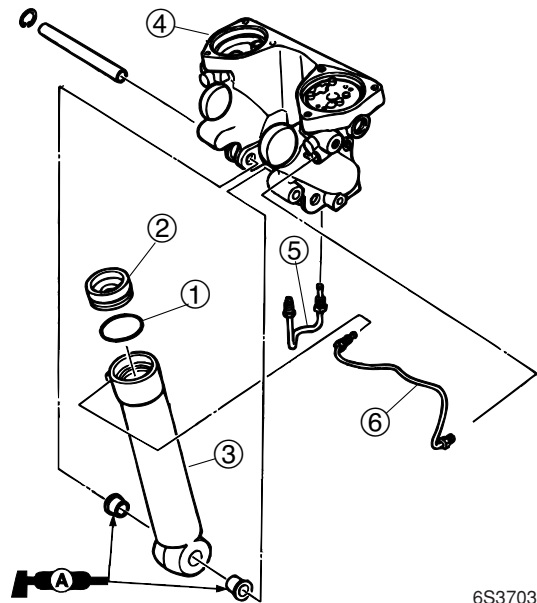
2. Install the new dust seal (7), circlip (8), and new O-ring (9) to the trim cylinder end screw (10).
3. Install the trim cylinder end screw (10) onto the trim ram (11).




6S370380

Installing the tilt cylinder

1. Install the new O-ring (1) to the free piston (2).
2. Push the free piston (2) into the tilt cylinder (3) until it bottoms out.
3. Install the tilt cylinder (3) to the PTT body (4).
4. Install pipes (5) and (6), and then tighten the pipe joints to the specified torque.



6S370385

 Pipe joint (5) and (6):
15 N·m (1.5 kgf·m, 11.1 ft·lb)

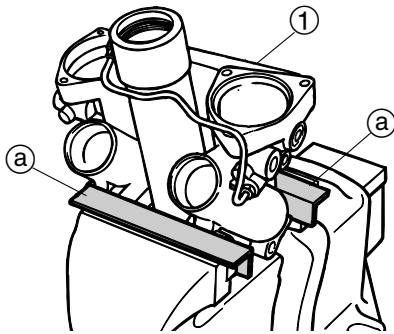
Installing the trim ram

CAUTION:

Do not use a rag when installing the PTT unit as dust and particles on the PTT unit components can lead to poor performance.

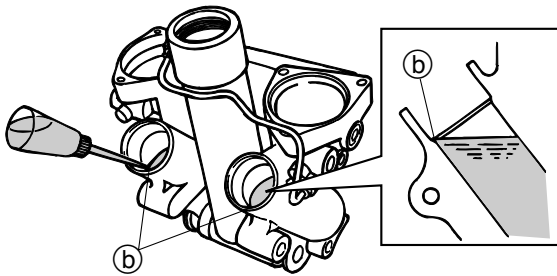
Tilt cylinder and trim cylinder

1. Hold the PTT body ① in a vice using aluminum plates ② on both sides.



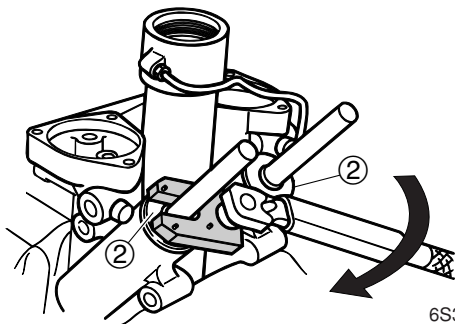
6S370390

2. Fill the trim cylinders with the recommended fluid to the correct level (b) as shown.



6S370400

3. Install the trim ram assembly into the trim cylinder, and then tighten the trim cylinder end screws ② to the specified torque.



6S370410

⚠ WARNING

Do not push the trim rams down while installing them into the trim cylinders. Otherwise, the PTT fluid may spurt out from the unit.



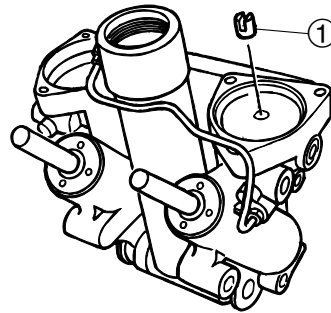
Cylinder-end screw wrench:
90890-06568



Trim cylinder end screw ②:
160 N·m (16 kgf·m, 118 ft·lb)

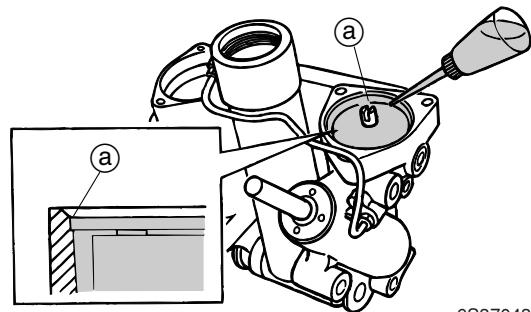
Installing the PTT motor

1. Install the joint ① into the gear pump.



6S370420

2. Fill the pump housing with the recommended fluid to the correct level (a) as shown.



6S370430a

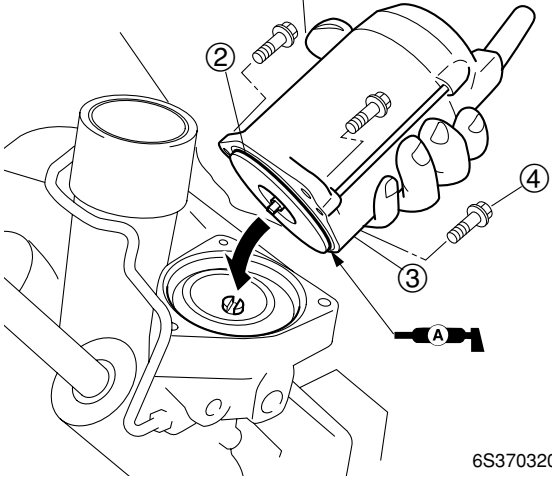
3. Remove all of the air bubbles with a syringe or suitable tool.

NOTE:

Turn the joint with a screwdriver, and then remove any air between the pump gear teeth.


7

4. Install the new O-ring ② and PTT motor ③, and then tighten the bolts ④ to the specified torque.



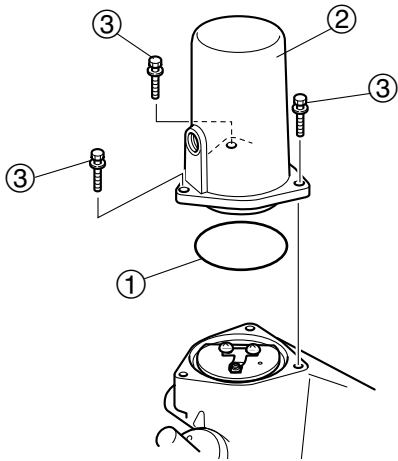
6S370320

NOTE: _____
Align the armature shaft with the recess in the joint.


	PTT motor mount bolt ④: 7 N·m (0.7 kgf·m, 5.2 ft·lb)
---	---

Installing the reservoir

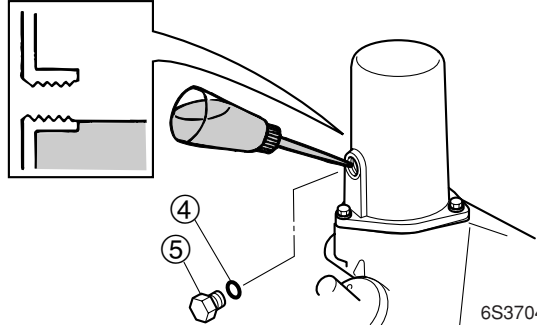
1. Install the new O-ring ① and reservoir ②, and then tighten the bolts ③ to the specified torque.



6S370450


	Reservoir mount bolt ③: 7 N·m (0.7 kgf·m, 5.2 ft·lb)
---	---

2. Fill the PTT fluid into the reservoir tank, and then install the new O-ring ④ and reservoir cap ⑤, and then tighten it to the specified torque.



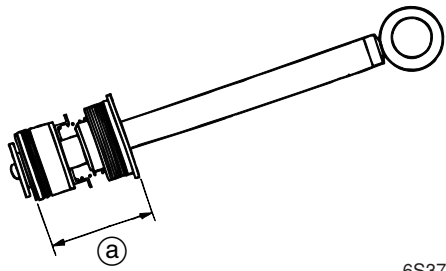
6S370455

NOTE: _____
Add sufficient fluid of the recommended type until it overflows out of the filler hole.

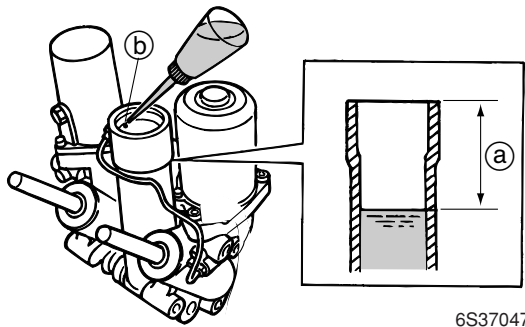
	Reservoir cap ⑤: 7 N·m (0.7 kgf·m, 5.2 ft·lb)
---	--

Installing the tilt ram

1. Fill the tilt cylinder with the recommended fluid to the correct level (a) as shown.
2. Add a small amount of the recommended fluid through the PTT body hole (b) as shown.



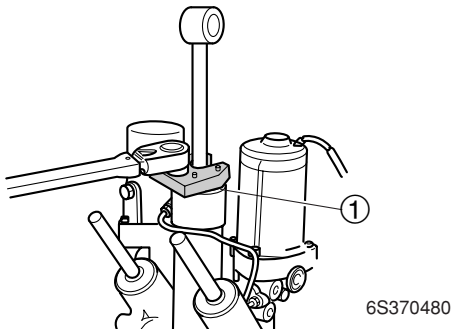
6S370410



6S370470

Tilt cylinder and trim cylinder

- Install the tilt piston assembly into the tilt cylinder, and then tighten the tilt cylinder end screw ① to the specified torque.



NOTE:

Place the tilt cylinder end screw at the bottom of the tilt ram and install the tilt piston assembly into the tilt cylinder.



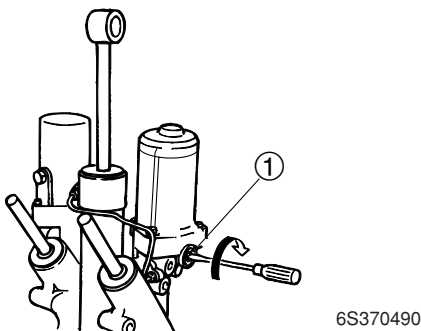
Cylinder-end screw wrench:
90890-06568



Tilt cylinder end screw ①:
90 N·m (9.0 kgf·m, 66.4 ft·lb)

Bleeding the PTT unit

- Tighten the manual valve ① by turning it clockwise.



Manual valve ①:
2 N·m (0.2 kgf·m, 1.5 ft·lb)

- Place the PTT unit in an upright position.
- Remove the reservoir cap, and then check the fluid level in the reservoir.

NOTE:

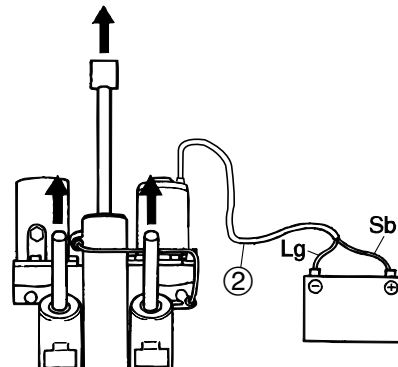
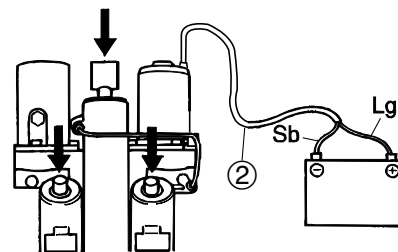
The fluid level should be at the brim of the filler hole.

- If fluid is below the correct level, add fluid of the recommended type.
- Install the reservoir cap, and then tighten it to the specified torque.



Reservoir cap:
7 N·m (0.7 kgf·m, 5.2 ft·lb)

- Connect the PTT motor leads ② to the battery terminals to fully retract the rams.
- Reverse the PTT motor leads between the battery terminals to fully extend the rams.



Ram	PTT motor lead	Battery terminal
Up	Sky blue (Sb)	⊕
	Light green (Lg)	⊖
Down	Light green (Lg)	⊕
	Sky blue (Sb)	⊖

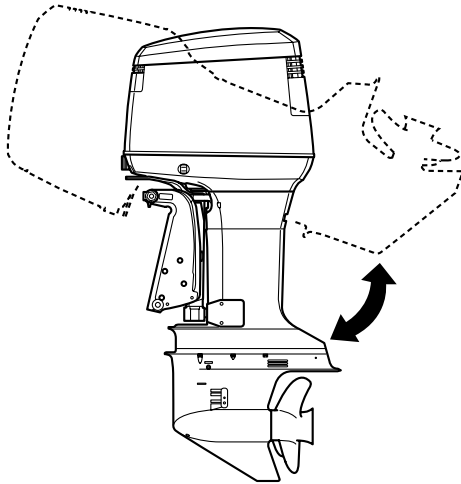
NOTE:

- Repeat this procedure so that the rams go up and down 4 or 5 times (be sure to wait a few seconds before switching the leads).
- If the rams do not move up and down easily, push and pull on the rams to assist operation.

8. Check the fluid level when the rams are fully extended. If the fluid level is low, add sufficient fluid, and then repeat step 7.

Bleeding the PTT unit (built-in)

1. Fully tilt the outboard motor up and down a few times.



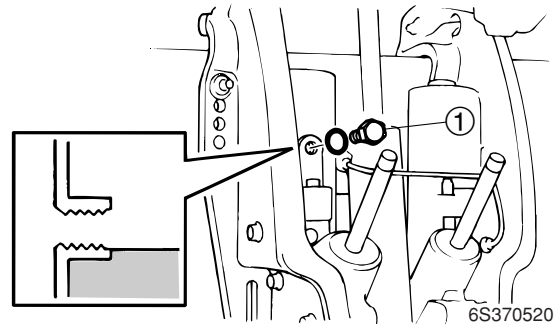
6S370510

NOTE: _____
 Connect the PTT motor leads to the battery terminals, without installing the power unit. To connect the PTT motor leads, see “Bleeding the PTT unit.”

