

**F15C**  
**F20B**

**SERVICE MANUAL**

**6AG-28197-3J-11**

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## 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.**

**F15C, F20B  
SERVICE MANUAL  
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## General information

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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 component 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  
Lower unit (regular rotation model)

④

③

No.	Part name	Qty	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/X-transom model
7	Drain screw	1	
8	Grommet	1	
9	Bolt	1	M10 × 45 mm
10	Bolt	1	M10 × 70 mm/X-transom model
11	Spacer	1	
12	Propeller	1	
13	Spacer	1	
14	Washer	1	
15	Cotter pin	1	Not reusable
16	Propeller nut	1	
17	Trim tab	1	

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**Drive shaft and lower case (regular rotation model)**

**Removing the drive shaft**

1. Remove the pinion nut.

①

②

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

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

Bearing separator ①: 90890-06534

**Disassembling the lower case**

1. Remove the needle bearing from the lower case.

①

②

**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.
- Be sure to remove the forward gear before removing the needle bearing.

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

**Disassembling the forward gear**

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

Ball bearing attachment ①: 90890-06655  
Driver rod LL ②: 90890-06605

6AL3J11 6-14

### Symbol

The symbols below are designed to indicate the content of a chapter.

General information



Fuel system



Bracket unit



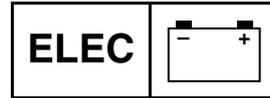
Specification



Power unit



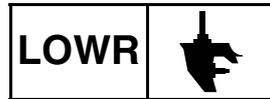
Electrical system



Periodic check and adjustment



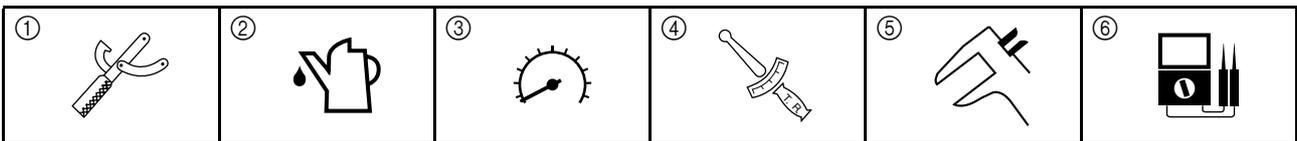
Lower unit



Troubleshooting

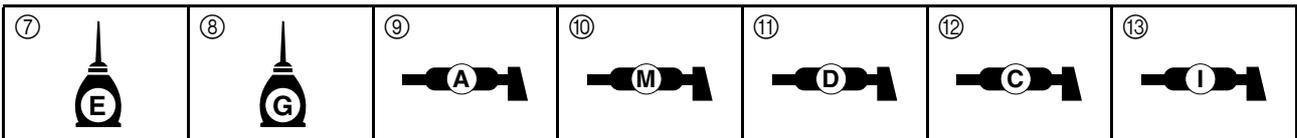


Symbols ① to ⑥ indicate specific data.



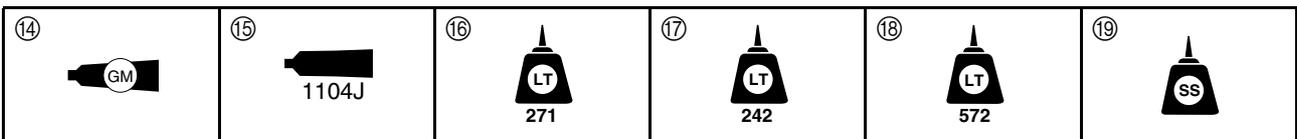
- ① Special service tool
- ② Specified oil or fluid
- ③ Specified engine speed
- ④ Specified tightening torque
- ⑤ Specified measurement
- ⑥ Specified electrical value (resistance, voltage, electric current)

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



- ⑦ Apply 4-stroke 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 silicone sealant



**Abbreviation**

The following abbreviations are used in this service manual.

Abbreviation	Description
API	American Petroleum Institute
BOW	Bow end
CCA	Cold Cranking Ampere
CDI	Capacitor Discharge Ignition
EN	European Norm (European standard)
EX	Exhaust
IEC	International Electrotechnical Commission
IN	Intake
PORT	Port side
SAE	Society of Automotive Engineers
STBD	Starboard side
TDC	Top Dead Center
WD	Wiring Diagram

**Sealant and locking agent table**

The following table contains sealants, locking agents, and greases used in this service manual that are not listed on page 1-2.

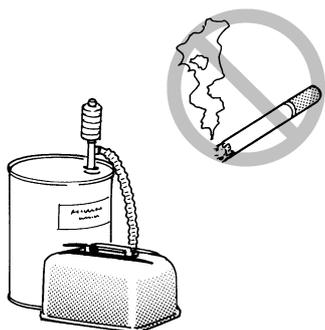
Symbol	Name	Application	Manufacturer
 S518	LOCTITE 518	Sealant	Henkel

## Safety while working

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

### Fire prevention

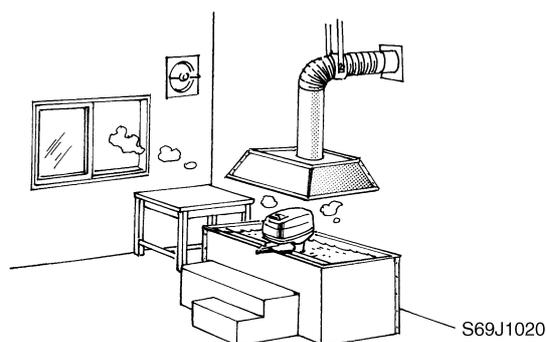
Gasoline is highly flammable. Keep gasoline and all flammable products away from heat, sparks, and open flames.



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.

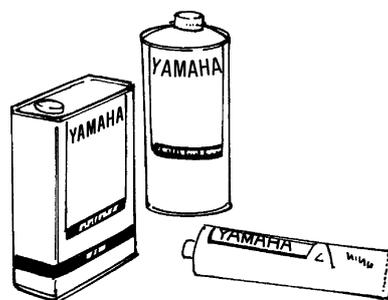
Protect your hands and feet by wearing protective gloves and safety shoes when necessary.



S69J1030

### Part, 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. Avoid contact with skin. Do not, for example, place a soiled rag in your pocket.
2. 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.
3. Change and wash clothing as soon as possible if soiled with lubricants.
4. To protect your skin, apply a protective cream to your hands before working on the outboard motor.
5. Keep a supply of clean, lint-free cloths for wiping up spills, etc.

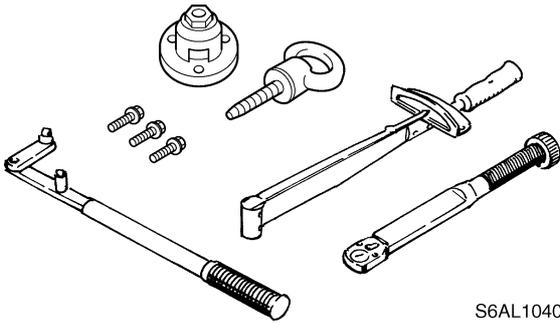


- Maintain good standards of personal and industrial hygiene.

**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.



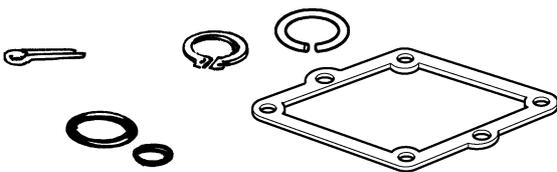
S6AL1040

**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 part**

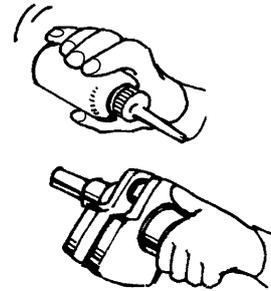
Always use new gaskets, seals, O-rings, cotter pins, circlips, etc., when installing or assembling parts.



S69J1060

**Disassembly and assembly**

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



S69J1070

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

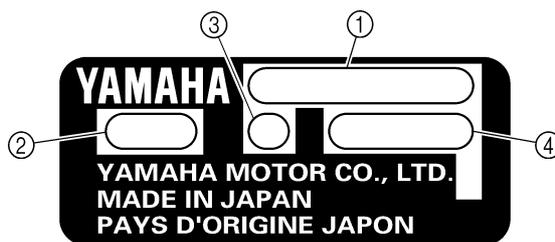
## Identification

### Model

This manual covers the following models.

Applicable model
F15CMH, F15CEH, F15CE, F15CEP, F20BMH, F20BEHP, F20BE, F20BEP

**NOTE:** \_\_\_\_\_  
F20BEHP is available only in Oceania.

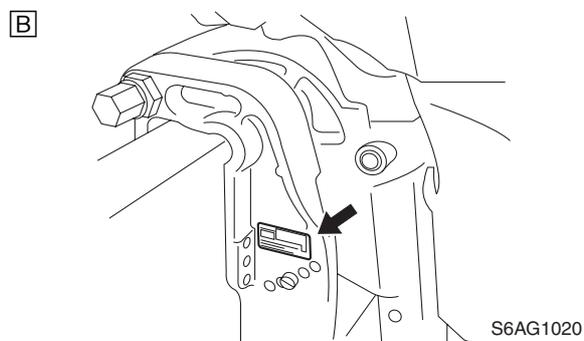
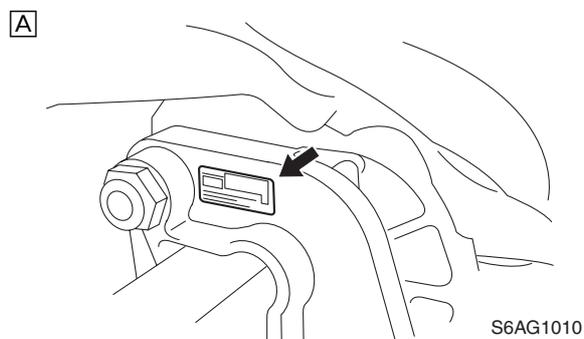


S6AL1D00

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

### Serial number

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

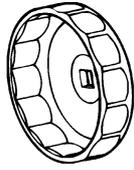


- A** Manual tilt model
- B** Power tilt model

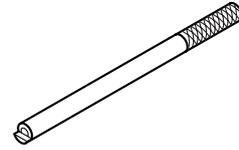
Model name	Approved model code	Starting serial No.
F15C	6AG	1000001-
F20B	6AH	1000001-



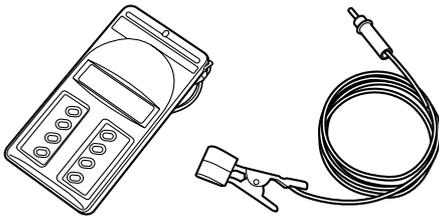
**Special service tool**



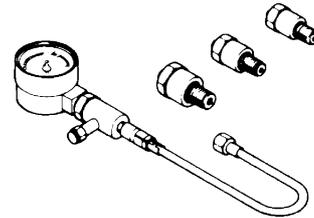
**Oil filter wrench**  
90890-01426



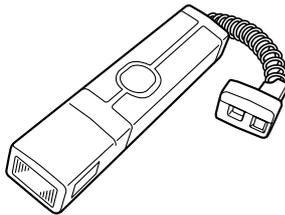
**Pilot screw adjusting tool**  
90890-03154



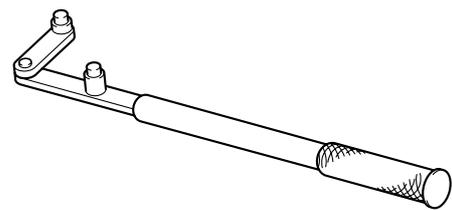
**Digital tachometer**  
90890-06760



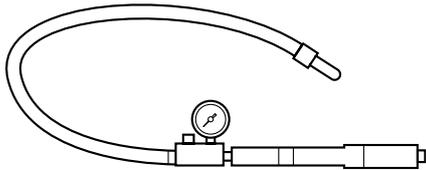
**Compression gauge**  
90890-03160



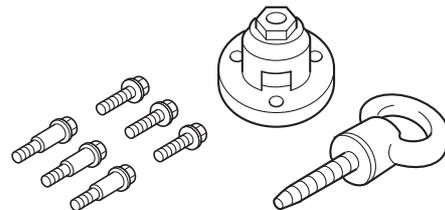
**Timing light**  
90890-03141



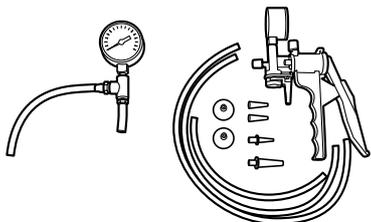
**Flywheel holder**  
90890-06522



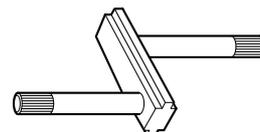
**Leakage tester**  
90890-06840



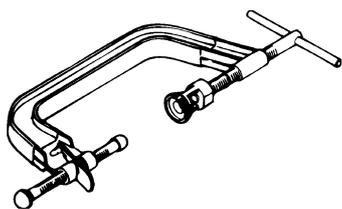
**Flywheel puller**  
90890-06521



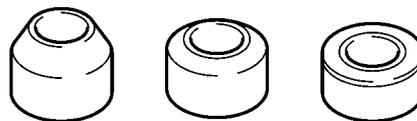
**Vacuum/pressure pump gauge set**  
90890-06756