2. Let the fluid settle for 5 minutes.
3. Push and hold the PTT switch in the up position until the outboard motor is fully tilted up.
4. Support the outboard motor with the tilt stop lever, and then let the fluid settle for 5 minutes.

⚠WARNING _____
 After tilting up the outboard motor, be sure to support it with the tilt stop lever. Otherwise, the outboard motor could suddenly lower if the PTT unit should lose fluid pressure.

5. Remove the reservoir cap ①, and then check the fluid level in the reservoir.




6S370520

NOTE: _____
 If the fluid is at the correct level, the fluid should overflow out of the filler hole when the cap ① is removed.

6. If the fluid is below the correct level, add fluid of the recommended type.
7. Install the new O-ring reservoir cap, and then tighten it to the specified torque.

NOTE: _____
 Repeat this procedure until the fluid remains at the correct level.

	Reservoir cap ①: 7 N·m (0.7 kgf·m, 5.2 ft·lb)
---	--

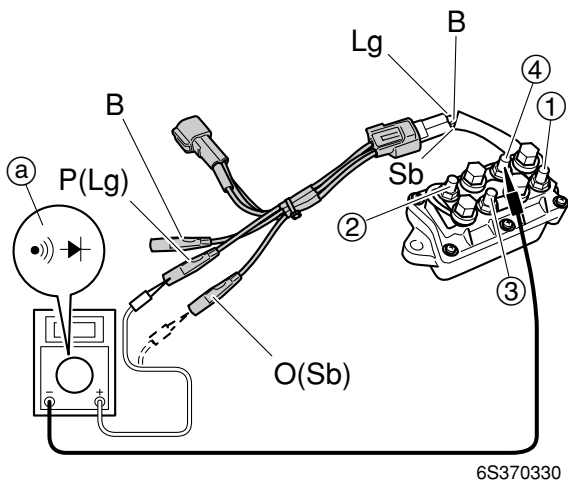
PTT electrical system

Checking the fuse

1. Check the fuse (80A) for continuity.
Replace if there is no continuity.

Checking the PTT relay

1. Remove the PTT relay from junction box.
2. Connect the test harness, and then check the PTT relay for continuity.
Replace if out of specification.



6S370330

NOTE:

- Be sure to set the measurement range (a) shown in the illustration when checking for continuity.
- Following [] in the continuity chart is indicate color code of the PTT relay.



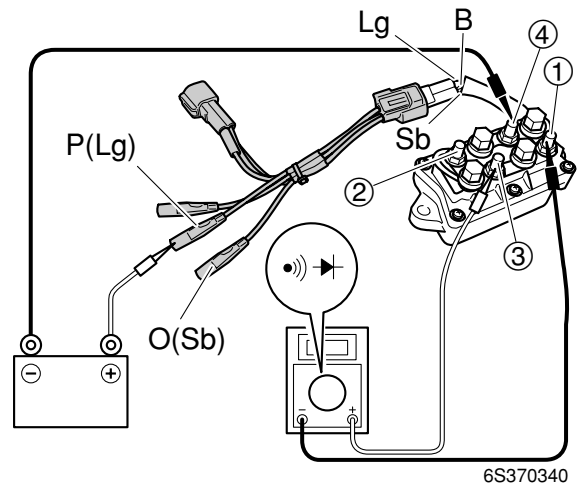
Test harness (3 pins): 90890-06857



PTT relay continuity

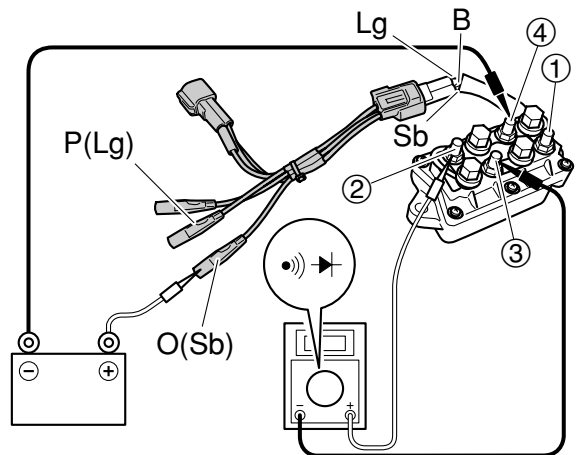
Test harness (O) [Sky blue (Sb)] – Terminal ④	Continuity
Test harness (P) [Light green (Lg)] – Terminal ④	
Terminal ① – Terminal ④	Continuity
Terminal ② – Terminal ④	
Terminal ① – Terminal ③	No continuity
Terminal ② – Terminal ③	

3. Connect the digital circuit tester between PTT relay terminals ① and ③.
4. Connect the light green (Lg) lead to the positive battery terminal and the terminal ④ lead to the negative battery terminal as shown.
5. Check for continuity between terminals ① and ③. Replace if there is no continuity.



6S370340

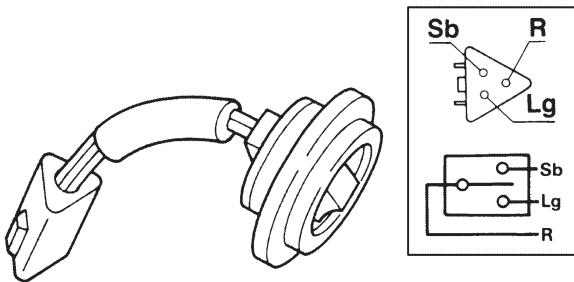
6. Connect the digital circuit tester between PTT relay terminals ② and ③.
7. Connect the sky blue (Sb) lead to the positive battery terminal and the terminal ④ lead to the negative battery terminal as shown.
8. Check for continuity between terminals ② and ③. Replace if there is no continuity.



6S370350

Checking the PTT switch

1. Check the PTT switch for continuity.
Replace if out of specification.

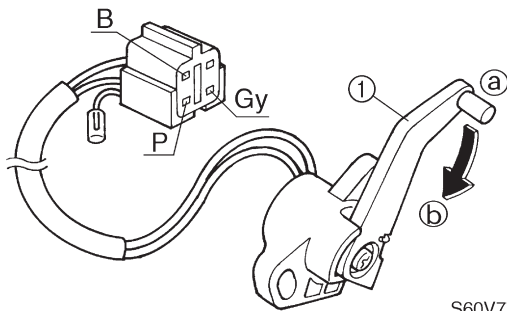


6G470810

Switch position	Lead color		
	Sky blue (Sb)	Red (R)	Light green (Lg)
Up	○	○	
Free			
Down		○	○


Checking the trim sensor

1. Measure the trim sensor resistance.
Replace if out of specification.



S60V7720

NOTE: Turn the lever ① and measure the resistances it gradually changes.

	Trim sensor resistance:
	Pink (P)–Black (B)
	248–388 Ω at (a)
	9–11 Ω at (b)

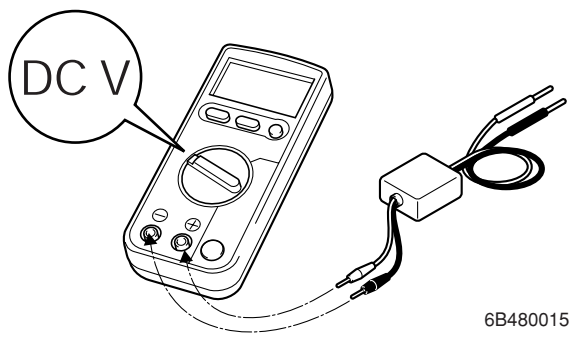
Electrical system

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Checking the Rectifier Regulator.....	8-20
Checking the hour meter	8-22
Oil feed pump control system	8-22
Checking the oil level sensor.....	8-22
Checking the emergency switch.....	8-23
Checking the oil pump (remote oil tank).....	8-23

Checking the electrical component

Measuring the peak voltage

To check the electrical components or measure the peak voltage, use the special service tools. A faulty electrical components can be easily checked by measuring the peak voltage. The specified engine speed when measuring the peak voltage is effected by many factors such as fouled spark plugs or a weak battery. If one of these factors is present, the peak voltage cannot be measured properly.



⚠ WARNING


When checking the peak voltage, do not touch any of the connections of the digital circuit tester leads.

CAUTION:

When measuring the voltage of an electrical component with the digital circuit tester, make sure that the tester leads do not contact each other. Otherwise, the electrical component could be damaged.

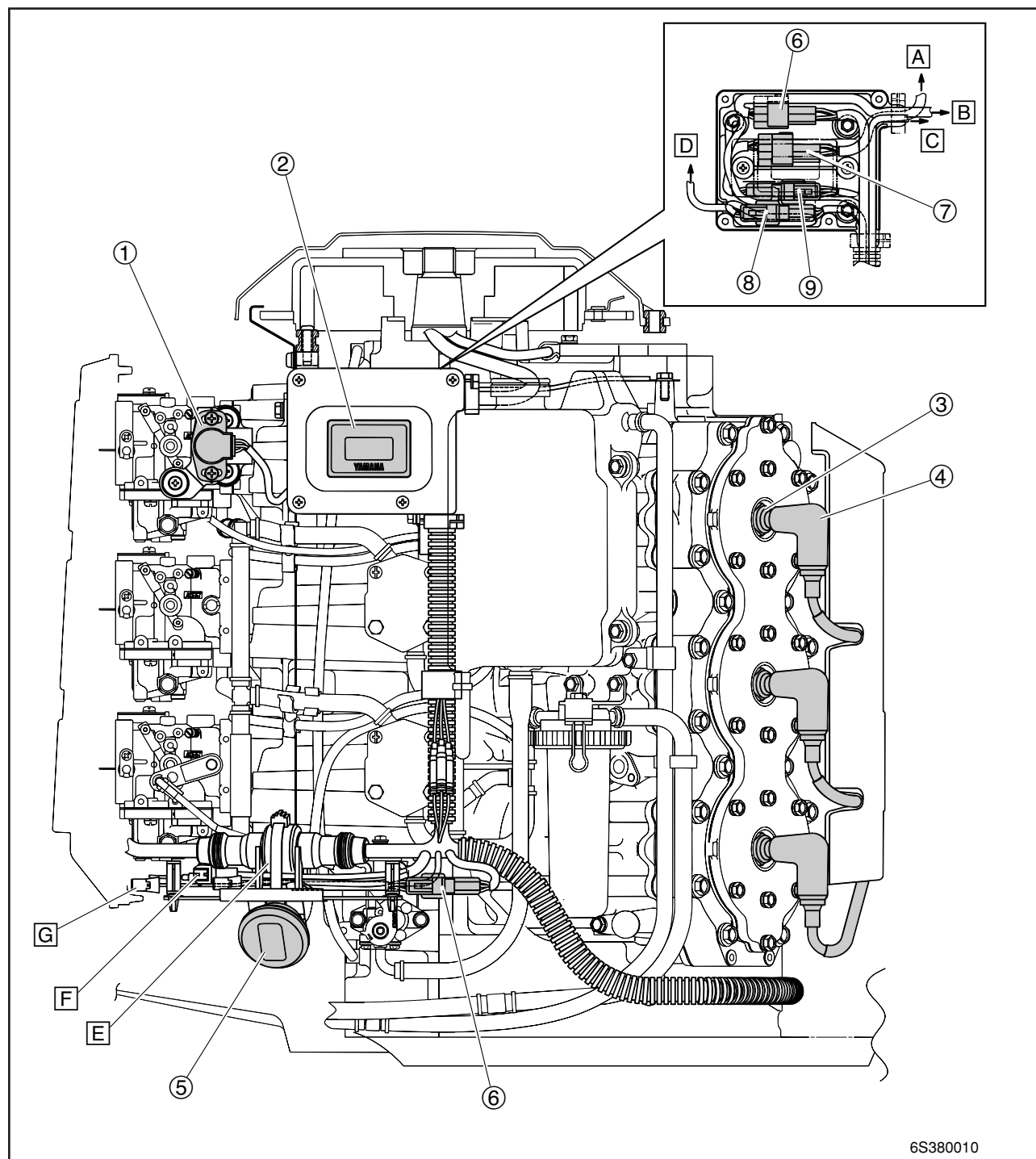
NOTE:

- Before measuring the peak voltage, check all wiring for proper connection and corrosion, and check that the battery is fully charged.
- Use the peak voltage adapter with the recommended digital circuit tester.
- Connect the positive pin of the peak voltage adapter to the positive terminal of the digital tester, and the negative pin to the negative terminal.
- When measuring the peak voltage, set the selector on the digital circuit tester to the **DC voltage mode**.

	Digital circuit tester: 90890-03174
	Peak voltage adaptor B: 90890-03172

Electrical component

Port view

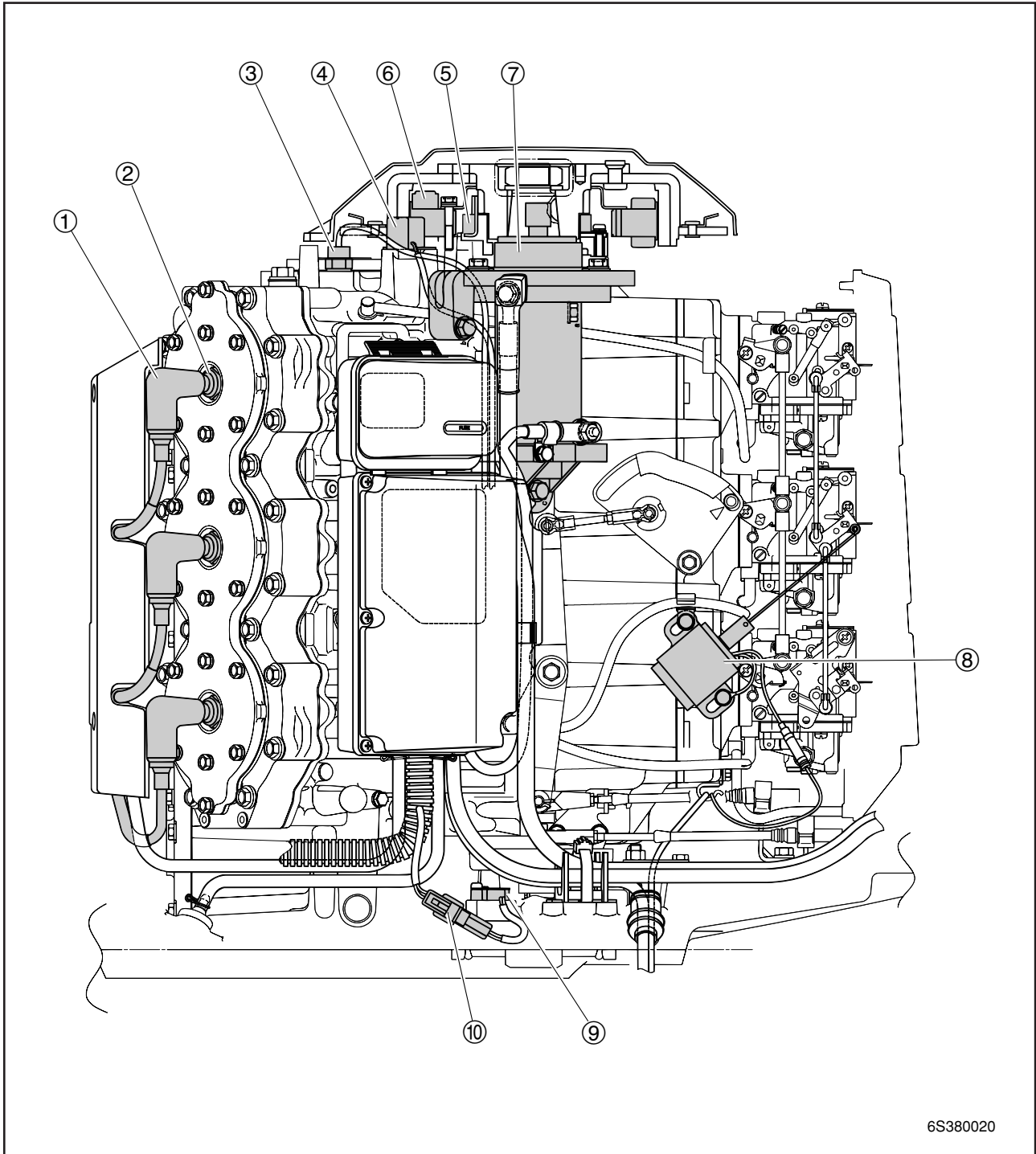


6S380010

- ① Throttle sensor
- ② Hour meter
- ③ Spark plug
- ④ Spark plug cap
- ⑤ PTT switch
- ⑥ Oil feed pump coupler
- ⑦ Pulser coil coupler
- ⑧ Throttle sensor coupler
- ⑨ Hour meter coupler

- Ⓐ To pulser coil.
- Ⓑ To oil feed pump (wiring harness).
- Ⓒ To CDI unit (wiring harness).
- Ⓓ To throttle sensor.
- Ⓔ Connect to remote control 10P coupler.
- Ⓕ To tachometer.
- Ⓖ To trim meter.

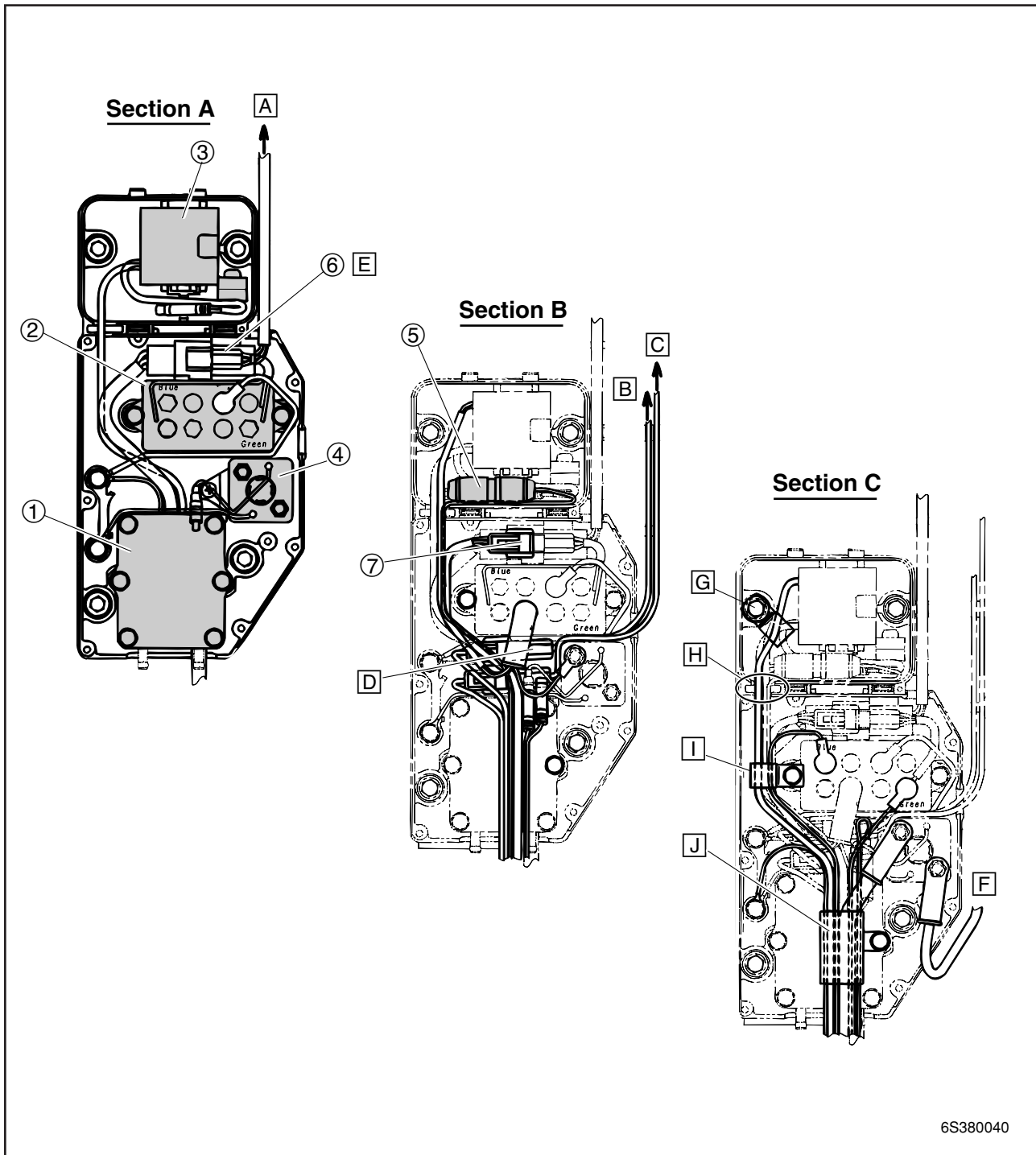
Starboard view



6S380020

- ① Spark plug cap
- ② Spark plug
- ③ Engine temperature sensor
- ④ Crank position sensor
- ⑤ Pulse coil assembly
- ⑥ Stator assembly
- ⑦ Starter motor
- ⑧ Choke solenoid
- ⑨ Shift cut switch
- ⑩ Shift cut switch coupler

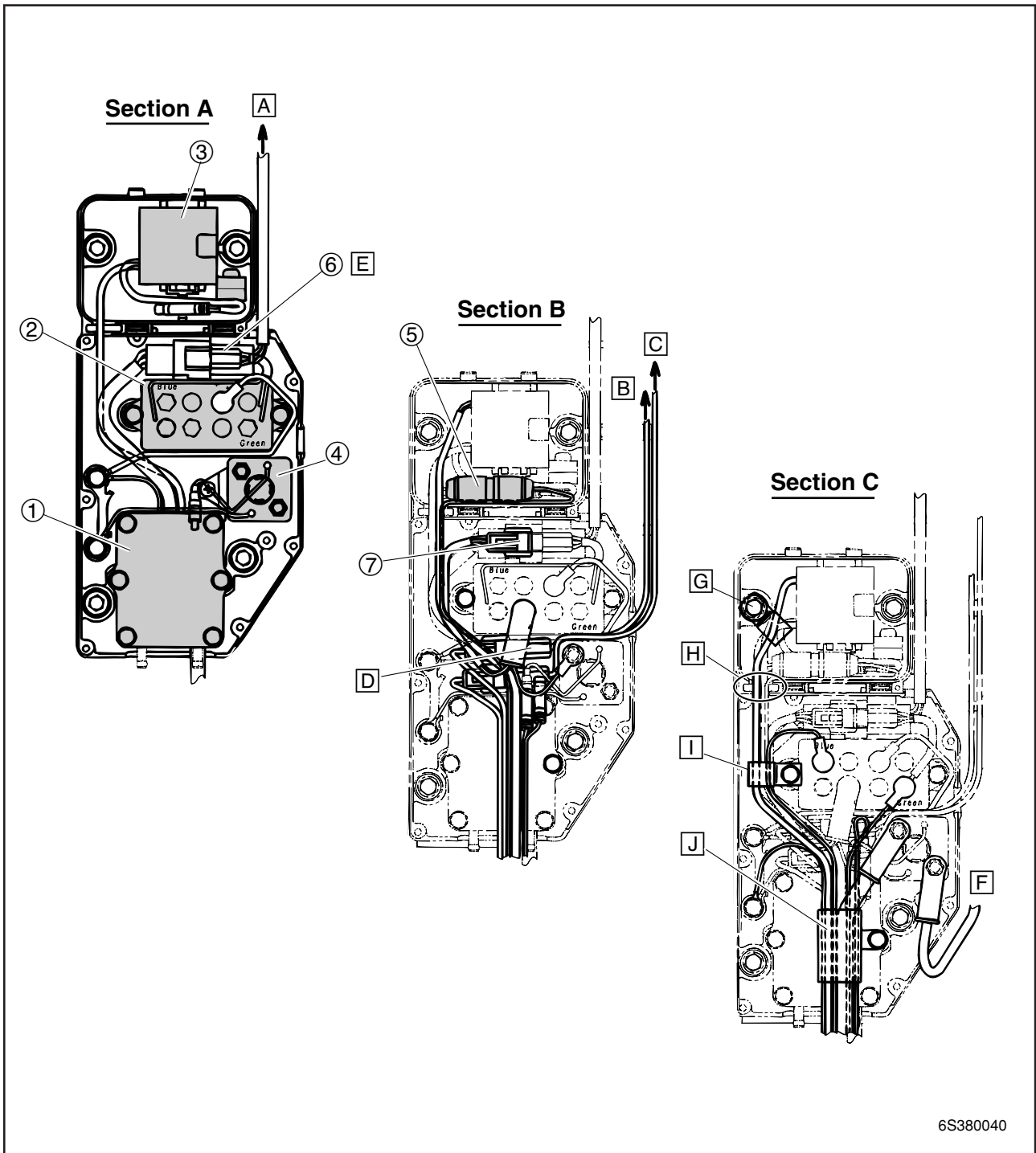
Junction box



6S380040

- ① Rectifier Regulator
- ② PTT relay
- ③ Fuse holder (80A)
- ④ Starter relay
- ⑤ Fuse holder (20A)
- ⑥ Lighting coil coupler
- ⑦ Crank position sensor coupler

- A To stator assembly.
- B To crank position sensor.
- C To engine temperature sensor.
- D Push into the crank position sensor coupler and engine temperature sensor coupler.
- E Connect to lighting coil coupler.
- F To starter motor.
- G Clamp the battery lead.



6S380040

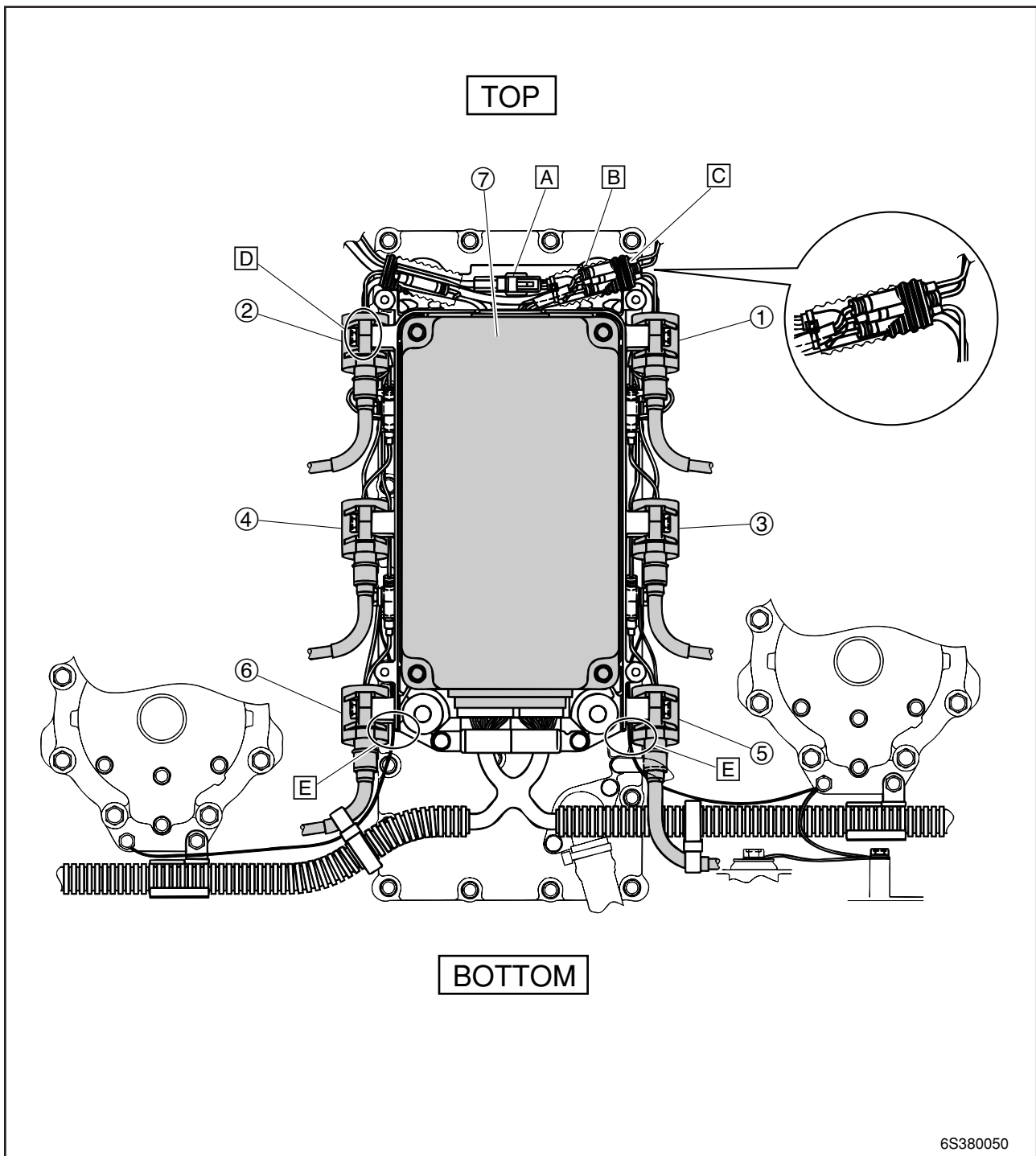
- [H] Do not out the leads from slot of the box.
- [I] Clamp with battery lead and PTT relay lead.
- [J] Clamp with ground lead, battery leads, battery cable and PTT relay leads.