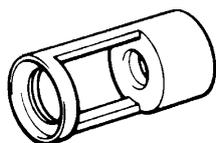
**Shaft holder**  
90890-06069



**Valve spring compressor**  
90890-04019



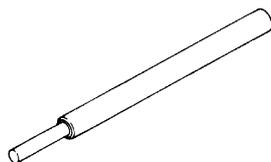
**Valve seat cutter**  
90890-06312, 90890-06315, 90890-06323,  
90890-06555, 90890-06818, 90890-06819



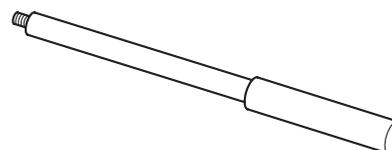
**Valve spring compressor attachment**  
90890-06320



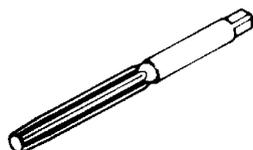
**Needle bearing attachment**  
90890-06612, 90890-06613, 90890-06614,  
90890-06616, 90890-06653



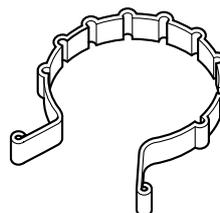
**Valve guide remover/installer**  
90890-06801



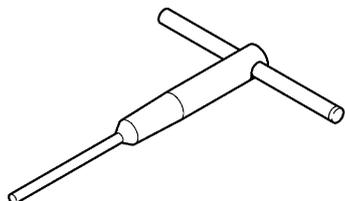
**Driver rod L3**  
90890-06652



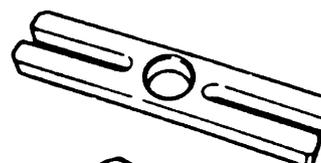
**Valve guide reamer**  
90890-06804



**Piston slider**  
90890-06529

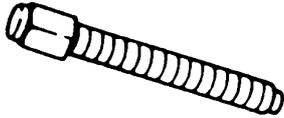


**Valve seat cutter holder**  
90890-06316

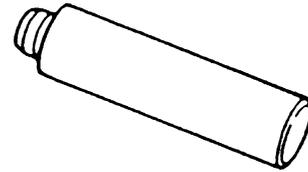


**Stopper guide plate**  
90890-06501

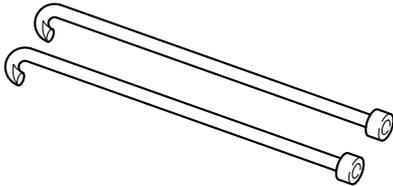




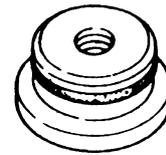
**Center bolt**  
90890-06504



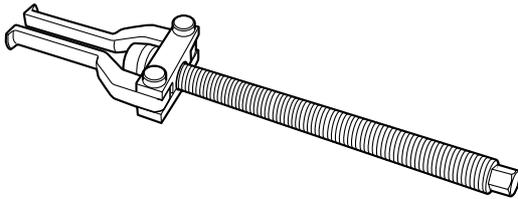
**Driver rod LS**  
90890-06606



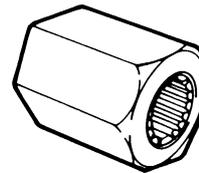
**Bearing housing puller claw S**  
90890-06564



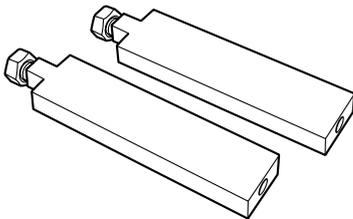
**Ball bearing attachment**  
90890-06632



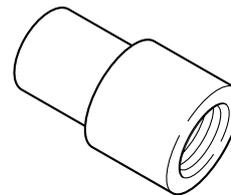
**Bearing puller assembly**  
90890-06535



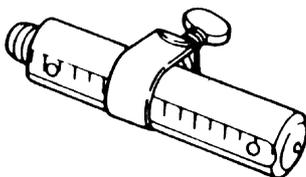
**Drive shaft holder 1**  
90890-06515



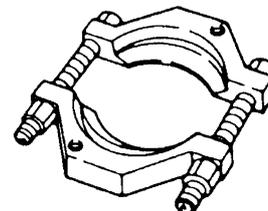
**Stopper guide stand**  
90890-06538



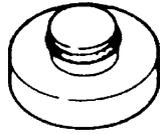
**Bushing attachment**  
90890-06649



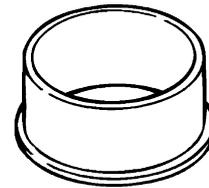
**Driver rod SS**  
90890-06604



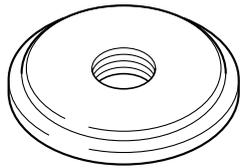
**Bearing separator**  
90890-06534



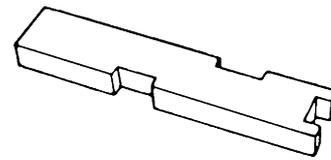
**Needle bearing attachment**  
90890-06617, 90890-06618



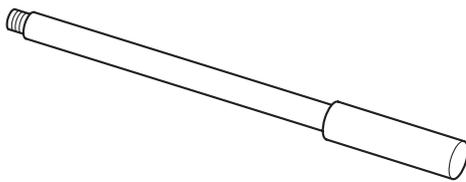
**Bearing inner race attachment**  
90890-06644



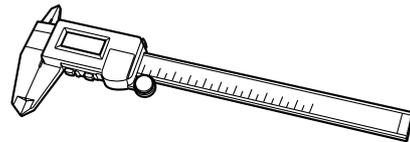
**Bearing outer race attachment**  
90890-06625



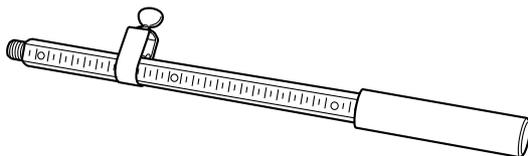
**Shimming plate**  
90890-06701



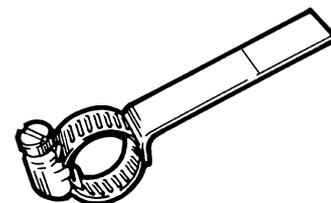
**Driver rod LL**  
90890-06605



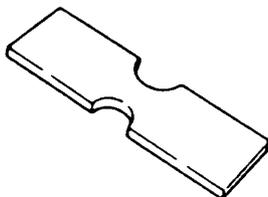
**Digital caliper**  
90890-06704



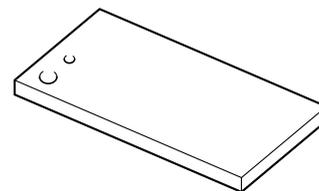
**Driver rod SL**  
90890-06602



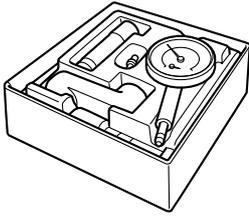
**Backlash indicator**  
90890-06706



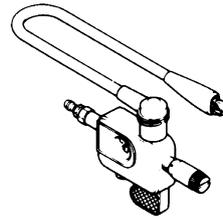
**Bearing depth plate**  
90890-06603



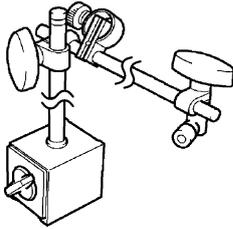
**Magnet base plate**  
90890-07003



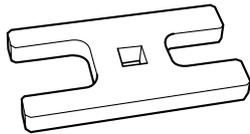
**Dial gauge set**  
90890-01252



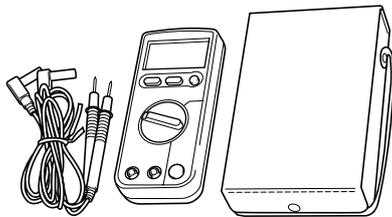
**Ignition tester**  
90890-06754



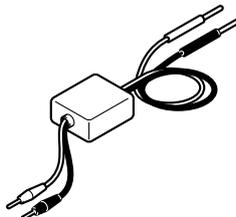
**Magnet base B**  
90890-06844



**Power tilt wrench**  
90890-06560



**Digital circuit tester**  
90890-03174



**Peak voltage adapter B**  
90890-03172

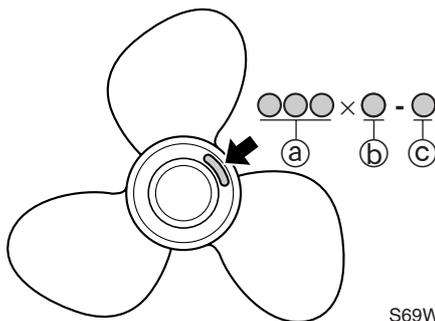
## Propeller selection

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.

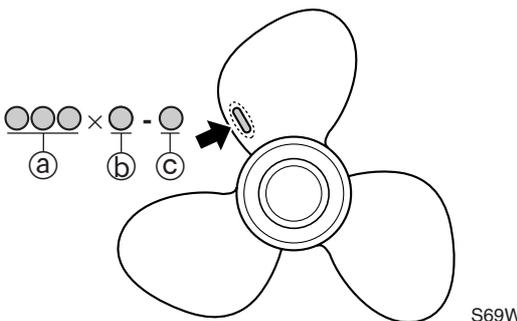
Use the following information as a guide for selecting a propeller that meets the operating conditions of the boat and the outboard motor.

### Propeller size

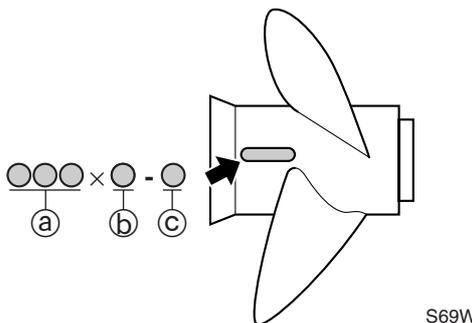
The size of the propeller is indicated on a propeller blade, on the propeller boss end, and on the side of the propeller boss.



S69W1030



S69W1040



S69W1050

- Ⓐ Propeller diameter (in inches)
- Ⓑ Propeller pitch (in inches)
- Ⓒ Propeller type (propeller mark)

### Selection

When the engine speed is at the full throttle operating range (5,000–6,000 r/min), the ideal propeller for the boat is one that provides maximum performance in relation to boat speed and fuel consumption.

Propeller size (in)	Material
9 1/4 × 9 3/4 - J	Aluminum
9 1/4 × 10 1/2 - J	
9 1/4 × 12 - J	
9 1/4 × 9 - J1	
9 1/4 × 10 - J1	
9 1/4 × 11 - J1	
9 1/4 × 12 - J1	

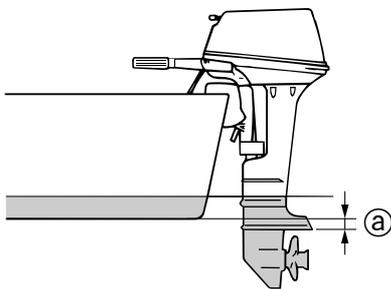
### Predelivery check

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



### Checking the outboard motor mounting height

1. Check that the anti-cavitation plate is between the bottom of the boat and a maximum of 25 mm (1 in) ① below it. 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 overheat. If the mounting height is too low, water resistance will increase and reduce engine efficiency.



S6D51030

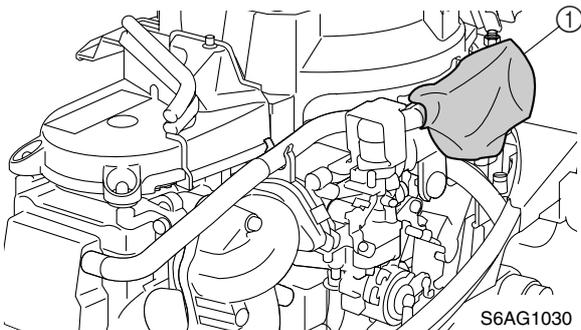
**NOTE:**

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 clamp bolts.