Section A
Wiring for Rectifier Regulator, starter relay, PTT relay and fuse holder.

Section B
Wiring for fuse holder, engine temperature sensor coupler and PTT relay leads.

Section C
Wiring for PTT relay leads, battery leads and battery cable.

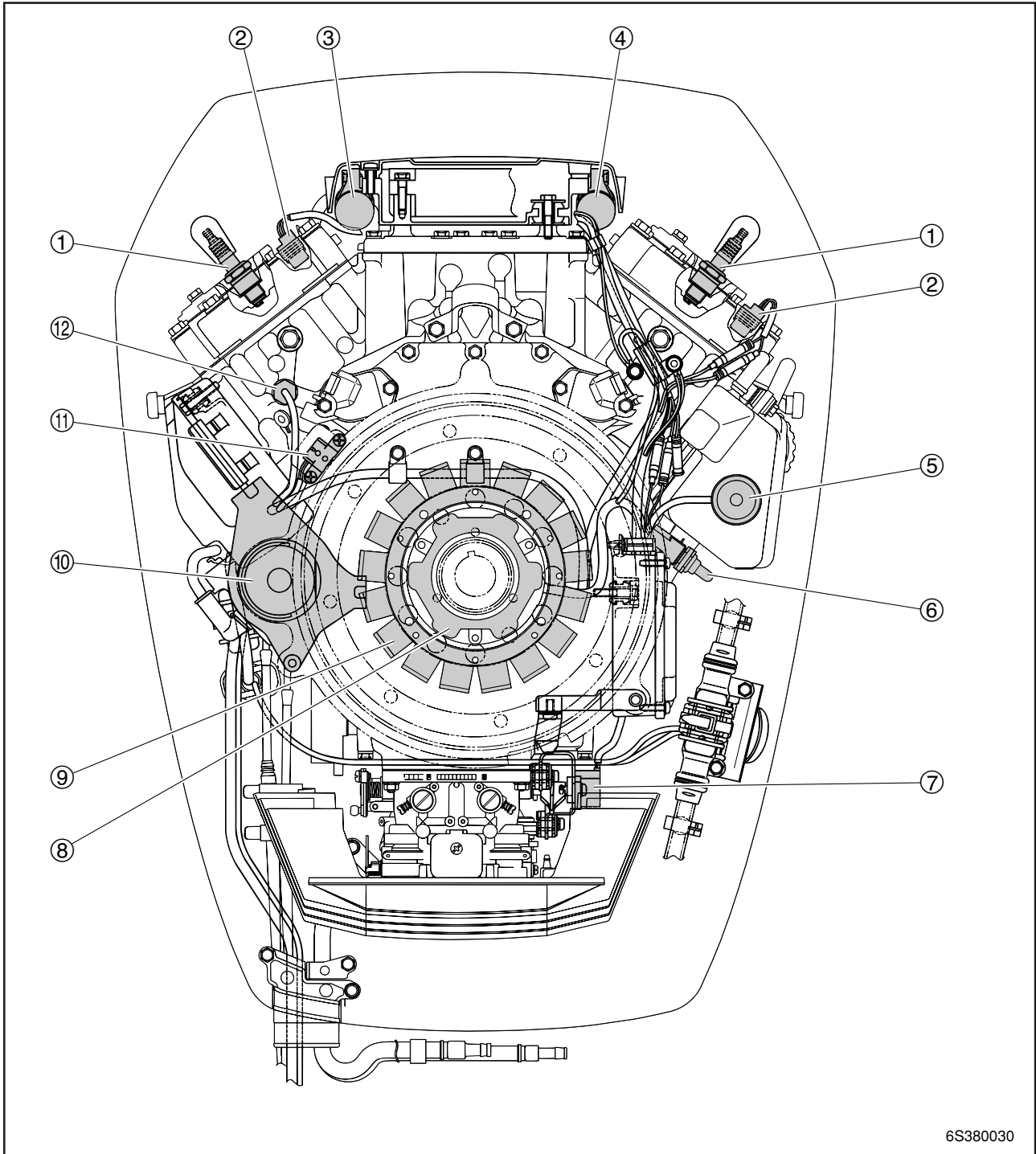
Aft view



- ① Ignition coil #1
- ② Ignition coil #2
- ③ Ignition coil #3
- ④ Ignition coil #4
- ⑤ Ignition coil #5
- ⑥ Ignition coil #6
- ⑦ CDI unit

- A** To locate the charge coil coupler.
- B** To locate the coupler to center of the CDI unit case, and then bend the harness and clamp them after install the tube.
- C** Face the cutting side to front, and then locate the center of CDI unit mount bolt.
- D** Do not tighten with ground lead and ignition coil out side.
- E** Route the ground lead of left and right into the CDI unit case and ignition coil.

Top view



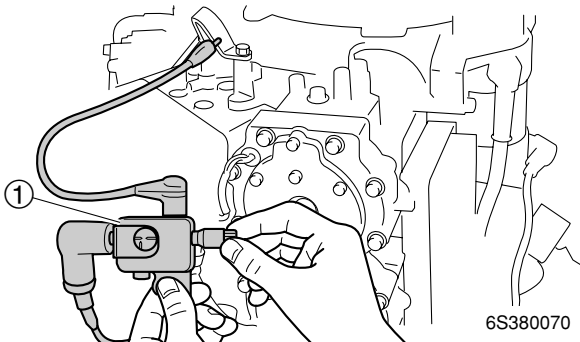
6S380030


- ① Spark plug
- ② Thermoswitch
- ③ Ignition coil #1
- ④ Ignition coil #2
- ⑤ Oil level gauge
- ⑥ Emergency switch
- ⑦ Throttle sensor
- ⑧ Pulser coil assembly
- ⑨ Stator assembly
- ⑩ Starter motor
- ⑪ Crank position sensor
- ⑫ Engine temperature sensor

Ignition and ignition control system

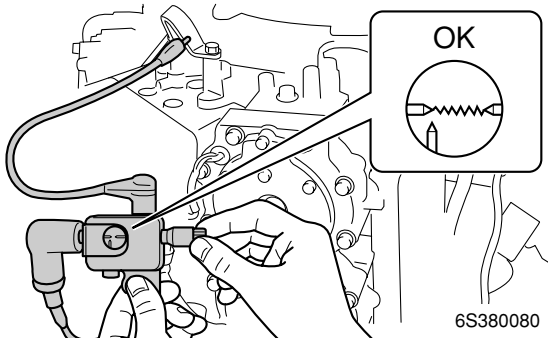
Checking the ignition spark gap

1. Disconnect the spark plug caps from the spark plugs.
2. Connect a spark plug cap to the special service tool.



 Ignition tester ①: 90890-06754

3. Crank the engine and observe the spark through the discharge window of the ignition tester. Check that the ignition system if the spark is weak.

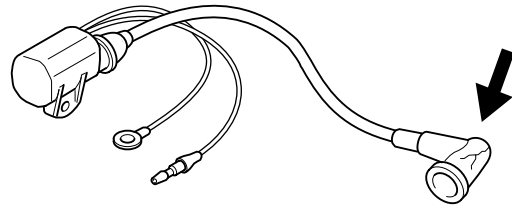


⚠ WARNING

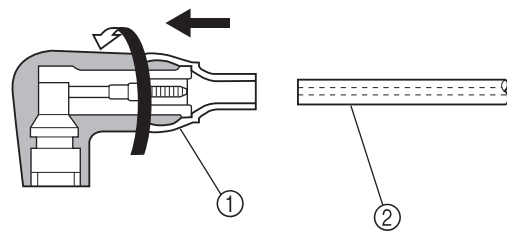
- Do not touch any of the connections of the ignition tester leads.
- Do not let sparks leak out of the removed spark plug caps.
- Keep flammable gas or liquids away, since this test can produce sparks.

Checking the spark plug cap

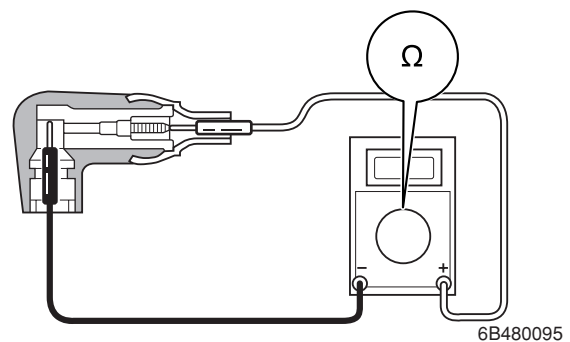
1. Remove the CDI unit cover, and then remove the ignition coils.
2. Check the spark plug caps for cracks or damage. Replace the spark plug cap if necessary.




3. Remove the spark plug caps ① from the spark plug wire ② by turning the cap counterclockwise.



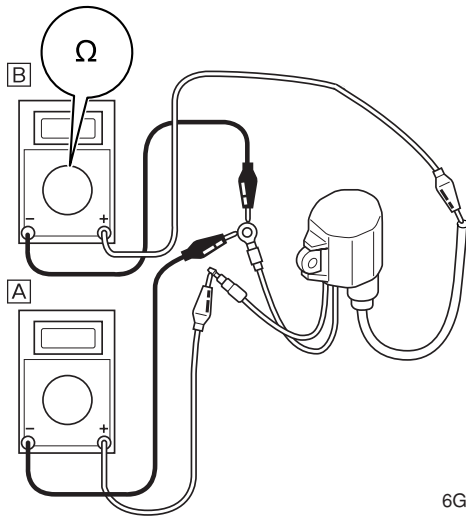
4. Measure the spark plug cap resistance. Replace the spark plug cap if out of specification.




 Spark plug cap resistance :
4.0–6.0 kΩ

Checking the ignition coil

1. Remove the CDI unit cover, and then remove the ignition coils.
2. Disconnect the ignition coil connectors.
3. Measure the ignition coil resistance. Replace the ignition coil if out of specification.



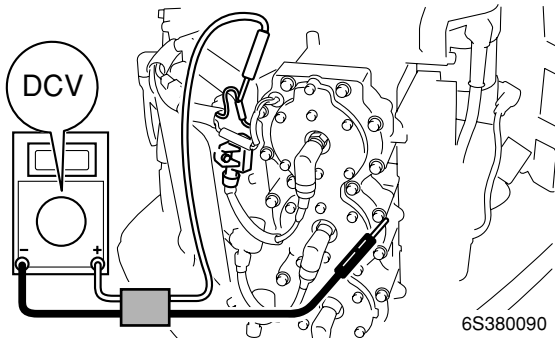
6G480105


 **Ignition coil resistance:**

- A** Primary coil:
Black/white (B/W) – Black (B)
0.18 – 0.24 Ω at 20°C (68°F)
- B** Secondary coil:
Black/white (B/W) – Spark plug wire
2.72 – 3.68 kΩ at 20°C (68°F)

Checking the CDI unit

1. Remove the CDI unit cover.
2. Connect the digital circuit tester with peak voltage adaptor B to the ignition coil lead and the ground.
3. Measure the CDI unit output peak voltage. If less than specification, measure the charge coil output peak voltage. Replace the CDI unit if the output peak voltage of the charge coil is more than specification.



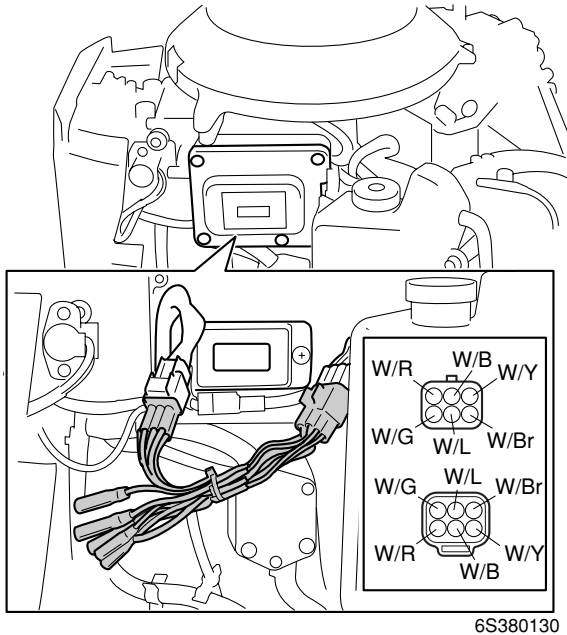
 **CDI unit output peak voltage:**
Black/white (B/W) – Ground (B)

r/min	Loaded		
	Cranking	1,500	3,500
DC V	120	150	130


NOTE: _____
Remove the all spark plug caps to prevent the engine ignite, when measure the CDI unit peak voltage at engine cranking.

Checking the pulser coil

1. Remove the hour meter cover.
2. Connect the test harness to the pulser coil.
3. Measure the pulser coil output peak voltage. Replace the pulser coil if less than specification.



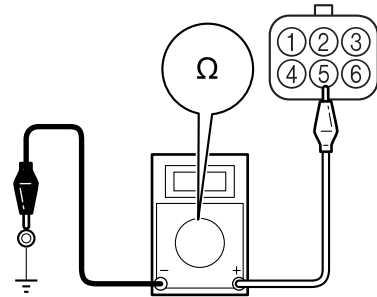
 Test harness (6 pins): 90890-06872


 Pulser coil output peak voltage:

- White/red (W/R) – Ground
- White/black (W/B) – Ground
- White/yellow (W/Y) – Ground
- White/green (W/G) – Ground
- White/blue (W/L) – Ground
- White/brown (W/Br) – Ground

r/min	Unloaded		Loaded	
	Cranking		1,500	3,500
DC V	5.0	5.0	20.0	38.0

4. Disconnect the pulser coil coupler.
5. Connect the digital circuit tester to the pulser coil coupler (pulser coil side).
6. Measure the pulser coil resistance. Replace the pulser coil resistance if out of specification.

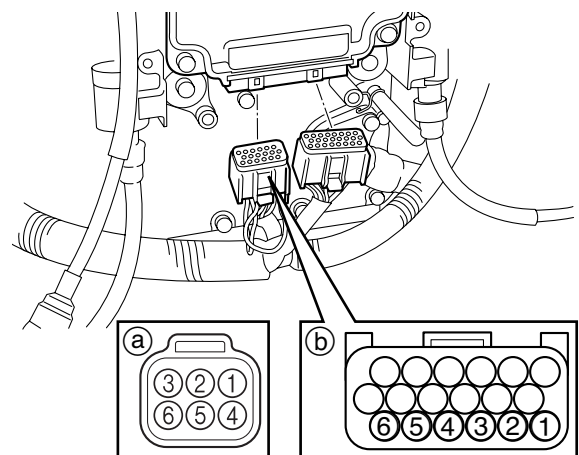


 Pulser coil resistance (reference data):

- White/red (W/R) ① – Ground
- White/black (W/B) ② – Ground
- White/yellow (W/Y) ③ – Ground
- White/green (W/G) ④ – Ground
- White/blue (W/L) ⑤ – Ground
- White/brown (W/Br) ⑥ – Ground

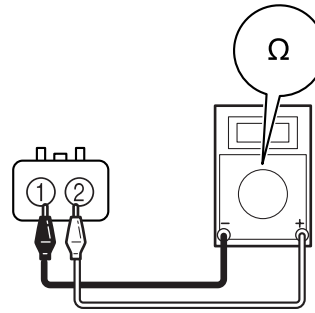
294 – 398 Ω at 20°C (68°F)

7. Connect the digital circuit tester to the pulser coil coupler (a) and CDI unit coupler (b) (wiring harness side).
8. Check the continuity. Replace the wiring harness if no continuity.

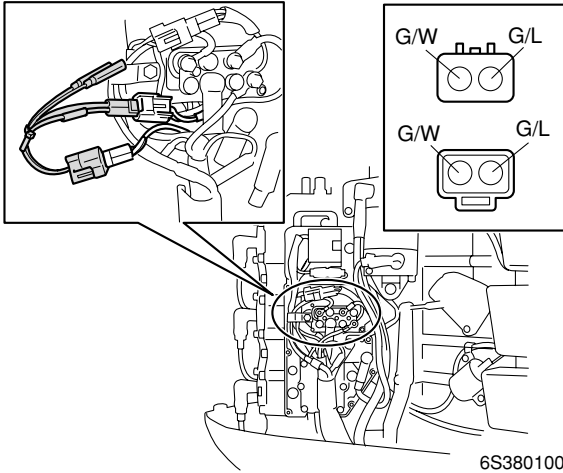


Checking the crank position sensor

1. Remove the junction box cover.
2. Connect the test harness to the crank position sensor.
3. Measure the crank position sensor output peak voltage. Replace the crank position sensor if less than specification.




6S380105




6S380100

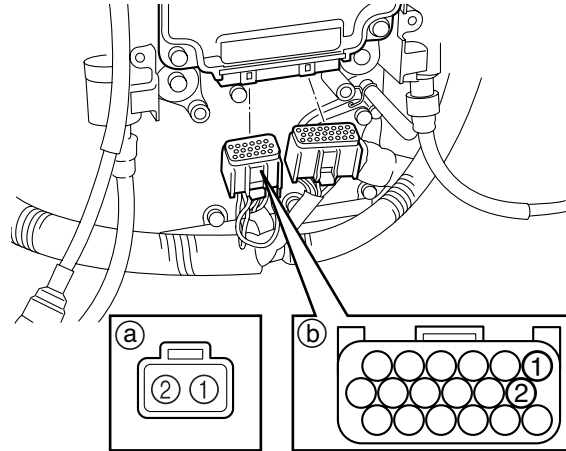
 **Test harness (2 pins): 90890-06867**

 **Crank position sensor output peak voltage (reference data, air gap at 0.55 mm):**
 Green/white (G/W) –
 Green/blue (G/L)

r/min	Unloaded		Loaded	
	Cranking		1,500	3,500
DC V	4.0	4.0	10.0	15.0

 **Crank position sensor resistance (reference data):**
 Green/white (G/W) ① –
 Green/blue (G/L) ②
 179 – 242 Ω at 20°C (68°F)

7. Connect the digital circuit tester to the crank position sensor coupler (a) and CDI unit coupler (b) (wiring harness side).
8. Check the continuity. Replace the wiring harness if no continuity.

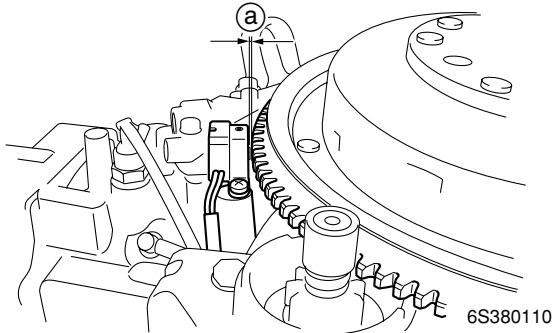



6S380106

4. Disconnect the crank position sensor coupler.
5. Connect the digital circuit tester to the crank position sensor coupler (crank position sensor side).
6. Measure the crank position sensor resistance. Replace the crank position sensor resistance if out of specification.

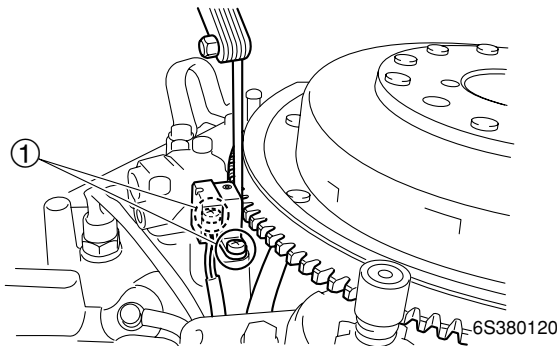
Checking the crank position sensor air gap

1. Remove the flywheel magnet cover.
2. Measure the crank position sensor air gap (a). Adjust if out of specification.



 Crank position sensor air gap:
0.5 – 1.5 mm (0.02 – 0.06 in)

3. Loosen the screws (1) and adjust the crank position sensor air gap.

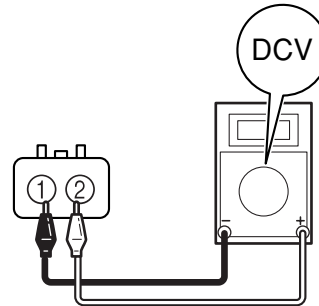



4. Tighten the screws, and then check the crank position sensor air gap.

Checking the engine temperature sensor

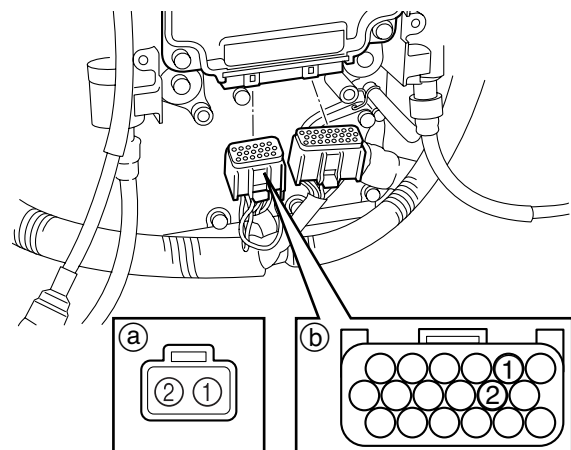
1. Remove the junction box cover.
2. Disconnect the engine temperature sensor coupler.
3. Turn the engine start switch to ON.

4. Measure the input voltage at the engine temperature sensor coupler (engine temperature sensor side). Check the wiring harness if less than specification.

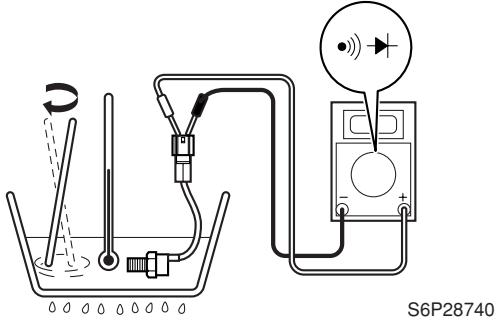


 Engine temperature sensor input voltage: (reference)
Black/yellow (B/Y) (1) –
Black/yellow (B/Y) (2)
5 V


5. Connect the digital circuit tester to the engine temperature sensor coupler (a) and CDI unit coupler (b) (wiring harness end).
6. Check the continuity. Replace the wiring harness if no continuity.



7. Remove the engine temperature sensor.
8. Place the engine temperature sensor in a container of water and slowly heat the water.



9. Measure the engine temperature sensor resistance. Replace the engine temperature sensor if out of specification.

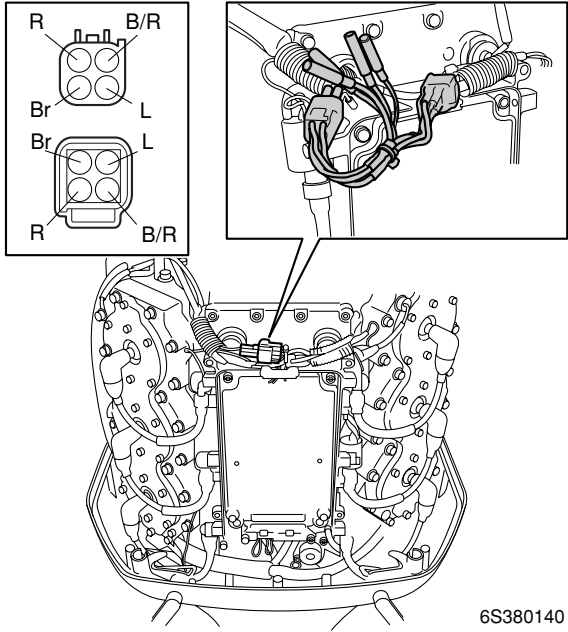


Engine temperature sensor resistance:

- Black/yellow (B/Y) – Black/yellow (B/Y)
- at 5°C (41°F): 128 kΩ (reference)
- at 20°C (68°F): 54.2 – 69.0 kΩ
- at 100°C (212°F): 3.12 – 3.48 kΩ


Checking the charge coil

1. Remove the CDI unit cover.
2. Connect the test harness to the charge coil.
3. Measure the charge coil output peak voltage. Replace the stator assembly if less than specification.





Test harness (4 pins): 90890-06871

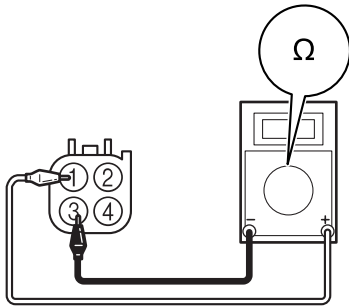


Charge coil output peak voltage:
 Red (R) – Brown (Br)
 Black/red (B/R) – Blue (L)

r/min	Unloaded		Loaded	
	Cranking		1,500	3,500
DC V	120	150	170	170

4. Disconnect the charge coil coupler.
5. Connect the digital circuit tester to the charge coil coupler (charge coil side).

- Measure the charge coil resistance. Replace the stator assembly if out of specification.



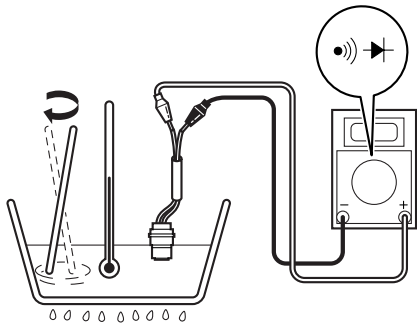
6S380145

Charge coil resistance (reference data):

- Red ① – Brown (Br) ③
224–336 Ω at 20°C (68°F)
- Black/red (B/R) ② – Blue (L) ④
224 – 336 Ω at 20°C (68°F)

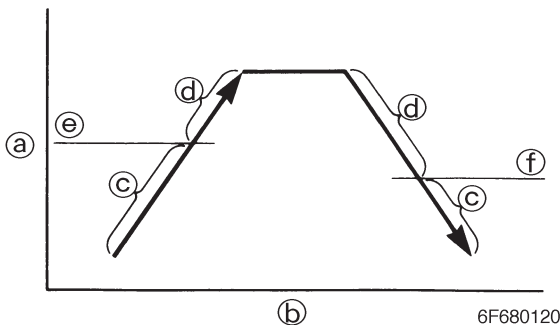
Checking the thermostwitch

- Place the thermostwitches in a container of water and slowly heat the water.



S6P28750

- Check the switches for continuity at the specified temperatures. Replace the thermostwitches if out of specification.



6F680120

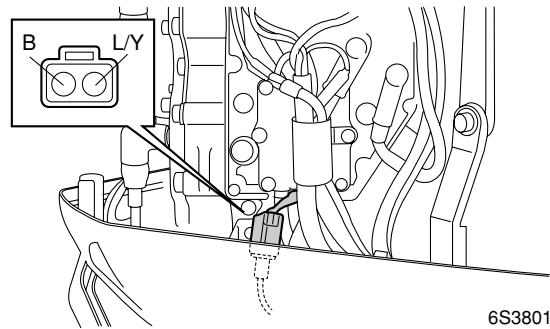
- (a) Temperature
- (b) Time
- (c) No continuity
- (d) Continuity

Thermostwitch continuity temperature:

- Pink (P) – Black (B)
ON (⊕): 84.0 – 90.0 °C
(183 – 194°F)
- OFF (⊖): 60.0 – 74.0 °C
(140 – 165°F)

Checking the shift cut switch

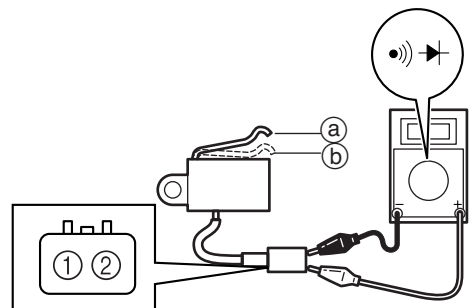
- Disconnect the shift cut switch coupler.
- Turn the engine start switch to ON.
- Measure the input voltage at the shift cut switch coupler (wiring harness side). Check the wiring harness to shift cut switch coupler continuity if there is no voltage.