### Removing the intake silencer protective covering

1. Remove the protective covering ① from the intake silencer.



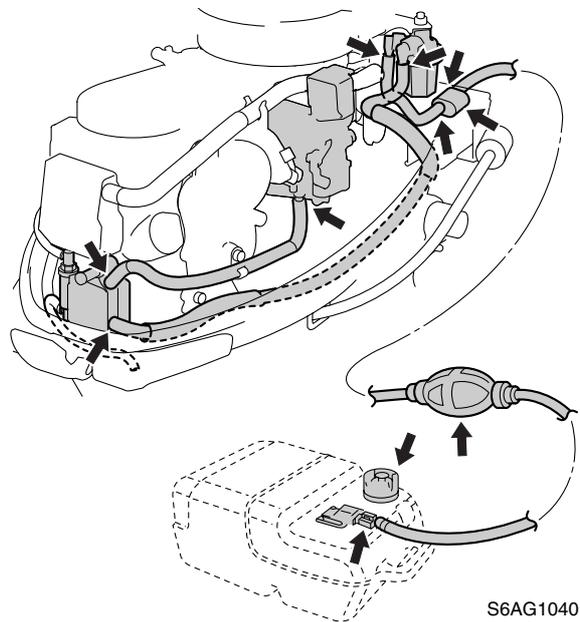
S6AG1030

**CAUTION:**

A protective covering ① is installed on the intake silencer when the outboard motor is shipped from the factory and must be removed before starting the engine for the first time.

### Checking the fuel system

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



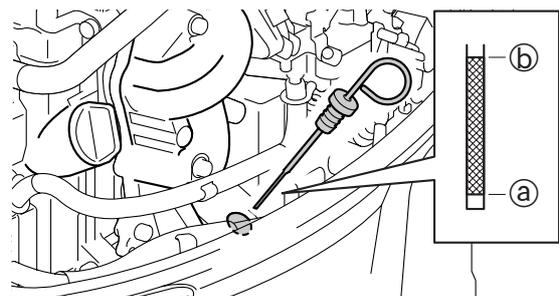
S6AG1040

**CAUTION:**

This is a 4-stroke engine. Never use pre-mixed fuel or 2-stroke outboard motor oil.

### Checking the engine oil level

1. Check the engine oil level.



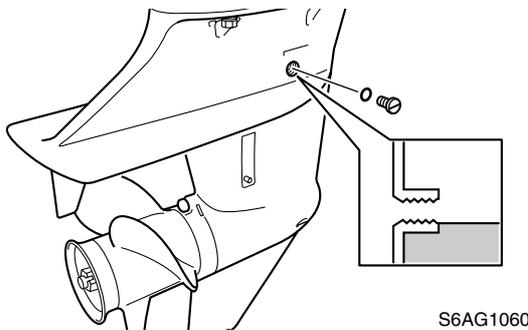
S6AG1050

**NOTE:**  
If the engine oil is below the minimum level mark ①, add sufficient oil until the level is between ① and ②.

	<p>Recommended engine oil: 4-stroke motor oil API: SE, SF, SG, SH, SJ, or SL SAE: 5W-30, 10W-30, or 10W-40 Engine oil quantity: Without oil filter replacement: 1.6 L (1.69 US qt, 1.41 Imp qt)</p>
---	---

**Checking the gear oil level**

1. Check the gear oil level.



**NOTE:**  
If the oil is at the correct level, a small amount of oil should overflow out of the check hole when the gear oil check screw is removed.

**Checking the battery (electric starter model)**

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

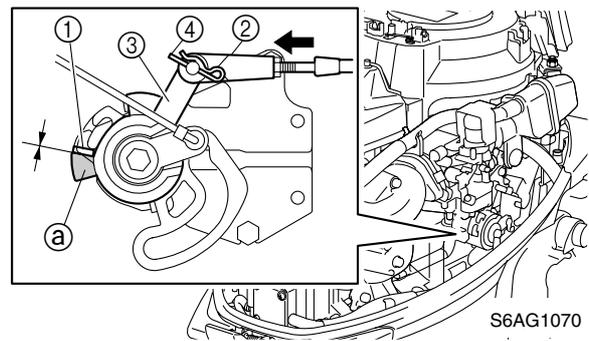
	<p>Recommended battery capacity: CCA/EN: 347.0 A 20HR/IEC: 40.0 Ah Electrolyte specific gravity: 1.280 at 20 °C (68 °F)</p>
---	---

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

**Setting the remote control cable (remote control model)**

**NOTE:**  
To adjust the throttle cable and shift cable, see “Adjusting the throttle cable (remote control model)” (3-8) or “Checking the gear shift operation (remote control model)” (3-10).

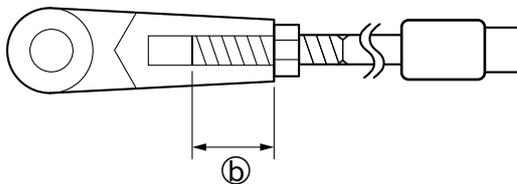
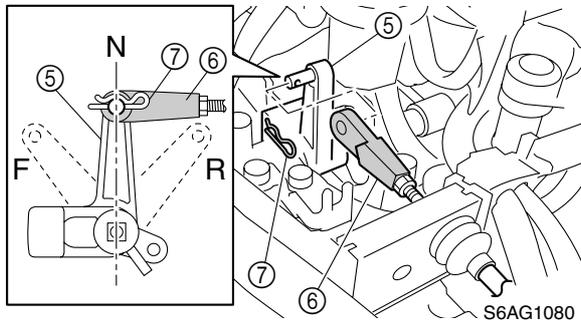
1. Set the remote control lever to the neutral position and the throttle lever to the fully closed position.
2. Check that the fully closed stopper ① on the throttle cam contacts the throttle cam bracket ②. Connect the throttle cable ③ to the throttle cam ④ and install the clip ⑤.



**NOTE:**  
Pull the throttle cable ② toward the engine to remove any free play in the cable before connecting the throttle cable joint.



3. Check that the shift rod lever joint ⑤ is in the neutral position as shown. Connect the shift cable ⑥ to the shift rod lever joint ⑤ and install the clip ⑦.



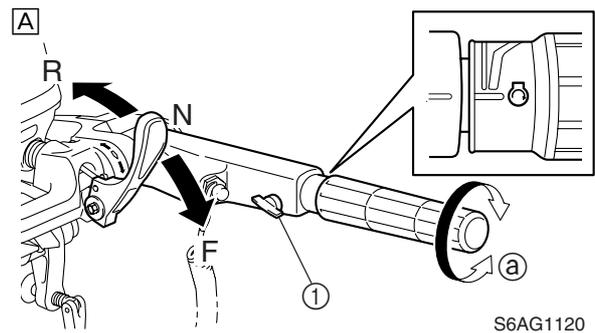
S6AG1090

**⚠ WARNING**

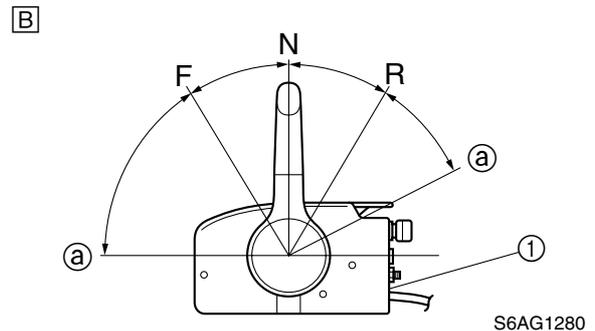
The shift/throttle cable joint must be screwed in a minimum of 8.0 mm (0.31 in) ⑥.

**Checking the gear shift and throttle operation**

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



S6AG1120



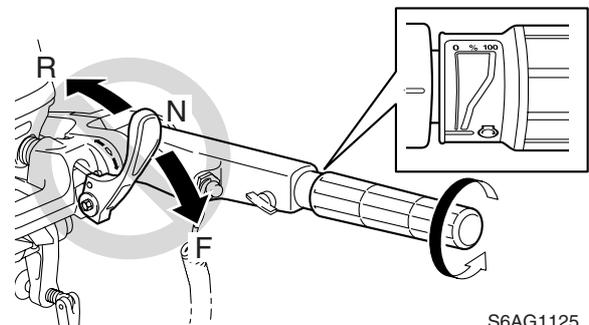
S6AG1280

- Ⓐ Tiller handle model
- Ⓑ Remote control model

**NOTE:**

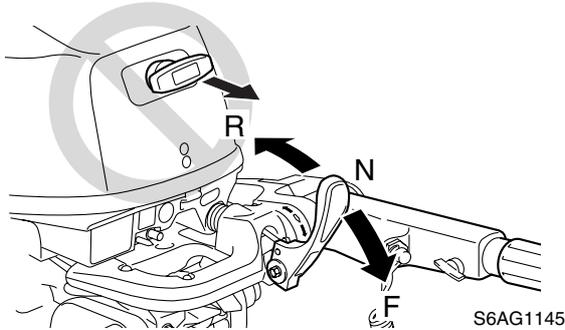
- The shift lever cannot be operated unless the throttle grip is in the fully closed position. (Tiller handle model)
- The resistance of the throttle grip (tiller handle model) or remote control lever (remote control model) can be adjusted using the throttle friction adjuster ①.

3. Check that the shift lever cannot be set to the forward or reverse position when the grip is not in the fully closed position. (Tiller handle model)



S6AG1125

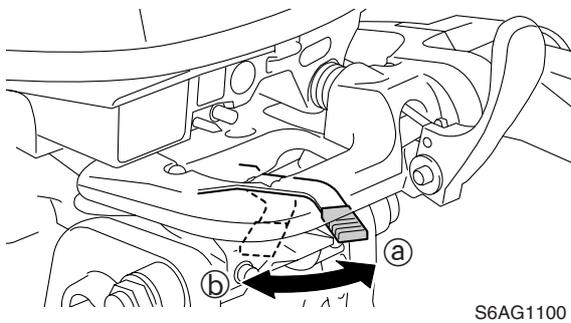
4. Set the shift lever to the forward or reverse position, and then check that the starter handle cannot be pulled. If the starter rope can be pulled out normally, adjust the start-in-gear protection cable. (Manual starter model)



**NOTE:**  
To adjust the start-in-gear protection cable, see “Checking the start-in-gear protection (manual starter model)” (3-11).

**Checking the steering system**

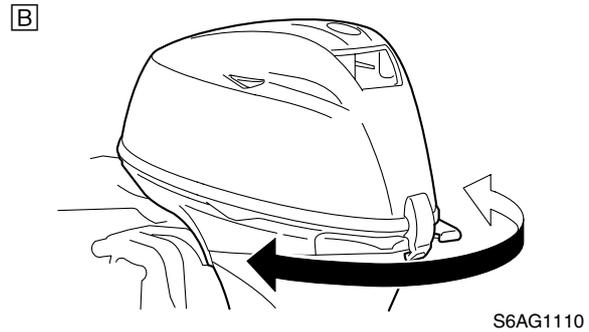
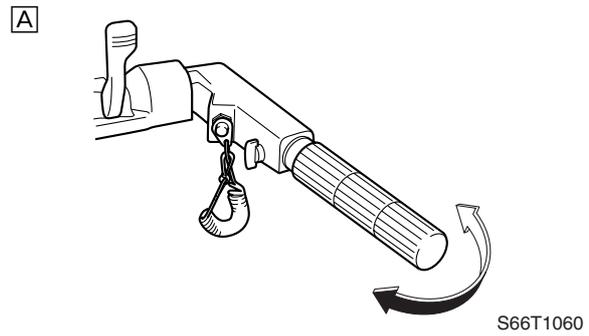
1. Check the steering friction for proper adjustment. (Tiller handle model)



**NOTE:**

- To increase the friction, move the steering lock lever in direction (a).
- To decrease the friction, move the steering lock lever in direction (b).

2. Check that the steering operates smoothly.



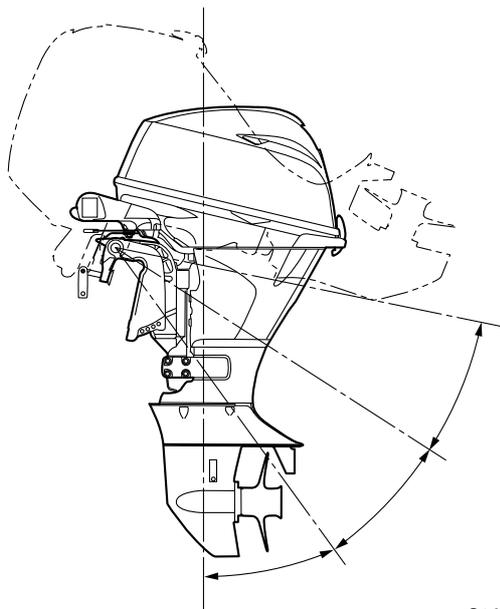
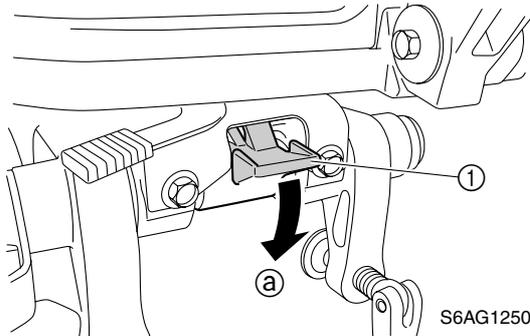
- A Tiller handle model
- B Remote control model

3. Check that there is no interference with leads, cables, or hoses when the out-board motor is steered.

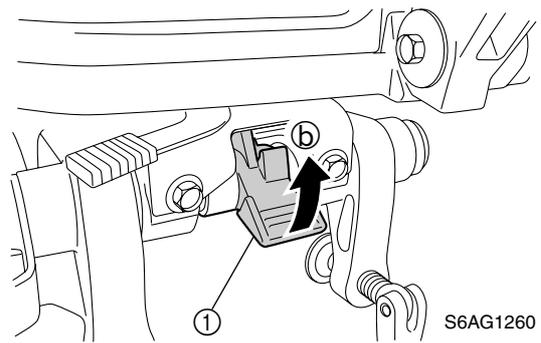


**Checking the tilt system (manual tilt model)**

1. Set the tilt lock lever ① to the release position ② and fully tilt the outboard motor up. Check that the outboard motor tilts up smoothly and automatically locks in 3 positions when it is tilted up.



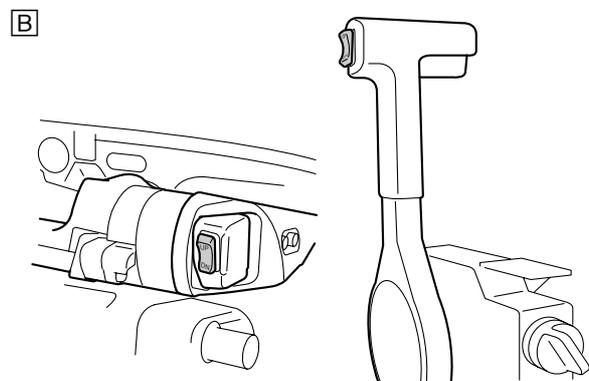
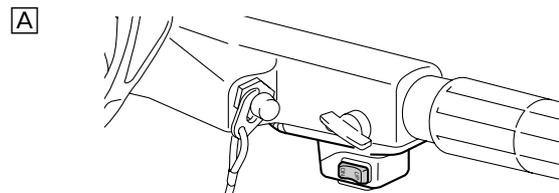
2. Set the tilt lock lever ① to the lock position ③, slightly tilt the outboard motor up, and then fully tilt it down. Check that the outboard motor tilts down smoothly and automatically locks in the fully tilted down position.



3. Check that there is no interference with leads, cables, or hoses when the tilted-up outboard motor is steered.

**Checking the power tilt system (power tilt model)**

1. Check that the outboard motor tilts up and down smoothly when operating the power tilt switch.

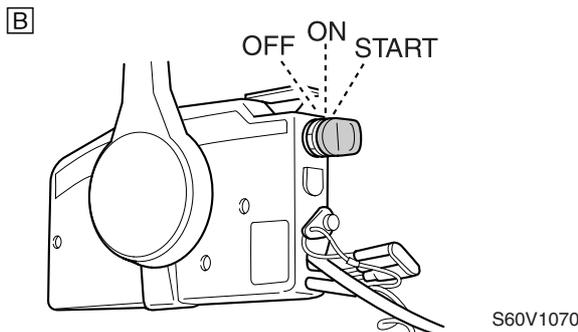
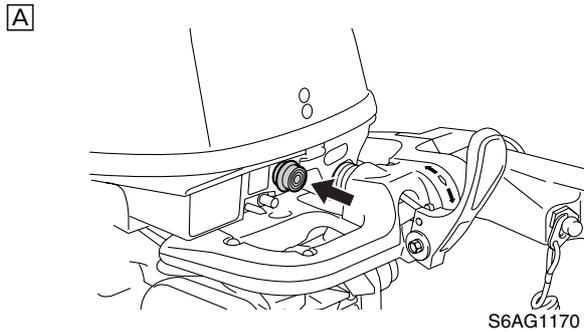


- A Tiller handle model
- B Remote control model

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 leads, cables, or hoses when the tilted-up outboard motor is steered.

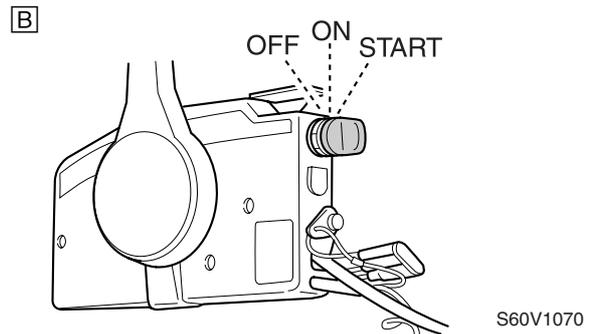
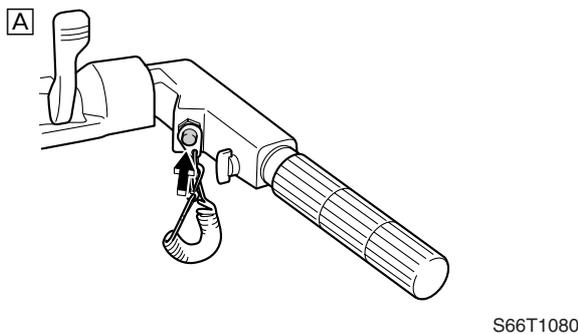
**Checking the engine start button or switch and engine stop lanyard switch**

1. Check that the engine starts when the engine start button is pushed. (Tiller handle model)  
Check that the engine starts when the engine start switch is turned to "START."  
(Remote control model)



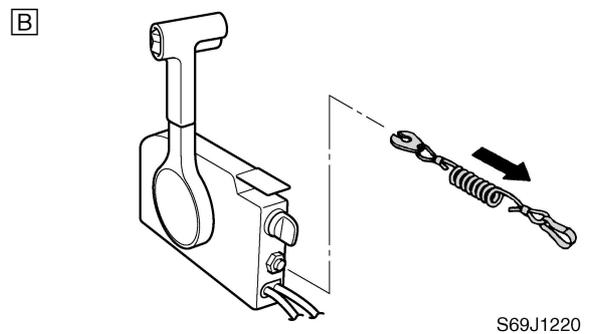
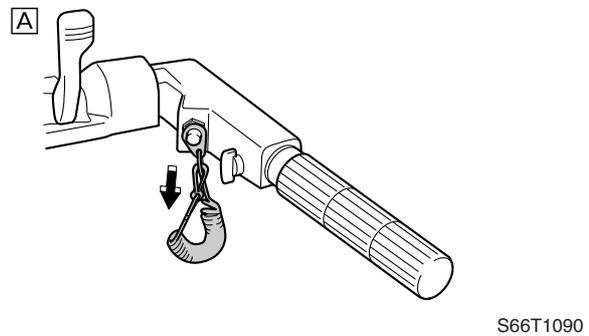
- A Tiller handle model
- B Remote control model

2. Check that the engine turns off when the engine stop lanyard switch is pushed. (Tiller handle model)  
Check that the engine turns off when the engine start switch is turned to "OFF."  
(Remote control model)



- A Tiller handle model
- B Remote control model

3. Check that the engine turns off when the clip is pulled from the engine stop lanyard switch.



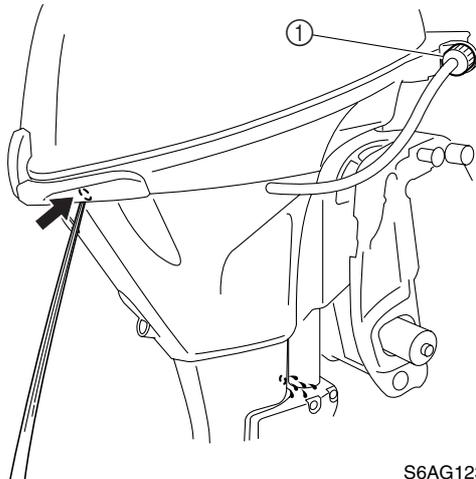
- A Tiller handle model
- B Remote control model

**Checking the cooling water pilot hole**

1. Place the lower unit in water, and then start the engine.



2. Check for water flow at the cooling water pilot hole.



S6AG1230J

**NOTE:**

Make sure that the cooling water hoses are securely connected and that the flushing hose joint adapter ① is not loose or damaged.

**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 2,000 r/min or at half throttle, then for another hour at 3,000 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:**

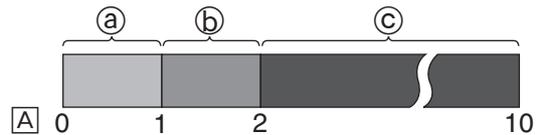
The test run is part of the break-in operation.

**Break-in**

During the test run, perform the break-in operation in the following 3 stages.

1. 1 hour (a) at 2,000 r/min or at approximately half throttle.

2. 1 hour (b) at 3,000 r/min or 3/4 throttle and 1 minute out of every 10 at full throttle.
3. 8 hours (c) with the engine at any speed. However, avoid operating at full throttle for more than 5 minutes at a time.



S69J1240

[A] Hour

**After test run**

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

**CAUTION:**

**Be sure to supply sufficient water and water pressure when flushing the cooling water passages. If sufficient water and sufficient water pressure are not supplied, the engine can overheat.**

**NOTE:**

When using the flushing device (flushing hose joint adapter), flush the cooling water passages without starting the engine.

**Precaution when transporting or storing the outboard motor**

1. Transport and store the outboard motor only as shown in the caution label. Otherwise, engine damage could result from leaking oil.



S6AG1240



**GEN  
INFO**



General information

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**— MEMO —**

# Specification

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  - Lower unit.....2-12
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- Tightening torque.....2-30**
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  - General torque.....2-33

## General specification

Item	Unit	Model			
		F15CMH	F15CEH	F20BMH	F20BEHP
<b>Dimension</b>					
Overall length	mm (in)	1,048 (41.3)			
Overall width	mm (in)	420 (16.5)			
Overall height (S)	mm (in)	1,078 (42.4)	—	1,078 (42.4)	—
(L)	mm (in)	1,205 (47.4)			
Transom height (S)	mm (in)	438 (17.2)	—	438 (17.2)	—
(L)	mm (in)	565 (22.2)			570 (22.4)
Boat transom height (S)	mm (in)	381 (15.0)	—	381 (15.0)	—
(L)	mm (in)	508 (20.0)			
<b>Weight</b>					
(with aluminum propeller) (S)	kg (lb)	51.7 (114)	—	51.7 (114)	—
(L)	kg (lb)	53.7 (118)	55.7 (123)	53.7 (118)	60.7 (134)
<b>Performance</b>					
Maximum output	kW (HP)	11.0 (15) at 5,500 r/min		14.7 (20) at 5,500 r/min	
Full throttle operating range	r/min	5,000–6,000			
Maximum fuel consumption	L (US gal, Imp gal)/hr	5.4 (1.4, 1.2) at 5,500 r/min		6.8 (1.8, 1.5) at 5,500 r/min	
Engine idle speed	r/min	1,050 ± 50			
<b>Power unit</b>					
Type		4-stroke L			
Cylinder quantity		2			
Total displacement	cm <sup>3</sup> (cu. in)	362 (22.1)			
Bore × stroke	mm (in)	63.0 × 58.1 (2.48 × 2.29)			
Compression ratio		9.3			
Control system		Tiller handle			
Starting system		Manual	Electric	Manual	Electric
Fuel system		Carburetor			
Enrichment system		Prime Start			
Ignition control system		CDI (micro computer)			

## General specification

Item	Unit	Model			
		F15CMH	F15CEH	F20BMH	F20BEHP
Advanced type Ignition timing at 1,050 r/min Maximum generator output Spark plug Cooling system Exhaust system Lubrication system	Degree V, A	Micro computer TDC ± 1.5 12, 10.0 DPR6EB-9 (NGK) Water Propeller boss Wet sump			
<b>Fuel and oil</b> Fuel type Engine oil type Engine oil grade <sup>(*)</sup> Engine oil quantity (without oil filter replacement) (with oil filter replacement) Gear oil type Gear oil grade <sup>(**)</sup> Gear oil quantity	API SAE L (US qt, Imp qt) L (US qt, Imp qt) API SAE cm <sup>3</sup> (US oz, Imp oz)	Regular unleaded gasoline 4-stroke motor oil SE, SF, SG, SH, SJ, or SL 5W-30, 10W-30, or 10W-40 1.6 (1.69, 1.41) 1.8 (1.90, 1.58) Hypoid gear oil GL-4 90 300 (10.14, 10.58)			
<b>Bracket unit</b> Trim angle (at 12° boat transom) Tilt-up angle Steering angle	Degree Degree Degree	0.0, 4.0, 8.0, 12.0 71 45 + 45 67 40 + 40			
<b>Power tilt system</b> Fluid type		—		ATF Dexron II	
<b>Drive unit</b> Gear shift positions Gear ratio Reduction gear type Clutch type Propeller shaft type Propeller direction (rear view) Propeller mark		F-N-R 2.08 (27/13) Spiral bevel gear Dog clutch Spline Clockwise J, J1			

<sup>(\*)</sup> If the recommended engine oil grades are not available, use engine oil with an API classification of SH, SJ, or SL and an SAE classification of 15W-40, 20W-40, or 20W-50.