6S380170

Shift cut switch input voltage:
Blue/yellow (L/Y) – Black (B)
12V

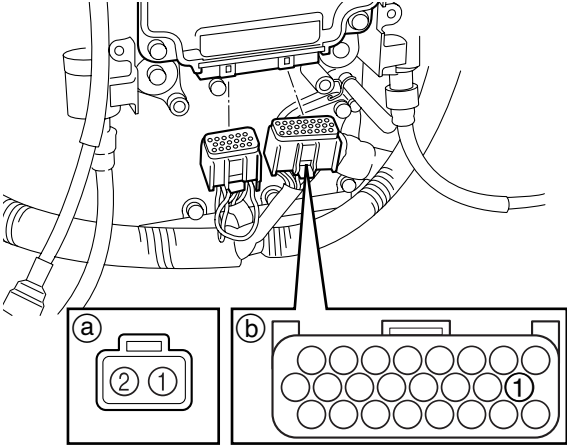
- Check the shift cut switch for continuity. Replace the shift cut switch if no continuity



S6P28760

Switch position	Lead color	
	Blue/yellow (L/Y) ①	Black (B) ②
Free (a)		
Push (b)	○—○	○—○

5. Check the continuity at the shift cut switch coupler (a) to CDI unit coupler (b) (wiring harness side). Replace the wiring harness if no continuity.



6S380175

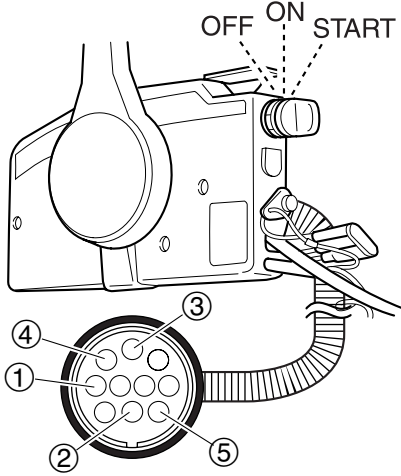
NOTE: Connect the coupler ② and ground, then check the continuity of the shift cut switch.

Starting system
Checking the fuse

1. Check the fuse for continuity. Replace the fuse if there is no continuity.

Checking the engine start switch

1. Disconnect the 10-pin main harness coupler.
2. Check the engine start switch for continuity at the 10-pin main harness coupler (engine start switch side). Check the wiring harness or replace the engine start switch if there is no continuity.

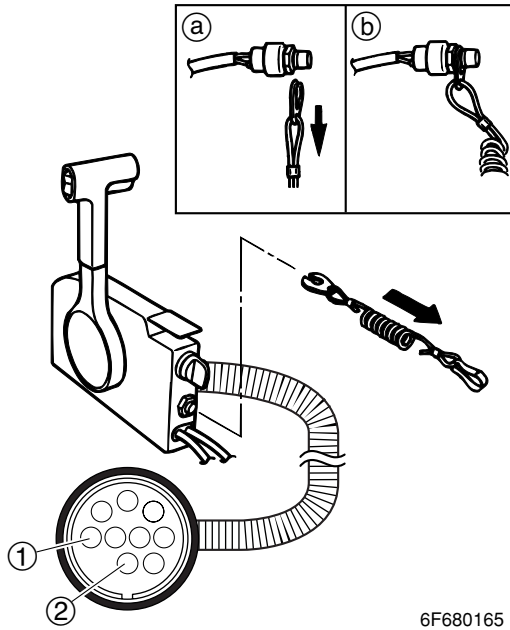


69D80206

Switch position	Lead color				
	White (W) ①	Black (B) ②	Red (R) ③	Yellow (Y) ④	Brown (Br) ⑤
OFF	○	○			
ON			○	○	
START			○	○	○

Checking the engine stop lanyard switch

1. Check the engine stop lanyard switch for continuity. Replace if there is no continuity.

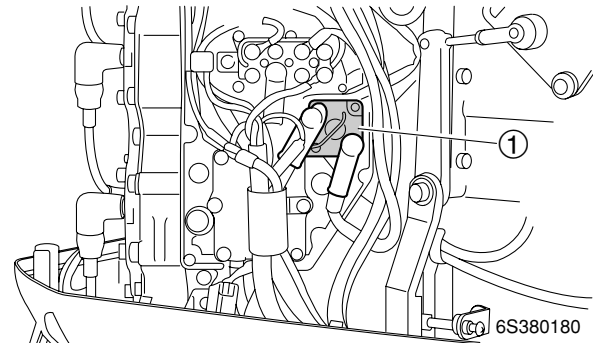


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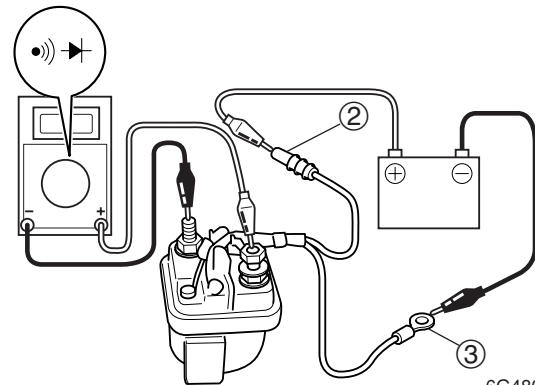
Switch position	Lead color	
	White (W) ①	Black (B) ②
Lock plate removed (a)		
Lock plate inserted (b)	○	○

Checking the starter relay

1. Remove the starter relay ①.



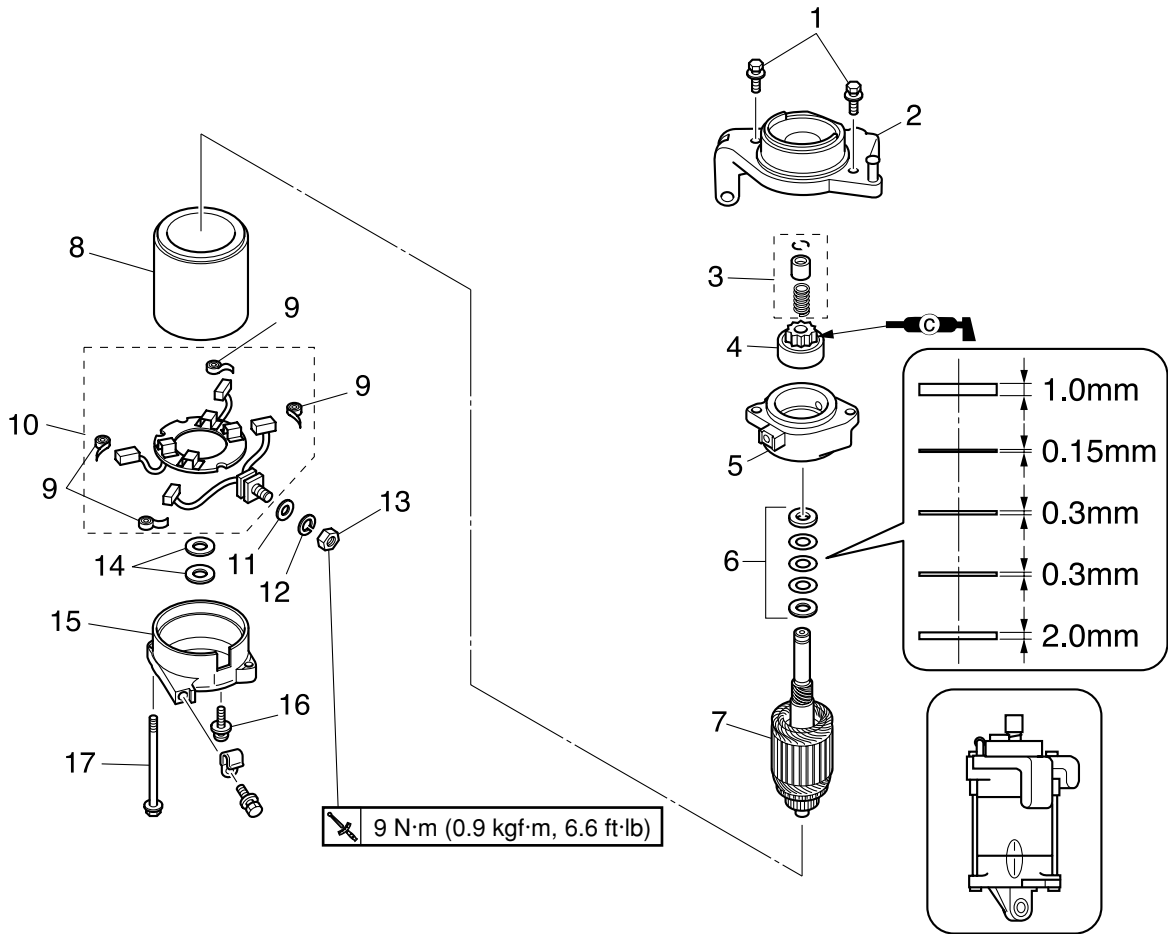
2. Connect the digital circuit tester leads to the starter relay terminals.
3. Connect the positive battery terminal to the brown (Br) lead ②.
4. Connect the negative battery terminal to the black (B) lead ③.
5. Check for continuity between the starter relay terminals. Replace the starter relay if there is no continuity.



6G480196

6. Check that there is no continuity between the starter relay terminals after disconnecting a battery terminal from the brown ② or black lead ③. Replace the starter relay if there is continuity.

Starter motor

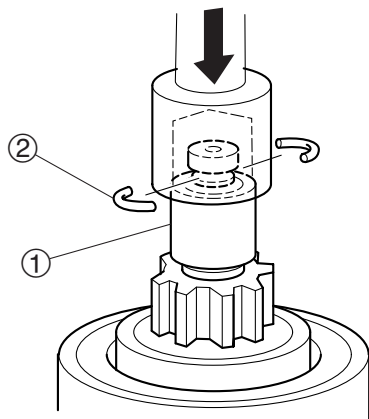


6S38010E

No.	Part name	Q'ty	Remarks
1	Bolt	2	M8 × 25 mm
2	Starting motor bracket	1	
3	Retainer	2	
4	Starter motor pinion	1	
5	Front bracket	1	
6	Washer	—	
7	Armature	1	
8	Stator	1	
9	Spring	4	
10	Brush holder	1	
11	Washer	1	
12	Washer	1	
13	Nut	1	
14	Washer	2	
15	Rear bracket	1	
16	Screw	2	
17	Bolt	2	M6 × 115 mm

Removing the starter motor pinion

- Slide the pinion stopper ① down using the box wrench, and then remove the clips ②.

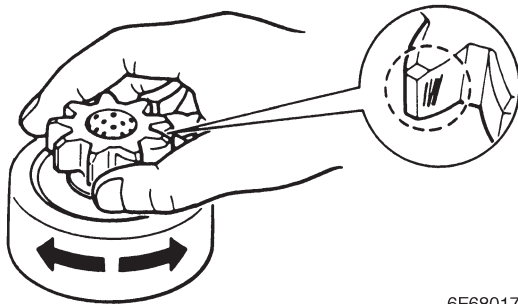


6S380195

- Remove the starter motor pinion.

Checking the starter motor pinion

- Check the teeth of the pinion for cracks or wear. Replace the pinion if necessary.
- Check the pinion for smooth operation. Replace pinion if necessary.



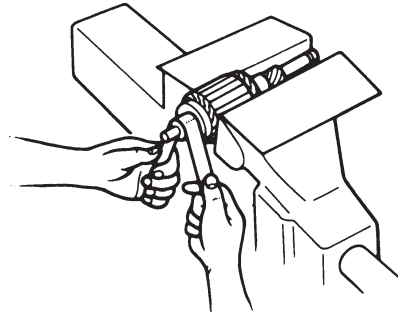
6F680170

NOTE:

Turn the pinion counterclockwise to check that it operates smoothly and turn it clockwise to check that it locks in place.

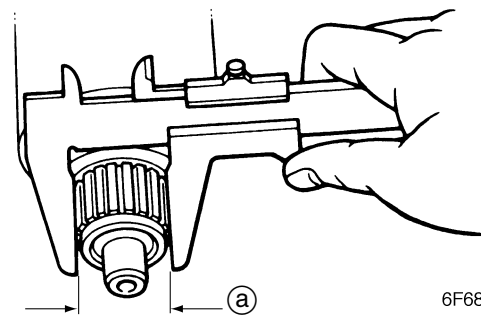
Checking the armature

- Check the commutator for dirt. Clean with 600– grit sandpaper and compressed air if necessary.



6G480220

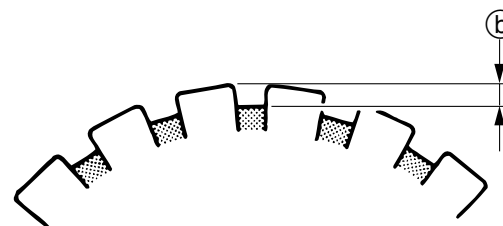
- Measure the commutator diameter ①. Replace the armature if below specification limit.



6F680175

	Standard diameter ①:
	33.0 mm (1.30 in)
	Wear limit:
	32.0 mm (1.26 in)

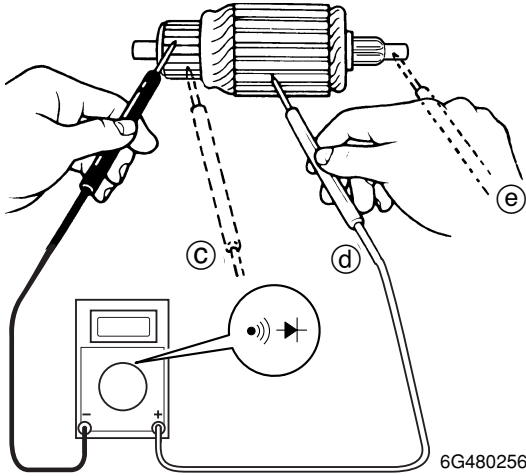
- Measure the commutator undercut ②. Replace the armature if below specification.




6F680180

	Commutator undercut ②:
	Wear limit :0.2 mm (0.01 in)

4. Check the armature for continuity. Replace the armature if out of specifications.

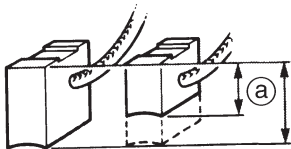


6G480256


	Armature continuity	
Commutator segments (c)		Continuity
Segment – Armature core (d)		No continuity
Segment – Armature shaft (e)		No continuity

Checking the brush

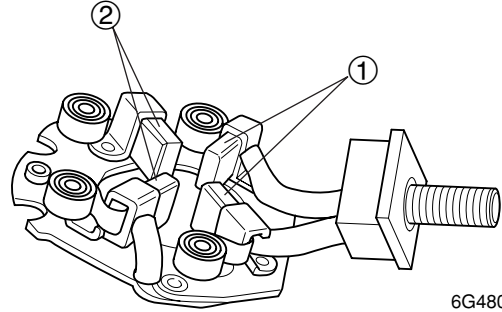
1. Measure the brush length (a). Replace the brush assembly if below specification limit.