<sup>(\*\*)</sup> Meeting both API and SAE requirements

# 2

<b>SPEC</b>		<b>Specification</b>
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Item	Unit	Model			
		F15CMH	F15CEH	F20BMH	F20BEHP
<b>Electrical</b>					
Battery minimum capacity					
CCA/EN	A	—	347.0	—	347.0
20HR/IEC	Ah	—	40.0	—	40.4
Electrolyte specific gravity at 20 °C (68 °F)		—	1.280	—	1.280

## General specification

Item	Unit	Model			
		F15CE	F15CEP	F20BE	F20BEP
<b>Dimension</b>					
Overall length	mm (in)	665 (26.2)			
Overall width	mm (in)	390 (15.4)			
Overall height (S)	mm (in)	1,078 (42.4)	—	1,078 (42.4)	
(L)	mm (in)	1,205 (47.4)			
Transom height (S)	mm (in)	438 (17.2)	—	438 (17.2)	443 (17.4)
(L)	mm (in)	565 (22.2)	570 (22.4)	565 (22.2)	570 (22.4)
Boat transom height (S)	mm (in)	381 (15.0)	—	381 (15.0)	
(L)	mm (in)	508 (20.0)			
<b>Weight</b> (with aluminum propeller)					
(S)	kg (lb)	52.7 (116)	—	52.7 (116)	58.7 (129)
(L)	kg (lb)	54.7 (121)	60.7 (134)	54.7 (121)	60.7 (134)
<b>Performance</b>					
Maximum output	kW (HP)	11.0 (15) at 5,500 r/min		14.7 (20) at 5,500 r/min	
Full throttle operating range	r/min	5,000–6,000			
Maximum fuel consumption	L (US gal, Imp gal)/hr	5.4 (1.4, 1.2) at 5,500 r/min		6.8 (1.8, 1.5) at 5,500 r/min	
Engine idle speed	r/min	1,050 ± 50			
<b>Power unit</b>					
Type		4-stroke L			
Cylinder quantity		2			
Total displacement	cm <sup>3</sup> (cu. in)	362 (22.1)			
Bore × stroke	mm (in)	63.0 × 58.1 (2.48 × 2.29)			
Compression ratio		9.3			
Control system		Remote control			
Starting system		Electric			
Fuel system		Carburetor			
Enrichment system		Prime Start			
Ignition control system		CDI (micro computer)			
Advanced type		Micro computer			
Ignition timing at 1,050 r/min	Degree	TDC ± 1.5			

# 2

Item	Unit	Model			
		F15CE	F15CEP	F20BE	F20BEP
Maximum generator output Spark plug Cooling system Exhaust system Lubrication system	V, A	12, 10.0 DPR6EB-9 (NGK) Water Propeller boss Wet sump			
<b>Fuel and oil</b> Fuel type Engine oil type Engine oil grade <sup>(*1)</sup>  Engine oil quantity (without oil filter replacement) (with oil filter replacement)  Gear oil type Gear oil grade <sup>(*2)</sup>  Gear oil quantity	API SAE  L (US qt, Imp qt) L (US qt, Imp qt)  API SAE  cm <sup>3</sup> (US oz, Imp oz)	Regular unleaded gasoline 4-stroke motor oil SE, SF, SG, SH, SJ, or SL 5W-30, 10W-30, or 10W-40  1.6 (1.69, 1.41) 1.8 (1.90, 1.58)  Hypoid gear oil GL-4 90 300 (10.14, 10.58)			
<b>Bracket unit</b> Trim angle (at 12° boat transom) Tilt-up angle (S) (L) Steering angle	Degree  Degree Degree Degree	0.0, 4.0, 8.0, 12.0   71      63      71      63 71      67      71      67 45 + 45      40 + 40      45 + 45      40 + 40			
<b>Power tilt system</b> Fluid type		—	ATF Dexron II	—	ATF Dexron II
<b>Drive unit</b> Gear shift positions Gear ratio Reduction gear type Clutch type Propeller shaft type Propeller direction (rear view) Propeller mark		F-N-R 2.08 (27/13) Spiral bevel gear Dog clutch Spline Clockwise J, J1			

(\*1) If the recommended engine oil grades are not available, use engine oil with an API classification of SH, SJ, or SL and an SAE classification of 15W-40, 20W-40, or 20W-50.

(\*2) Meeting both API and SAE requirements.

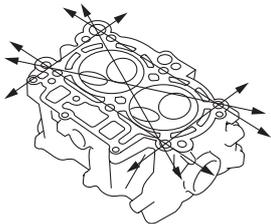
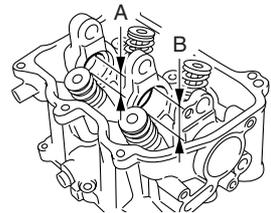
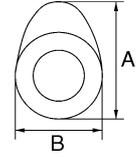
**General specification**

Item	Unit	Model			
		F15CE	F15CEP	F20BE	F20BEP
<b>Electrical</b>					
Battery minimum capacity					
CCA/EN	A			347.0	
20HR/IEC	Ah			40.0	
Electrolyte specific gravity at 20 °C (68 °F)				1.280	



## Maintenance specification

### Power unit

Item	Unit	Model			
		F15CMH	F15CEH	F20BMH	F20BEHP
<b>Power unit</b>					
Minimum compression pressure <sup>(*)</sup>	kPa (kgf/cm <sup>2</sup> , psi)	730 (7.3, 105.9)	860 (8.6, 124.7)	730 (7.3, 105.9)	860 (8.6, 124.7)
Oil pressure <sup>(*)</sup>	kPa (kgf/cm <sup>2</sup> , psi)	400 (4.0, 58.0) at engine idle speed			
<b>Cylinder head</b>					
Warpage limit	mm (in)	0.10 (0.0039)			
 (lines indicate straightedge position)					
Cylinder head journal inside diameter (A)	mm (in)	22.000–22.021 (0.8661–0.8670)			
Cylinder head journal inside diameter (B)	mm (in)	34.000–34.025 (1.3386–1.3396)			
					
<b>Camshaft</b>					
Intake (A)	mm (in)	28.546–28.646 (1.1239–1.1278)			
Exhaust (A)	mm (in)	28.582–28.682 (1.1253–1.1292)			
Intake and exhaust (B)	mm (in)	23.95–24.05 (0.9429–0.9468)			
					

<sup>(\*)</sup> Measuring conditions:

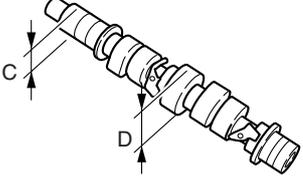
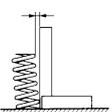
Ambient temperature 20 °C (68 °F), wide open throttle, with spark plugs removed from all cylinders.

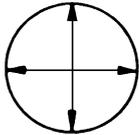
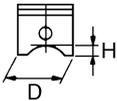
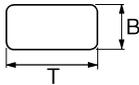
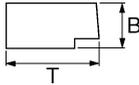
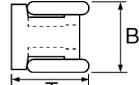
Since this outboard motor is equipped with an automatic decompression mechanism, the compression pressure may vary depending on the speed at which the starter handle is pulled when using the manual starter to crank the engine. (Manual starter model)

The figures are for reference only.

<sup>(\*)</sup> For details of the checking method, see “Checking the oil pressure” (5-1).

The figures are for reference only.

Item	Unit	Model			
		F15CMH	F15CEH	F20BMH	F20BEHP
Camshaft journal diameter (C) Camshaft journal diameter (D)	mm (in) mm (in)	21.967–21.980 (0.8648–0.8654) 33.935–33.955 (1.3360–1.3368)			
					
Camshaft runout limit	mm (in)	0.03 (0.0012)			
<b>Rocker arm shaft</b>					
Outside diameter	mm (in)	12.941–12.951 (0.5095–0.5099)			
<b>Rocker arm</b>					
Inside diameter	mm (in)	13.000–13.018 (0.5118–0.5125)			
<b>Valve</b>					
Valve clearance (cold)					
Intake	mm (in)	0.15–0.25 (0.006–0.010)			
Exhaust	mm (in)	0.25–0.35 (0.010–0.014)			
Head diameter (A)					
Intake	mm (in)	27.9–28.1 (1.10–1.11)			
Exhaust	mm (in)	24.0–24.2 (0.94–0.95)			
Face width (B)					
Intake	mm (in)	1.98–2.40 (0.0780–0.0945)			
Exhaust	mm (in)	1.98–3.11 (0.0780–0.1224)			
Seat contact width (C)	mm (in)	1.2–1.6 (0.047–0.063)			
Margin thickness (D)					
Intake	mm (in)	0.8–1.2 (0.0315–0.0472)			
Exhaust	mm (in)	1.0–1.4 (0.0394–0.0551)			
Stem diameter					
Intake	mm (in)	5.475–5.490 (0.2156–0.2161)			
Exhaust	mm (in)	5.460–5.475 (0.2150–0.2156)			
Stem runout limit	mm (in)	0.01 (0.0004)			
Guide inside diameter					
Intake and exhaust	mm (in)	5.500–5.512 (0.2165–0.2170)			
Stem-to-guide clearance					
Intake	mm (in)	0.010–0.037 (0.0004–0.0015)			
Exhaust	mm (in)	0.025–0.052 (0.0010–0.0020)			
Valve guide height					
Intake and exhaust	mm (in)	10.8 ± 0.2 (0.4 ± 0.01)			
<b>Valve spring</b>					
Free length	mm (in)	32.63 (1.2846)			
Tilt limit	mm (in)	1.4 (0.055)			
					

Item	Unit	Model			
		F15CMH	F15CEH	F20BMH	F20BEHP
<b>Cylinder</b> Bore size 	mm (in)	63.000–63.015 (2.4803–2.4809)			
<b>Piston</b> Piston diameter (D)  Measuring point (H) Piston clearance <sup>(*)</sup> Piston pin boss bore Oversize piston diameter 1st 2nd Piston ring groove Top ring 2nd ring Oil ring	mm (in) mm (in)	62.950–62.965 (2.4783–2.4789) 3.5 (0.14) 0.035–0.065 (0.0014–0.0026) 16.004–16.015 (0.6301–0.6305) 63.200–63.215 (2.4882–2.4888) 63.450–63.465 (2.4980–2.4986) 1.21–1.23 (0.0476–0.0484) 1.21–1.23 (0.0476–0.0484) 2.51–2.53 (0.0988–0.0996)			
<b>Piston pin</b> Outside diameter	mm (in)	15.995–16.000 (0.6297–0.6299)			
<b>Piston ring</b> Top ring Dimension B  Dimension T End gap <sup>(*)</sup> Side clearance 2nd ring Dimension B  Dimension T End gap <sup>(*)</sup> Side clearance Oil ring Dimension B  Dimension T End gap <sup>(*)</sup> Side clearance	mm (in) mm (in)	Barrel 1.17–1.19 (0.0461–0.0469) 2.30–2.50 (0.0906–0.0984) 0.15–0.30 (0.0059–0.0118) 0.02–0.06 (0.0008–0.0024) Taper 1.17–1.19 (0.0461–0.0469) 2.4–2.6 (0.0945–0.1024) 0.25–0.4 (0.0098–0.0157) 0.02–0.06 (0.0008–0.0024) 2.34–2.46 (0.0921–0.0969) 2.75 (0.1083) 0.2–0.7 (0.0079–0.0276) 0.05–0.19 (0.0020–0.0075)			
<b>Connecting rod</b> Small end inside diameter Big end inside diameter Big end side clearance <sup>(*)</sup> Crankpin oil clearance <sup>(*)</sup>	mm (in) mm (in) mm (in) mm (in)	16.015–16.029 (0.6305–0.6311) 34.030–34.042 (1.3398–1.3402) 0.05–0.22 (0.0020–0.0087) 0.021–0.045 (0.0008–0.0018)			

(\*) The figures are for reference only.

**Maintenance specification**



Item	Unit	Model			
		F15CMH	F15CEH	F20BMH	F20BEHP
<b>Crankshaft</b>					
Crankshaft journal diameter	mm (in)	36.997–37.009 (1.4566–1.4570)			
Crankpin diameter	mm (in)	33.997–34.009 (1.3385–1.3389)			
Crankpin width	mm (in)	21.000–21.070 (0.8268–0.8295)			
Crankshaft runout limit	mm (in)	0.05 (0.0020)			
<b>Crankcase</b>					
Crankshaft journal oil clearance <sup>(*)</sup>	mm (in)	0.011–0.039 (0.0004–0.0015)			
Upper and lower crankcase main journal bearing thickness					
A - (Blue)	mm (in)	1.502–1.506 (0.0591–0.0593)			
B - (Black)	mm (in)	1.498–1.502 (0.0590–0.0591)			
C - (Brown)	mm (in)	1.494–1.498 (0.0588–0.0590)			
<b>Oil pump</b>					
Type		Trochoid			
Outer rotor-to-housing clearance	mm (in)	0.09–0.15 (0.0035–0.0059)			
Outer rotor-to-inner rotor clearance	mm (in)	Within 0.12 (0.0047)			
Rotor-to-cover clearance	mm (in)	0.03–0.08 (0.0012–0.0031)			
Relief valve opening pressure	kPa (kgf/cm <sup>2</sup> , psi)	350–450 (3.50–4.50, 50.8–65.3)			
<b>Thermostat</b>					
Opening temperature at 0.05 mm (0.0020 in)	°C (°F)	58–62 (136–144)			
Fully open temperature	°C (°F)	70 (158)			
Valve open lower limit	mm (in)	3.0 (0.12)			
<b>Manual starter</b>					
Starter rope length	mm (in)	1,800 (70.9)	—	1,800 (70.9)	—
Starter rope pulling length	mm (in)	1,400– 1,600 (55.12– 62.99)	—	1,400– 1,600 (55.12– 62.99)	—

(\*) The figures are for reference only.

**Fuel system**

Item	Unit	Model			
		F15CMH	F15CEH	F20BMH	F20BEHP
<b>Carburetor</b>					
ID mark					
(For Europe)		6AG10	6AG50	6AH10	6AH50
(For Oceania)		6AG20	6AG60	6AH20	6AH60
Float height	mm (in)	15.0 ± 1.0 (0.59 ± 0.04)			
Valve seat size	mm (in)	1.0 (0.04)			
Main jet (M.J.)					
(For Europe)		#80		#112	
(For Oceania)		#80		#118	
Main nozzle (M.N.)	mm (in)	2.2 (0.09)		2.4 (0.09)	
Pilot jet (P.J.)		#38		#45	
Pilot screw (P.S.)					
(For Europe)	turns out	1 ± 1/2		3 1/2 ± 1/2	3 3/8 ± 1/2
(For Oceania)	turns out	3 1/8 ± 1/2		2 3/4 ± 1/2	
Idle speed	r/min	1,050 ± 50			
<b>Fuel pump</b>					
Fuel pump holding pressure					
Fuel inlet positive pressure	kPa (kgf/cm <sup>2</sup> , psi)		50 (0.5, 7.3)		
Fuel inlet negative pressure	kPa (kgf/cm <sup>2</sup> , psi)		30 (0.3, 4.4)		
Fuel outlet positive pressure	kPa (kgf/cm <sup>2</sup> , psi)		50 (0.5, 7.3)		
Fuel joint holding pressure					
Positive pressure	kPa (kgf/cm <sup>2</sup> , psi)		50 (0.5, 7.3)		
Fuel filter assembly holding pressure					
Positive pressure	kPa (kgf/cm <sup>2</sup> , psi)		200 (2.0, 29.0)		

**Lower unit**

Item	Unit	Model			
		F15CMH	F15CEH	F20BMH	F20BEHP
<b>Lower unit</b> Holding pressure	kPa (kgf/cm <sup>2</sup> , psi)	100 (1.0, 14.5)			
<b>Gear backlash</b> Pinion-to-forward gear	mm (in)	0.18–0.87 (0.0071–0.0343)			
Pinion-to-reverse gear	mm (in)	0.95–1.66 (0.0374–0.0654)			
Pinion shims	mm	1.13, 1.20			
Forward gear shims	mm	0.10, 0.12, 0.15, 0.18, 0.30, 0.40, 0.50			
Reverse gear shims	mm	0.1, 0.2, 0.3, 0.4, 0.5			
<b>Propeller shaft</b> Runout limit	mm (in)	0.05 (0.0020)			
<b>Drive shaft</b> Runout limit	mm (in)	0.5 (0.0197)			

**Electrical**

Item	Unit	Model			
		F15CMH	F15CEH	F20BMH	F20BEHP
<b>Ignition and ignition control system</b> Spark plug gap	mm (in)	0.8–0.9 (0.031–0.035)			
Spark plug cap resistance	k $\Omega$	3.75–6.25			
Ignition coil resistance Primary coil (O – B) at 20 °C (68 °F)	$\Omega$	0.26–0.35			
Secondary coil (spark plug wire – spark plug wire) at 20 °C (68 °F)	k $\Omega$	6.8–10.2			
Pulser coil output peak voltage (W/R – B) at cranking (unloaded)	V	5.1			
at cranking (loaded)	V	2.6			
at 1,500 r/min (loaded)	V	5.3			
at 3,500 r/min (loaded)	V	8.4			
Pulser coil resistance <sup>(*1)</sup> (W/R – B) at 20 °C (68 °F)	$\Omega$	152–228			

(\*1) The figures are for reference only.

# 2

Item	Unit	Model			
		F15CMH	F15CEH	F20BMH	F20BEHP
Charge coil output peak voltage (B/R – G/R)					
at cranking (unloaded)	V		60		
at cranking (loaded)	V		140		
at 1,500 r/min (loaded)	V		150		
at 3,500 r/min (loaded)	V		150		
Charge coil resistance <sup>(*)</sup> (B/R – G/R)					
at 20 °C (68 °F)	Ω		25.5–34.5		
CDI unit output peak voltage (O – B)					
at cranking (loaded)	V		140		
at 1,500 r/min (loaded)	V		150		
at 3,500 r/min (loaded)	V		150		
<b>Thermoswitch</b>					
ON temperature	°C (°F)		76–84 (169–183)		
OFF temperature	°C (°F)		63–77 (145–171)		
<b>Oil pressure switch</b>					
Specified oil pressure	kPa (kgf/cm <sup>2</sup> , psi)		29.4–58.81 (0.294–0.5881, 4.263–8.527)		
<b>Fuel control system</b>					
Prime Start resistance <sup>(*)</sup> (L – L)					
at 24 °C (75 °F)	Ω		16.4–24.8		
Prime Start plunger length <sup>(*)</sup>	mm (in)		10.7 (0.42)		
<b>Starting system</b>					
Power bobbin output peak voltage (L – L)					
at cranking (unloaded)	V		10.3		
at 1,500 r/min (unloaded)	V		27.8		
at 3,500 r/min (unloaded)	V		63.2		
at cranking (loaded)	V		9.5		
at 1,500 r/min (loaded)	V		27.5		
at 3,500 r/min (loaded)	V		61.6		
Power bobbin resistance <sup>(*)</sup> (L – L)					
at 20 °C (68 °F)	Ω		0.77–1.04		

<sup>(\*)</sup> The figures are for reference only.

<sup>(\*)</sup> Ambient temperature 24 °C (75 °F), with no power supplied.  
The figures are for reference only.

**Maintenance specification**

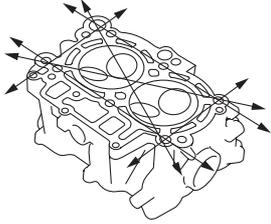
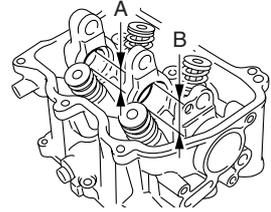
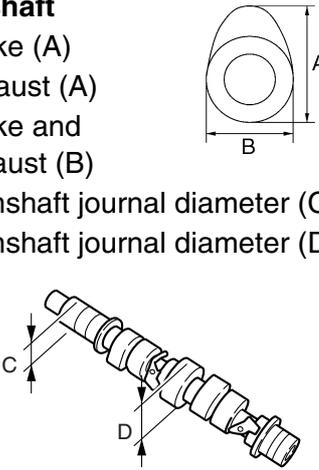
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Item	Unit	Model			
		F15CMH	F15CEH	F20BMH	F20BEHP
<b>Starter motor</b>					
Type		—	Bendix	—	Bendix
Output	kW	—	0.60	—	0.60
Cranking time limit	Second	—	30	—	30
Stator motor clearance	mm (in)	—	0.05–	—	0.05–
			0.25 (0.002– 0.010)		0.25 (0.002– 0.010)
Wear limit	mm (in)	—	0.6 (0.02)	—	0.6 (0.02)
<b>Brushes</b>					
Standard length	mm (in)	—	12.5 (0.49)	—	12.5 (0.49)
Wear limit	mm (in)	—	9.0 (0.35)	—	9.0 (0.35)
<b>Commutator</b>					
Standard diameter	mm (in)	—	30.0 (1.18)	—	30.0 (1.18)
Wear limit	mm (in)	—	29.0 (1.14)	—	29.0 (1.14)
Standard undercut	mm (in)	—	0.8 (0.03)	—	0.8 (0.03)
Wear limit	mm (in)	—	0.2 (0.01)	—	0.2 (0.01)
Pinion stopper height	mm (in)	—	26.5–	—	26.5–
			28.5 (1.04– 1.12)		28.5 (1.04– 1.12)
<b>Charging system</b>					
Fuse	A	—	20	—	20
Lighting coil output peak voltage (G – G) at cranking (unloaded) at 1,500 r/min (unloaded) at 3,500 r/min (unloaded)	V	—	13.4	—	13.4
	V	—	33.2	—	33.2
	V	—	75.4	—	75.4
Lighting coil resistance <sup>(*)</sup> (G – G) at 20 °C (68 °F)	Ω	—	0.31–	—	0.31–
			0.43		0.43
<b>Rectifier Regulator output</b>					
peak voltage (R – B) at 1,500 r/min (unloaded) at 3,500 r/min (unloaded)	V	—	13	—	13
	V	—	13	—	13

(\*) The figures are for reference only.

Item	Unit	Model			
		F15CMH	F15CEH	F20BMH	F20BEHP
<b>Power tilt motor</b>					
Output	kW		—		0.18
Brushes					
Standard length	mm (in)		—		6.0 (0.24)
Wear limit	mm (in)		—		3.0 (0.12)
Commutator					
Standard diameter	mm (in)		—		16.5 (0.65)
Wear limit	mm (in)		—		15.5 (0.61)
Standard undercut	mm (in)		—		1.00 (0.039)
Wear limit	mm (in)		—		0.50 (0.020)

**Power unit**

Item	Unit	Model			
		F15CE	F15CEP	F20BE	F20BEP
<p><b>Power unit</b></p> <p>Minimum compression pressure<sup>(*1)</sup></p> <p>Oil pressure<sup>(*2)</sup></p>	<p>kPa (kgf/cm<sup>2</sup>, psi)</p> <p>kPa (kgf/cm<sup>2</sup>, psi)</p>	<p>860 (8.6, 124.7)</p> <p>400 (4.0, 58.0) at engine idle speed</p>			
<p><b>Cylinder head</b></p> <p>Warpage limit</p>  <p>(lines indicate straightedge position)</p> <p>Cylinder head journal inside diameter (A)</p> <p>Cylinder head journal inside diameter (B)</p> 	<p>mm (in)</p> <p>mm (in)</p> <p>mm (in)</p>	<p>0.10 (0.0039)</p> <p>22.000–22.021 (0.8661–0.8670)</p> <p>34.000–34.025 (1.3386–1.3396)</p>			
<p><b>Camshaft</b></p> <p>Intake (A)</p> <p>Exhaust (A)</p> <p>Intake and exhaust (B)</p> <p>Camshaft journal diameter (C)</p> <p>Camshaft journal diameter (D)</p>  <p>Camshaft runout limit</p>	<p>mm (in)</p> <p>mm (in)</p> <p>mm (in)</p> <p>mm (in)</p> <p>mm (in)</p> <p>mm (in)</p>	<p>28.546–28.646 (1.1239–1.1278)</p> <p>28.582–28.682 (1.1253–1.1292)</p> <p>23.95–24.05 (0.9429–0.9468)</p> <p>21.967–21.980 (0.8648–0.8654)</p> <p>33.935–33.955 (1.3360–1.3368)</p> <p>0.03 (0.0012)</p>			

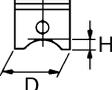
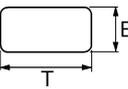
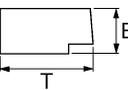
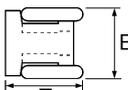
(\*1) Measuring conditions:

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

(\*2) For details of the checking method, see “Checking the oil pressure” (5-1).

The figures are for reference only.