6G470330

	Standard length: 17.0 mm (0.67 in)
	Wear limit (a): 10.0 mm (0.39 in)

2. Check the brush holder assembly for continuity. Replace the brush holder if out of specifications.



6G480270

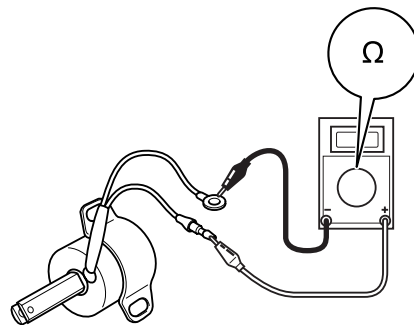
	Brush continuity:	
Brush (1) – Brush (2)		No continuity

Checking the starter motor operation


1. Check the operation of the starter motor after installing it onto the power unit.

Checking the choke solenoid

1. Disconnect the choke solenoid leads.
2. Connect the digital circuit tester to the choke solenoid leads.
3. Measure the resistance of the choke solenoid. Replace the choke solenoid if out of specification.



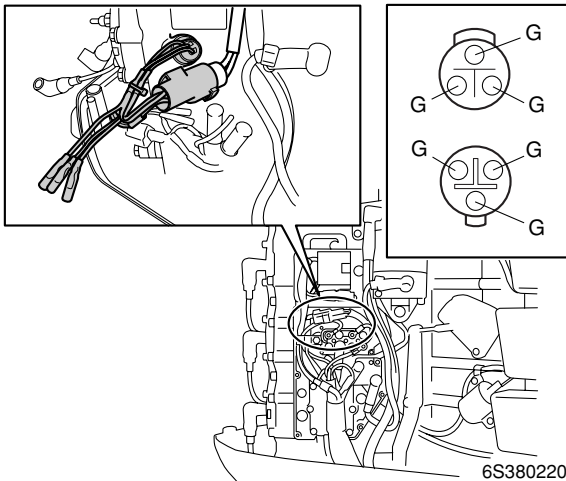
6G480280

	Choke solenoid resistance: 3.4 – 4.0 Ω
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Charging system

Checking the lighting coil

1. Remove the junction box cover.
2. Connect the test harness to the lighting coil.
3. Measure the lighting coil output peak voltage. Replace the stator assembly if less than specification.



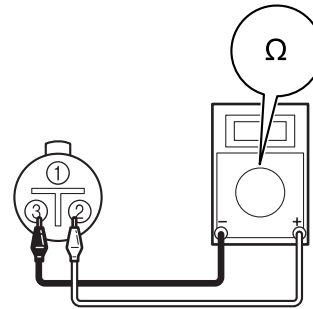
Test harness (3 pins): 90890-06870



Lighting coil output peak voltage:
Green (G) – Green (G)
Test harness side :
Green/white (G/W) – Green (G)

r/min	Unloaded		
	Cranking	1,500	3,500
DC V	8.0	45.0	90.0

4. Disconnect the lighting coil coupler.
5. Connect the digital circuit tester to the lighting coil coupler (lighting coil side).
6. Measure the lighting coil resistance. Replace the stator assembly if out of specification.



6S380225



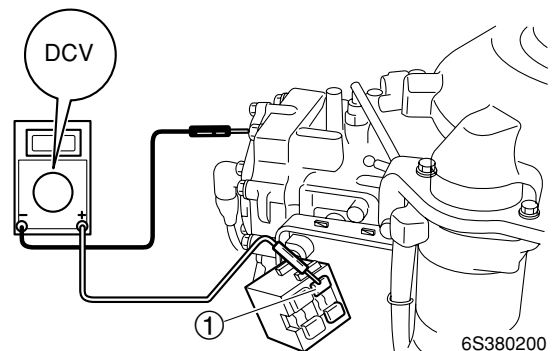
Lighting coil resistance
(reference data):
Green (G) ① or ② – Green (G) ③
0.2 – 0.3 Ω at 20°C (68°F)

Checking the Rectifier Regulator

CAUTION:

If the battery cable are connected in reverse, the Rectifier Regulator can be damaged.


1. Remove the junction box cover, and then remove the fuse holder from junction box.
2. Connect the digital circuit tester to the fuse ① and ground.
3. Measure the Rectifier Regulator output peak voltage. If less than specification, measure the lighting coil output peak voltage. Replace the Rectifier Regulator if the output peak voltage of the lighting coil is more than specification.



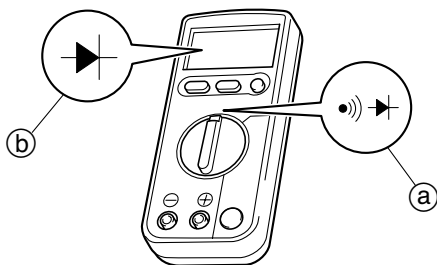
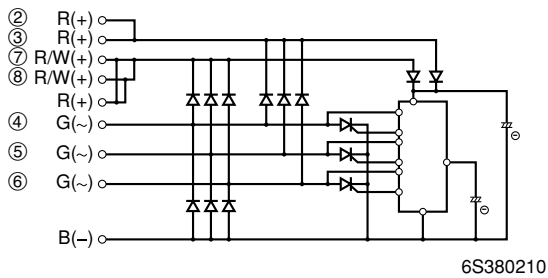
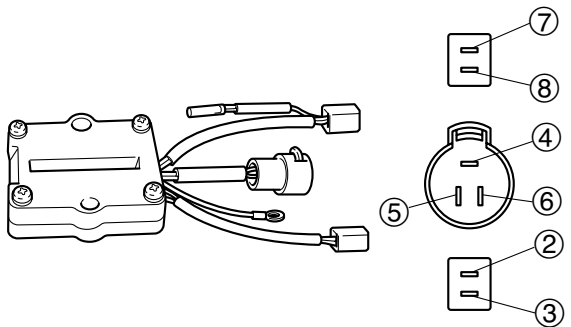
6S380200

NOTE:

Do not use the peak voltage adaptor when measuring the output peak voltage of the Rectifier Regulator.


	Rectifier Regulator output peak voltage: Red (R) – Ground or Red/white (R/W) – Ground	
r/min	Unloaded	
	1,500	3,500
DC V	13	13

4. Check the Rectifier Regulator for continuity. Replace if out of specification.



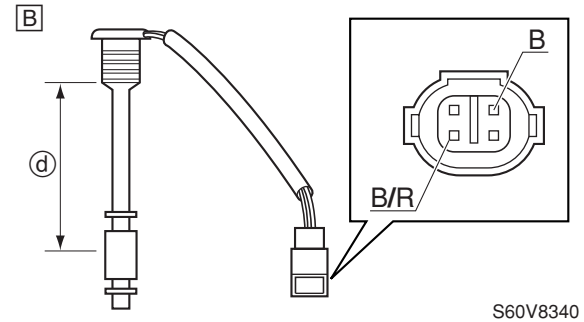
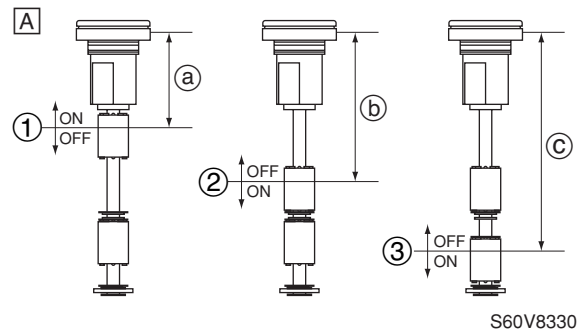
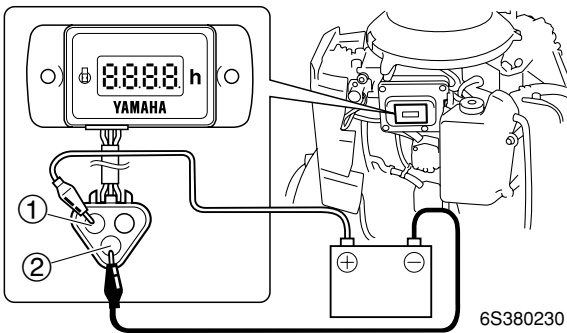
S6S18360

NOTE: _____
Set the measurement range (a), push the "SHIFT" switch to display the mark (b), and then checking the Rectifier Regulator continuity.

	Rectifier Regulator continuity	
Tester lead		
+	-	
G ④	R ②	0.42 – 0.45 V (reference data)
G ④	R ③	
G ⑤	R ②	
G ⑤	R ③	
G ⑥	R ②	
G ⑥	R ③	
G ④	R/W ⑦	
G ④	R/W ⑧	
G ⑤	R/W ⑦	
G ⑤	R/W ⑧	
G ⑥	R/W ⑦	OL (over load)
G ⑥	R/W ⑧	
R ②	G ④	
R ②	G ⑤	
R ②	G ⑥	
R ③	G ④	
R ③	G ⑤	
R ③	G ⑥	
R/W ⑦	G ④	
R/W ⑦	G ⑤	
R/W ⑦	G ⑥	
R/W ⑧	G ④	
R/W ⑧	G ⑤	
R/W ⑧	G ⑥	

Checking the hour meter

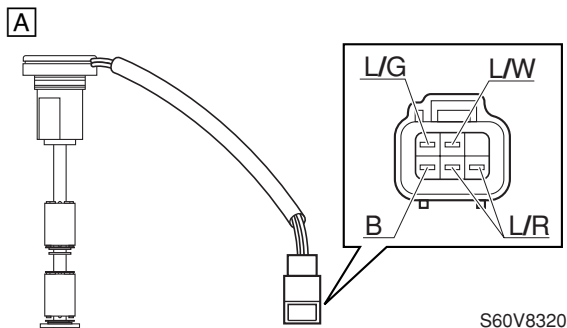
1. Remove the hour meter cover.
2. Disconnect the hour meter coupler.
3. Connect the positive battery lead to the yellow (Y) terminal ①.
4. Connect the negative battery lead to the black (B) terminal ②.
5. Check for hour meter displayed the all segment has been illuminated for 2 seconds. Replace the hour meter if there is no illuminated.



Oil feed pump control system

Checking the oil level sensor

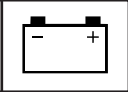
1. Remove the oil level sensor from engine oil tank and remote oil tank.
2. Check the oil level sensor for continuity. Replace if oil level sensor is no continuity.



Float position	Lead color			
	Black (B)	Blue/white (L/W)	Blue/green (L/G)	Blue/red (L/R)
① ON	○	○		
① OFF				
② ON	○		○	
② OFF				
③ ON	○			○
③ OFF				

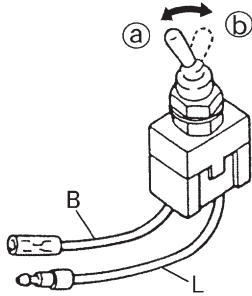
Float distance:
 (a): 53 – 57 mm (2.09 – 2.24 in)
 (b): 83 – 87 mm (3.279 – 3.43 in)
 (c): 126.5 – 130.5 mm (4.98 – 5.14 in)
 (d): 150 – 153 mm (5.91 – 6.02 in)

- A: Engine oil tank
- B: Remote oil tank



Checking the emergency switch

1. Remove the emergency switch from the engine oil tank.
2. Disconnect the emergency switch connector from the wiring harness.
3. Check the emergency switch for continuity. Replace if there is no continuity.



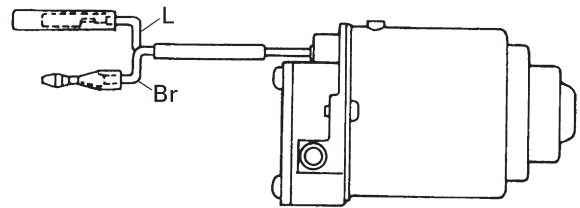
S60V8400

Switch position	Lead color	
	Blue (L)	Black (B)
Home (a)		
ON (b)	○	○

4. Check that the emergency switch returns automatically to the home position from the on position when released.

Checking the oil pump (remote oil tank)

1. Connect the positive battery lead to the brown (Br) lead.
2. Connect the negative battery lead to the blue (L) lead.
3. Listen to the operating sound of the oil pump (remote oil tank). Replace if there is no sound.



S60V8410

Troubleshooting

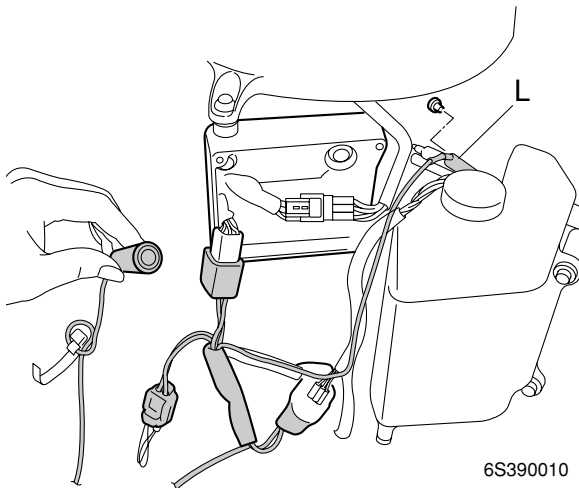
Troubleshooting the power unit	9-1
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Troubleshooting the PTT unit	9-7
Troubleshooting the lower unit.....	9-8

Troubleshooting the power unit
Troubleshooting the power unit
using the diagnostic flash indicator

NOTE: _____

- When checking the diagnostic cord, to start the engine.
- The diagnostic signal code is the same among Yamaha outboard motors.
- The diagnosis flash indicator lights for 3 seconds after the engine start switch is turned on.

1. Connect the special service tool to the outboard motor as shown.



6S390010

NOTE: _____

When performing this diagnosis, all of the electrical wires must be properly connected.

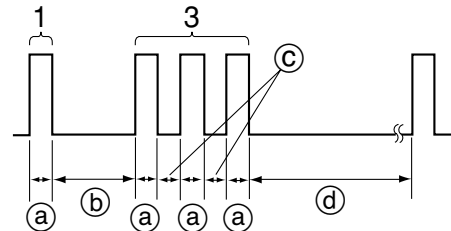
	Diagnostic flash indicator B: 90890-06865
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2. Start the engine and let it idle.
3. Check the flash pattern of the special service tool to determine if there are any malfunctions.
 - Normal condition (no defective part or irregular processing is found)
 - Single flash is given every 4.95 seconds.
 - Ⓐ: Light on, 0.33 second
 - Ⓑ: Light off, 4.95 seconds



6S390020

- Trouble code indication
 Example: The illustration indicates code number 13 (Pulser coil malfunction).
 - Ⓐ: Light on, 0.33 second
 - Ⓑ: Light off, 4.95 seconds
 - Ⓒ: Light off, 0.33 second
 - Ⓓ: Light off, 1.65 seconds



6S390030

4. If a flash pattern listed in the trouble code chart is displayed, check the malfunctioning part according to the flash pattern.

NOTE: _____

When more than one problem is detected, the light of the special service tool flashes in the pattern of the lowest numbered problem. After that problem is corrected, the light flashes in the pattern of the next lowest numbered problem. This continues until all of the problems are detected and corrected.

Code	Symptom
1	Normal
13	Incorrect pulser coil signal
14	Incorrect crank position sensor signal
15	Incorrect engine temperature sensor signal
18	Incorrect throttle sensor signal
19	Incorrect battery voltage
44	Incorrect engine stop lanyard switch signal

Troubleshooting the power unit (trouble code not available)

The trouble shooting when a trouble code is not available consists of the following 4 items.

Symptom 1: Specific trouble conditions

Symptom 2: Trouble conditions of an area or individual part

Cause 1: The content considered as the trouble factors of symptom 2.

Cause 2: The content considered as the trouble causes of cause 1 (described if necessary).

Symptom 1: Engine does not crank

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Starter motor does not operate	Discharged battery	—	Check the battery for electrolyte level, gravity and voltage.	3-14
	Loose connection of battery terminal	—	Check the battery terminal.	—
	Short, open, or loose connection in starter motor circuit	—	Check the wiring harness continuity.	*1
	Starter relay malfunction	—	Check the starter relay.	8-16
	Blown fuse (80A)	—	Check the fuse (80A).	8-15
	Starter motor malfunction	—	Disassemble and check the starter motor.	8-18
	Engine start switch malfunction	—	Check the engine start switch.	8-15
	Gear shift not in the neutral position	—	Shift the remote control lever to neutral.	3-9
Starter motor operates, but the engine does not crank	Stuck piston	—	Disassemble and check the power unit.	5-29
	Piston lock due to water or oil in the combustion chamber			

*1 See the wiring diagram

Symptom 1: Engine will not start (engine cranks)

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
—	Deterioration or dirty fuel	—	Replace the new fuel.	—
Fuel not supplied	Fuel supplied to the carburetor improperly	Fuel line malfunction	Check the fuel line.	3-2
		Fuel pump malfunction	Check the fuel pump.	4-14
	Carburetor malfunction	—	Adjust and check the carburetor.	4-10
Spark plug does not spark (all cylinders)	Engine stop lanyard switch malfunction	—	Check for continuity.	8-16
	Crank position sensor malfunction	—	Check the crank position sensor.	8-11
	Short, open, or loose connection in ignition coil ground circuit	—	Check the wiring harness continuity.	*1
Spark plug does not spark	Spark plug malfunction	—	Check the ignition spark, check the spark plug wires.	8-8
		Spark plug gap improperly	Check the spark plug gap and condition.	3-3
	Short, open or loose connection in ignition coil circuit	—	Check the wiring harness continuity.	*1
	Ignition coil malfunction	Ignition coil resistance out of specifications	Change the ignition coil and check the ignition spark.	8-8
	CDI unit malfunction	CDI unit output peak voltage less than specifications	Measure the CDI output peak voltage.	8-9
Change the CDI unit and check the ignition spark.			8-8	

*1 See the wiring diagram

Trouble shooting the power unit

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Spark plug does not spark	Pulser coil malfunction	Pulser coil output peak voltage less than specifications	Measure the pulser coil output peak voltage and resistance.	8-10
			Change the pulser coil and check the ignition spark.	5-3 8-8
	Charge coil malfunction	Charge coil output peak voltage less than specifications	Measure the charge coil output peak voltage and resistance.	8-13
			Change the stator assembly and check the ignition spark.	5-3 8-8
Low compression pressure	Cylinder head gasket malfunction	—	Check the compression pressure.	5-1
	Reed valves malfunction	—	Disassemble and check the reed valves.	5-17
	Scratched piston or wear the piston rings	—	Disassemble and check the power unit.	5-29
	Scratched cylinder wall			

Symptom 1: Unstable engine idle speed, poor acceleration, poor performance

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
—	Throttle cable adjusting improperly	—	Check and adjust the throttle cable.	3-8
	Throttle link length improperly	—	Check and adjust.	3-7
Fuel not supplied properly	Fuel supplied to the carburetor improperly	Fuel filter malfunction	Check and adjust the throttle link length.	3-2
		Fuel pump malfunction	Check the fuel filter for clog.	4-14
	Carburetor malfunction	Pilot screw settings improperly	Check and adjust the pilot screw settings.	4-11
		Throttle valve stuck or damage	Disassemble and check the carburetor.	4-10
		Jet or nozzle clogged and or float damaged		

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Fuel not supplied properly	Carburetor malfunction	Float height improperly	Disassemble and check the carburetor.	4-10
Spark plug sparks improperly	Spark plug malfunction	Spark plug gap improperly	Check the spark plug gap and condition.	3-3
	Short, open or loose connection in ignition coil circuit	—	Check the wiring harness continuity.	*1
	Ignition coil malfunction	Ignition coil resistance out of specifications	Change the ignition coil and check the ignition spark.	5-8 8-8
	CDI unit malfunction	CDI unit output peak voltage less than specifications	Measure the charge coil output peak voltage and resistance.	8-9
Change the CDI unit and check the ignition spark.			5-8 8-8	
Low compression pressure	Cylinder head gasket malfunction	—	Check the compression pressure.	5-1
	Reed valves malfunction	—	Disassemble and check the reed valves	5-17
	Scratched piston or wear the piston rings	—	Check the compression pressure and disassembling the power unit.	5-29
	Scratched cylinder wall			

*1 See the wiring diagram

Symptom 1: Limited engine speed (below 2,000 r/min)

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
<ul style="list-style-type: none"> • Buzzer comes on • Overheat warning indicator comes on • Cooling water does not discharge from the cooling water pilot hole 	Clogged cooling water inlet	—	Check the cooling water inlet.	3-4
	Water pump malfunction	Water pump impeller malfunction	Check the impeller.	6-5 6-34
			Check the Woodruff key.	6-5 6-34
		Water leakage from water pump housing	Check the water pump housing.	6-5 6-34
			Check the insert cartridge.	6-5 6-34
	Check the outer plate cartridge.	6-5 6-34		
	Clogged cooling water passage	—	Check the cooling water passage (exhaust guide, and upper case).	7-10
Thermostat malfunction	—	Check the thermostat.	3-3	
<ul style="list-style-type: none"> • Buzzer comes on • Oil level warning indicator comes on 	Oil level decrease	Clogged oil hose	Check the oil hose.	4-1
		Oil hose disconnected	Connect the oil hose. (power unit and remote oil tank)	4-1
		Oil feed pump malfunction	Check the oil feed pump.	8-23
		Emergency switch malfunction	Check the emergency switch and circuit.	8-23

Troubleshooting the PTT unit
Symptom 1: PTT unit does not operate

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
PTT relay does not operate	PTT switch malfunction	—	Check the PTT switch.	7-49
	Short, open, or loose connection of the wiring harness	—	Check the wiring harness continuity.	*1
	PTT relay malfunction	—	Check the PTT relay.	7-48
PTT motor does not operate	Short, open, or loose connection of the PTT motor lead	—	Check the PTT motor lead.	*1
	PTT motor malfunction	—	Disassemble and check the PTT motor.	7-28
	Blown fuse (80A)	—	Check the fuse (80A).	7-48
	Loose connection of the battery terminal	—	Check the battery terminal	—
	Discharged battery	—	Check the battery for electrolyte level, gravity and voltage.	3-14
Oil pressure does not increase	Manual valve opened	Manual valve malfunction	Check the manual valve.	—
	Insufficient PTT fluid	—	Add sufficient fluid.	3-11
	PTT fluid leakage	—	Check the PTT unit for leakage.	7-41
	Clogged filter	—	Disassemble and check the PTT unit.	7-34
	Clogged fluid passage			

*1 See the wiring diagram

Symptom 1: PTT unit does not hold the outboard motor up

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
—	Manual valve opened	Manual valve malfunction	Check the manual valve.	—
	Insufficient PTT fluid	—	Add sufficient fluid.	3-11
	PTT fluid leakage	—	Check the PTT unit for leakage.	7-41
	Clogged fluid passage	—	Disassemble and check the PTT unit.	7-34

Troubleshooting the lower unit

Symptom 1: Shift mechanism of the forward gear and reverse gear does not operate properly

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
—	Remote control box malfunction	—	Check the remote control box.	—
	Shift cable and shift cable end malfunction	—	Check the shift cable and shift cable end.	3-9
			Adjust the shift cable.	3-9
	Shift rod operation malfunction	—	Disassemble the lower case and check the shift rod joint.	6-9 6-39
Shift rod connection malfunction		—	Check the shift rod connection.	6-5 6-34

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WIRING DIAGRAM


250G, L250G

- ① Throttle sensor
 - ② PTT switch
 - ③ Oil level sensor (engine oil tank)
 - ④ Emergency switch
 - ⑤ Thermostwitch
 - ⑥ Spark plug
 - ⑦ Ignition coil
 - ⑧ CDI unit
 - ⑨ Pulser coil
 - ⑩ Charge coil
 - ⑪ Ignition coil
 - ⑫ Crank position sensor
 - ⑬ Engine temperature sensor
 - ⑭ Fuse (20A)
 - ⑮ Fuse (80A)
 - ⑯ Rectifier Regulator
 - ⑰ Shift cut switch
 - ⑱ Hour meter
 - ⑲ Trim sensor
 - ⑳ PTT motor
 - ㉑ Starter motor
 - ㉒ Hour meter
 - ㉓ Starter relay
 - ㉔ Battery
 - ㉕ Choke solenoid
 - ㉖ Oil feed pump (remote oil tank)
 - ㉗ Oil level sensor (remote oil tank)
-
- [A] To remote control box/switch panel
 - [B] To trim meter
 - [C] To oil level lamp

Color code

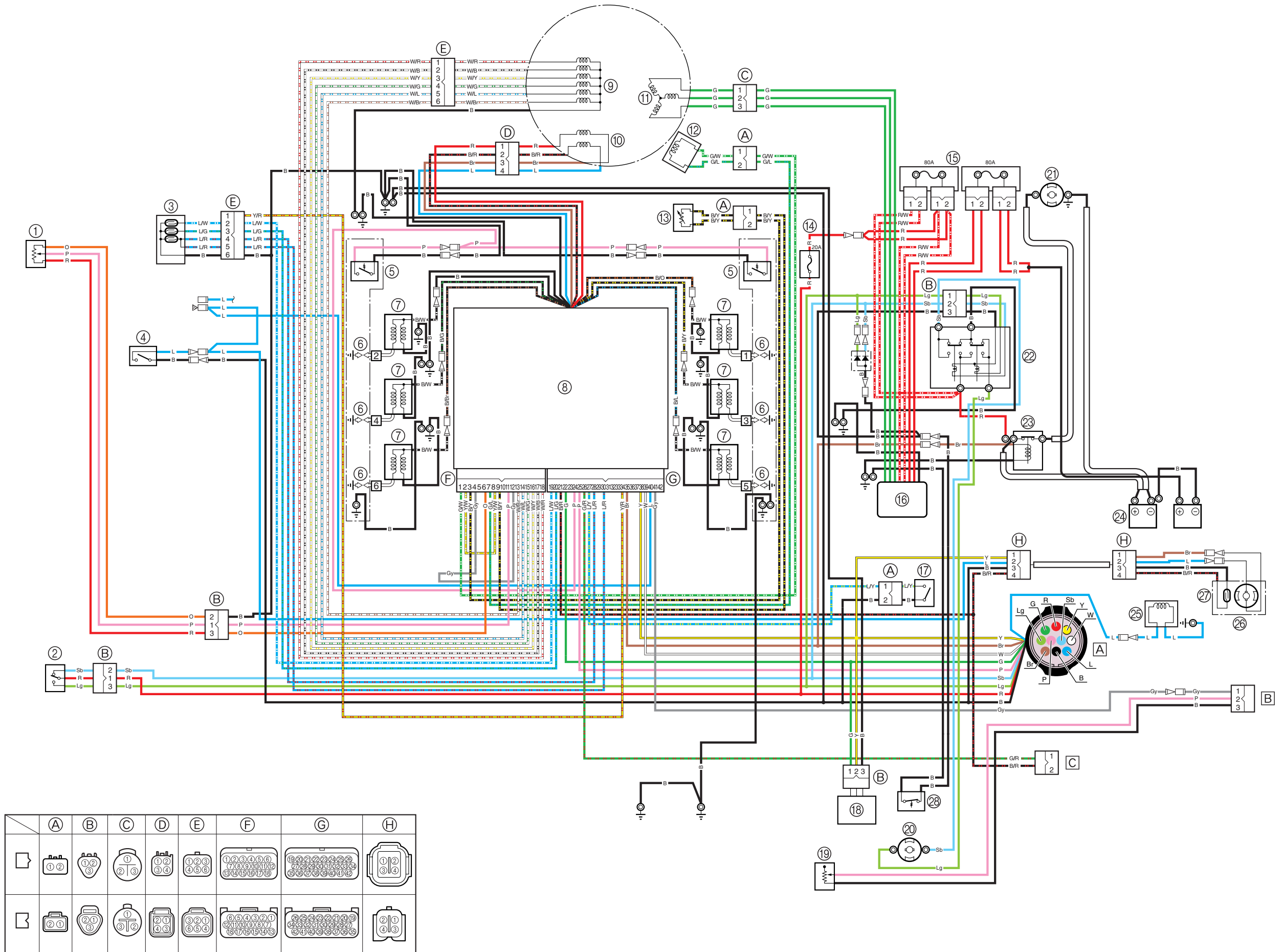
- B : Black
- B/Br : Black/brown
- B/G : Black/green
- B/R : Black/red
- B/W : Black/white
- B/Y : Black/yellow
- Br : Brown
- G : Green
- G/L : Green/blue
- G/R : Green/red
- G/W : Green/white
- Gy : Gray
- L : Blue
- L/G : Blue/green
- L/R : Blue/red
- L/W : Blue/white
- L/Y : Blue/yellow
- Lg : Light green
- O : Orange
- P : Pink
- R : Red
- R/W : Red/white
- Sb : Sky blue
- W : White
- W/B : White/black
- W/Br : White/brown
- W/G : White/green
- W/L : White/blue
- W/R : White/red
- W/Y : White/yellow
- Y : Yellow
- Y/W : Yellow/white



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