Item	Unit	Model			
		F15CE	F15CEP	F20BE	F20BEP
<b>Piston</b>  Piston diameter (D) Measuring point (H) Piston clearance <sup>(*)</sup> Piston pin boss bore Oversize piston diameter 1st 2nd Piston ring groove Top ring 2nd ring Oil ring	mm (in) mm (in)	62.950–62.965 (2.4783–2.4789) 3.5 (0.14) 0.035–0.065 (0.0014–0.0026) 16.004–16.015 (0.6301–0.6305) 63.200–63.215 (2.4882–2.4888) 63.450–63.465 (2.4980–2.4986) 1.21–1.23 (0.0476–0.0484) 1.21–1.23 (0.0476–0.0484) 2.51–2.53 (0.0988–0.0996)			
<b>Piston pin</b> Outside diameter	mm (in)	15.995–16.000 (0.6297–0.6299)			
<b>Piston ring</b> Top ring  Dimension B Dimension T End gap <sup>(*)</sup> Side clearance 2nd ring  Dimension B Dimension T End gap <sup>(*)</sup> Side clearance Oil ring  Dimension B Dimension T End gap <sup>(*)</sup> Side clearance	mm (in) mm (in)	Barrel 1.17–1.19 (0.0461–0.0469) 2.30–2.50 (0.0906–0.0984) 0.15–0.30 (0.0059–0.0118) 0.02–0.06 (0.0008–0.0024) Taper 1.17–1.19 (0.0461–0.0469) 2.4–2.6 (0.0945–0.1024) 0.25–0.4 (0.0098–0.0157) 0.02–0.06 (0.0008–0.0024) 2.34–2.46 (0.0921–0.0969) 2.75 (0.1083) 0.2–0.7 (0.0079–0.0276) 0.05–0.19 (0.0020–0.0075)			
<b>Connecting rod</b> Small end inside diameter Big end inside diameter Big end side clearance <sup>(*)</sup> Crankpin oil clearance <sup>(*)</sup>	mm (in) mm (in) mm (in) mm (in)	16.015–16.029 (0.6305–0.6311) 34.030–34.042 (1.3398–1.3402) 0.05–0.22 (0.0020–0.0087) 0.021–0.045 (0.0008–0.0018)			
<b>Crankshaft</b> Crankshaft journal diameter Crankpin diameter Crankpin width Crankshaft runout limit	mm (in) mm (in) mm (in) mm (in)	36.997–37.009 (1.4566–1.4570) 33.997–34.009 (1.3385–1.3389) 21.000–21.070 (0.8268–0.8295) 0.05 (0.0020)			

(\*) The figures are for reference only.

Item	Unit	Model			
		F15CE	F15CEP	F20BE	F20BEP
<b>Crankcase</b>					
Crankshaft journal oil clearance <sup>(*)</sup>	mm (in)	0.011–0.039 (0.0004–0.0015)			
Upper and lower crankcase main journal bearing thickness					
A - (Blue)	mm (in)	1.502–1.506 (0.0591–0.0593)			
B - (Black)	mm (in)	1.498–1.502 (0.0590–0.0591)			
C - (Brown)	mm (in)	1.494–1.498 (0.0588–0.0590)			
<b>Oil pump</b>					
Type		Trochoid			
Outer rotor-to-housing clearance	mm (in)	0.09–0.15 (0.0035–0.0059)			
Outer rotor-to-inner rotor clearance	mm (in)	Within 0.12 (0.0047)			
Rotor-to-cover clearance	mm (in)	0.03–0.08 (0.0012–0.0031)			
Relief valve opening pressure	kPa (kgf/cm <sup>2</sup> , psi)	350–450 (3.50–4.50, 50.8–65.3)			
<b>Thermostat</b>					
Opening temperature at 0.05 mm (0.0020 in)	°C (°F)	58–62 (136–144)			
Fully open temperature	°C (°F)	70 (158)			
Valve open lower limit	mm (in)	3.0 (0.12)			

(\*) The figures are for reference only.

## Fuel system

Item	Unit	Model			
		F15CE	F15CEP	F20BE	F20BEP
<b>Carburetor</b>					
ID mark		6AG50		6AH50	
(For Europe)		—		6AH60	
(For Oceania)					
Float height	mm (in)	15.0 ± 1.0 (0.59 ± 0.04)			
Valve seat size	mm (in)	1.0 (0.04)			
Main jet (M.J.)		#80		#112	
(For Europe)		#80		#118	
(For Oceania)					
Main nozzle (M.N.)	mm (in)	2.2 (0.09)		2.4 (0.09)	
Pilot jet (P.J.)		#38		#45	
Pilot screw (P.S.)		1 ± 1/2		3 3/8 ± 1/2	
(For Europe)	turns out	—		2 3/4 ± 1/2	
(For Oceania)	turns out				
Idle speed	r/min	1,050 ± 50			

## Maintenance specification

Item	Unit	Model			
		F15CE	F15CEP	F20BE	F20BEP
<b>Fuel pump</b>					
Fuel pump holding pressure					
Fuel inlet positive pressure	kPa (kgf/cm <sup>2</sup> , psi)			50 (0.5, 7.3)	
Fuel inlet negative pressure	kPa (kgf/cm <sup>2</sup> , psi)			30 (0.3, 4.4)	
Fuel outlet positive pressure	kPa (kgf/cm <sup>2</sup> , psi)			50 (0.5, 7.3)	
Fuel joint holding pressure					
Positive pressure	kPa (kgf/cm <sup>2</sup> , psi)			50 (0.5, 7.3)	
Fuel filter assembly holding pressure					
Positive pressure	kPa (kgf/cm <sup>2</sup> , psi)			200 (2.0, 29.0)	

### Lower unit

Item	Unit	Model			
		F15CE	F15CEP	F20BE	F20BEP
<b>Lower unit</b>					
Holding pressure	kPa (kgf/cm <sup>2</sup> , psi)			100 (1.0, 14.5)	
<b>Gear backlash</b>					
Pinion-to-forward gear	mm (in)			0.18–0.87 (0.0071–0.0343)	
Pinion-to-reverse gear	mm (in)			0.95–1.66 (0.0374–0.0654)	
Pinion shims	mm			1.13, 1.20	
Forward gear shims	mm			0.10, 0.12, 0.15, 0.18, 0.30, 0.40, 0.50	
Reverse gear shims	mm			0.1, 0.2, 0.3, 0.4, 0.5	
<b>Propeller shaft</b>					
Runout limit	mm (in)			0.05 (0.0020)	
<b>Drive shaft</b>					
Runout limit	mm (in)			0.5 (0.0197)	

## Electrical

Item	Unit	Model			
		F15CE	F15CEP	F20BE	F20BEP
<b>Ignition and ignition control system</b>					
Spark plug gap	mm (in)	0.8–0.9 (0.031–0.035)			
Spark plug cap resistance	kΩ	3.75–6.25			
Ignition coil resistance					
Primary coil (O – B) at 20 °C (68 °F)	Ω	0.26–0.35			
Secondary coil (spark plug wire – spark plug wire) at 20 °C (68 °F)	kΩ	6.8–10.2			
Pulser coil output peak voltage (W/R – B)					
at cranking (unloaded)	V	5.1			
at cranking (loaded)	V	2.6			
at 1,500 r/min (loaded)	V	5.3			
at 3,500 r/min (loaded)	V	8.4			
Pulser coil resistance <sup>(*1)</sup> (W/R – B)	Ω	152–228			
Charge coil output peak voltage (B/R – G/R)					
at cranking (unloaded)	V	60			
at cranking (loaded)	V	140			
at 1,500 r/min (loaded)	V	150			
at 3,500 r/min (loaded)	V	150			
Charge coil resistance <sup>(*1)</sup> (B/R – G/R)	Ω	25.5–34.5			
CDI unit output peak voltage (O – B)					
at cranking (loaded)	V	140			
at 1,500 r/min (loaded)	V	150			
at 3,500 r/min (loaded)	V	150			
<b>Thermoswitch</b>					
ON temperature	°C (°F)	76–84 (169–183)			
OFF temperature	°C (°F)	63–77 (145–171)			
<b>Oil pressure switch</b>					
Specified oil pressure	kPa (kgf/cm <sup>2</sup> , psi)	29.4–58.81 (0.294–0.5881, 4.263–8.527)			

(\*1) The figures are for reference only.

## Maintenance specification

# 2

Item	Unit	Model			
		F15CE	F15CEP	F20BE	F20BEP
<b>Fuel control system</b>					
Prime Start resistance <sup>(*1)</sup> (L-L) at 24 °C (75 °F)	Ω	16.4–24.8			
Prime Start plunger length <sup>(*1)</sup>	mm (in)	10.7 (0.42)			
<b>Starting system</b>					
Power bobbin output peak voltage (L-L) at cranking (unloaded)	V	10.3			
at 1,500 r/min (unloaded)	V	27.8			
at 3,500 r/min (unloaded)	V	63.2			
at cranking (loaded)	V	9.5			
at 1,500 r/min (loaded)	V	27.5			
at 3,500 r/min (loaded)	V	61.6			
Power bobbin resistance <sup>(*2)</sup> (L-L) at 20 °C (68 °F)	Ω	0.77–1.04			
<b>Starter motor</b>					
Type		Bendix			
Output	kW	0.60			
Cranking time limit	Second	30			
Stator motor clearance	mm (in)	0.05–0.25 (0.002–0.010)			
Wear limit	mm (in)	0.6 (0.02)			
Brushes					
Standard length	mm (in)	12.5 (0.49)			
Wear limit	mm (in)	9.0 (0.35)			
Commutator					
Standard diameter	mm (in)	30.0 (1.18)			
Wear limit	mm (in)	29.0 (1.14)			
Standard undercut	mm (in)	0.8 (0.03)			
Wear limit	mm (in)	0.2 (0.01)			
Pinion stopper height	mm (in)	26.5–28.5 (1.04–1.12)			

(\*1) Ambient temperature 24 °C (75 °F), with no power supplied.

The figures are for reference only.

(\*2) The figures are for reference only.

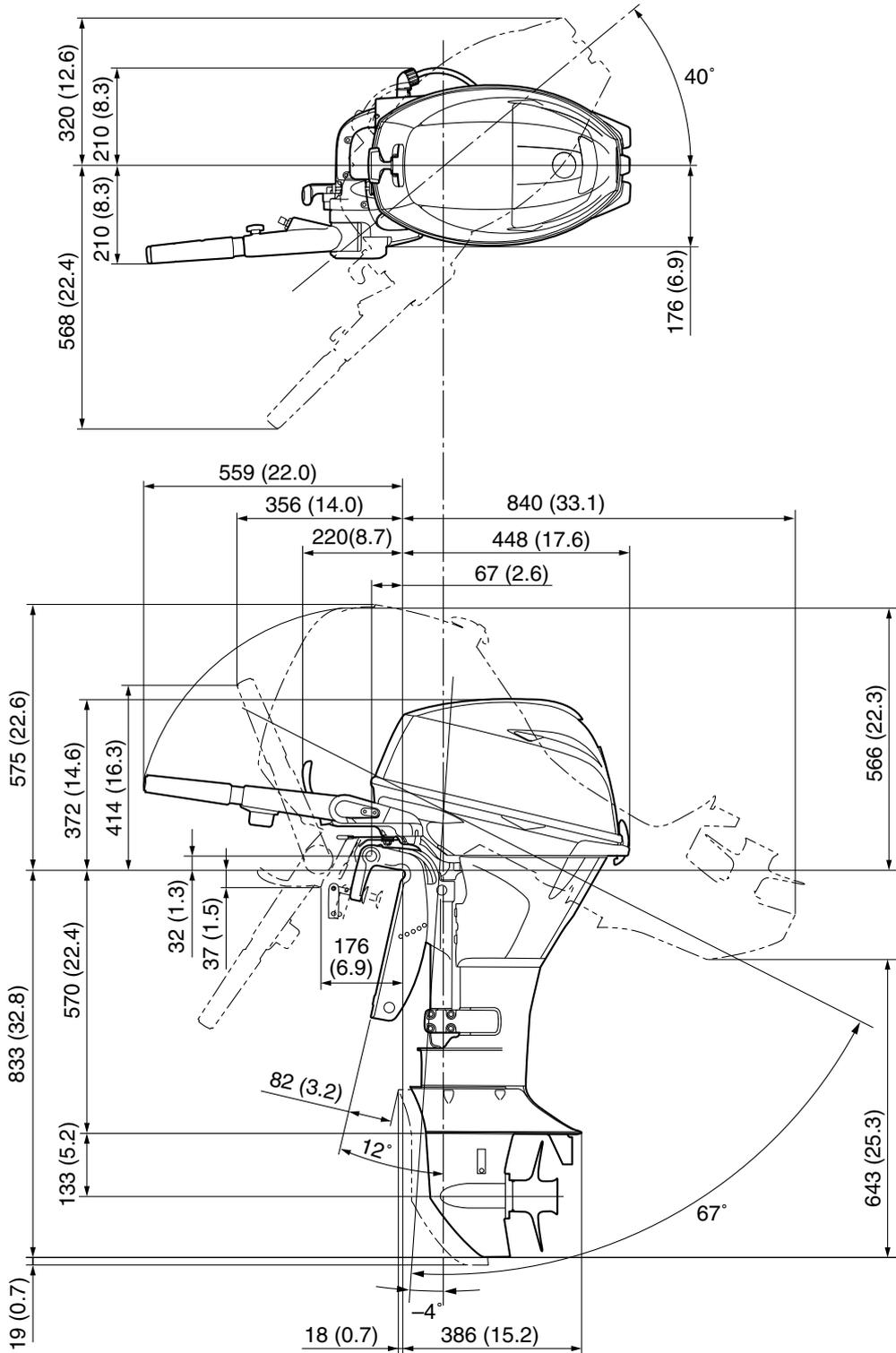
Item	Unit	Model			
		F15CE	F15CEP	F20BE	F20BEP
<b>Charging system</b>					
Fuse	A	20			
Lighting coil output peak voltage (G – G)					
at cranking (unloaded)	V		13.4		
at 1,500 r/min (unloaded)	V		33.2		
at 3,500 r/min (unloaded)	V		75.4		
Lighting coil resistance <sup>(*)</sup> (G – G)					
at 20 °C (68 °F)	Ω		0.31–0.43		
Rectifier Regulator output peak voltage (R – B)					
at 1,500 r/min (unloaded)	V		13		
at 3,500 r/min (unloaded)	V		13		
<b>Power tilt motor</b>					
Output	kW	—	0.18	—	0.18
Brushes					
Standard length	mm (in)	—	6.0 (0.24)	—	6.0 (0.24)
Wear limit	mm (in)	—	3.0 (0.12)	—	3.0 (0.12)
Commutator					
Standard diameter	mm (in)	—	16.5 (0.65)	—	16.5 (0.65)
Wear limit	mm (in)	—	15.5 (0.61)	—	15.5 (0.61)
Standard undercut	mm (in)	—	1.00 (0.039)	—	1.00 (0.039)
Wear limit	mm (in)	—	0.50 (0.020)	—	0.50 (0.020)

<sup>(\*)</sup> The figures are for reference only.



Exterior F20BEHP

mm (in)

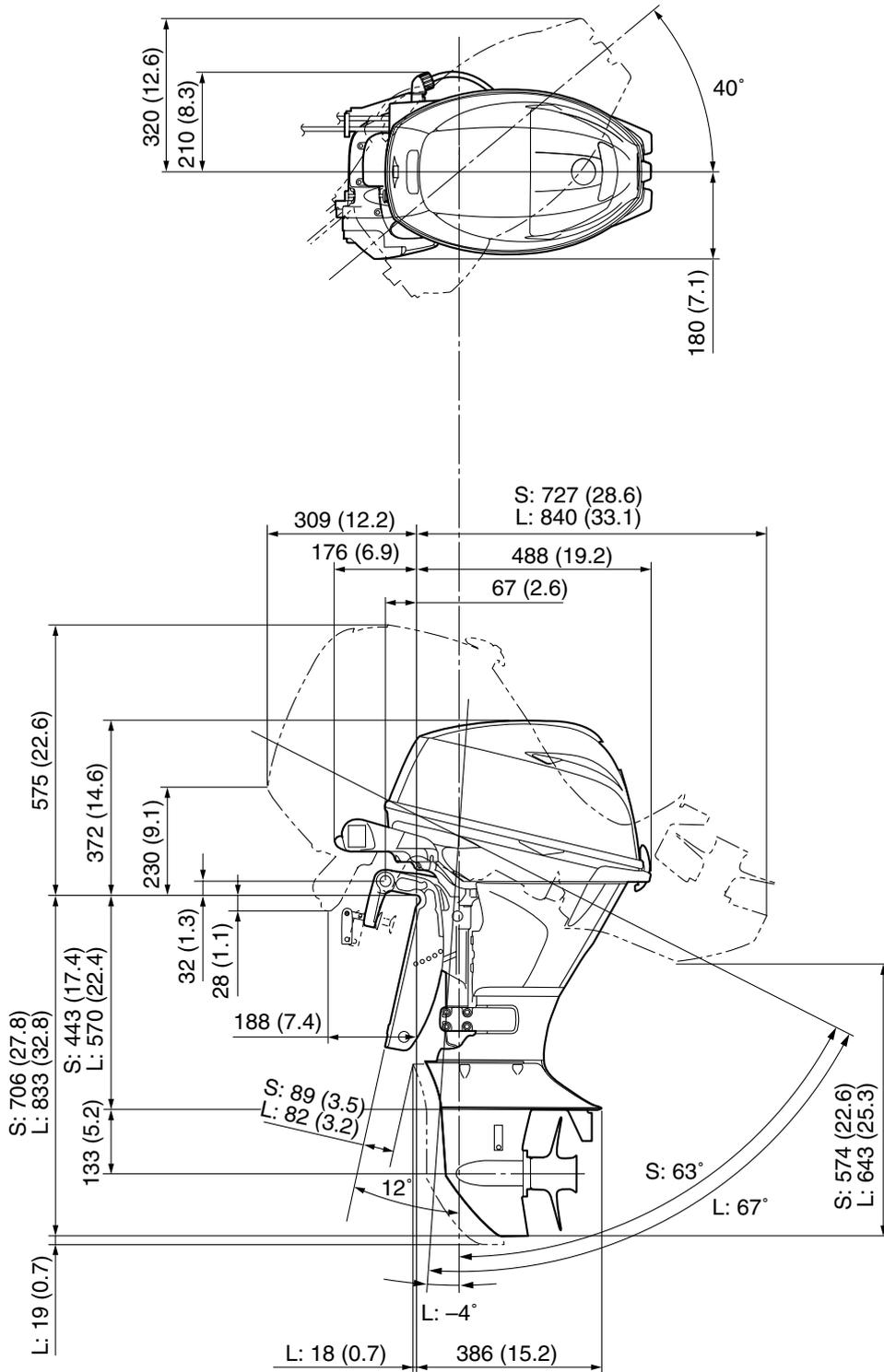


S6AG2020



Exterior F15CEP, F20BEP

mm (in)

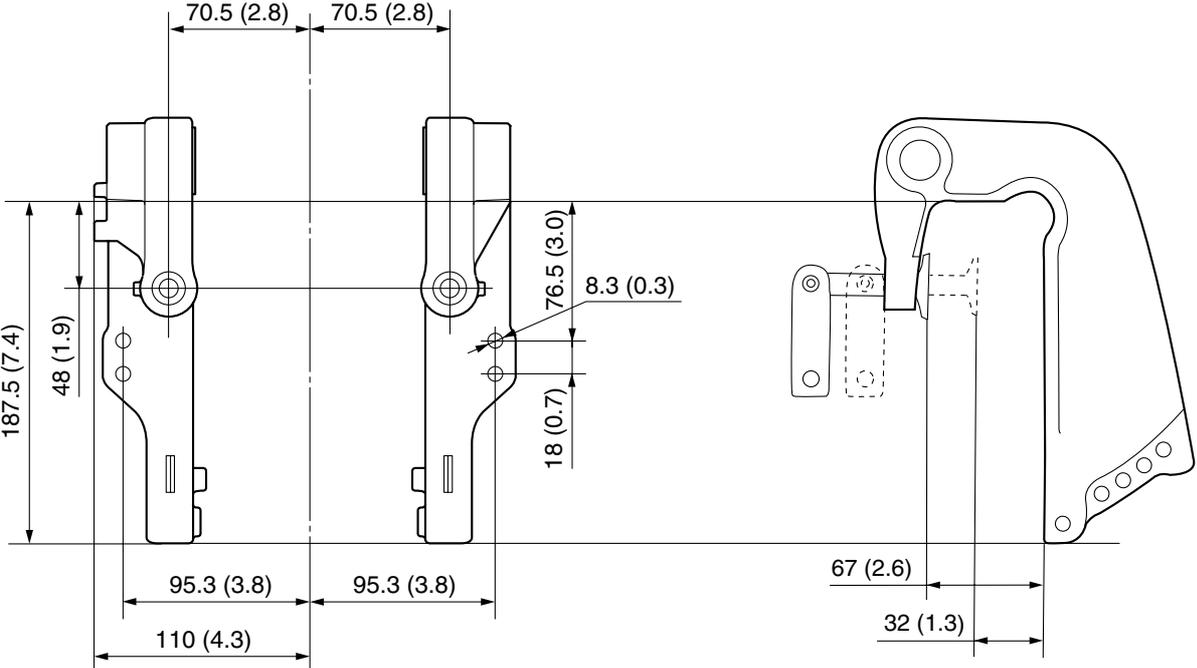


S6AG2040

Clamp bracket F15CMH, F15CEH, F15CE, F20BMH, F20BE

mm (in)

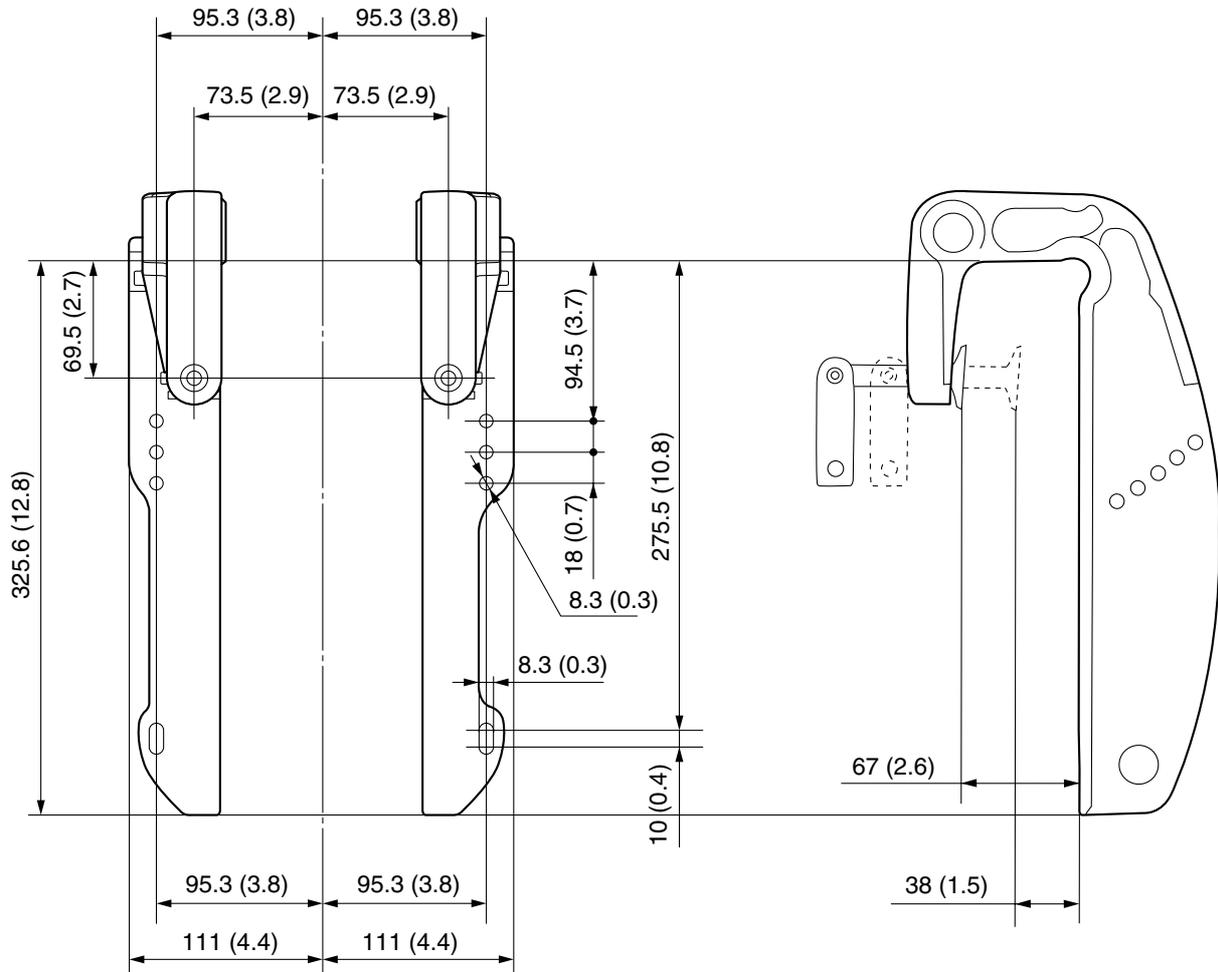
2



S6AG2050

**Clamp bracket F15CEP, F20BEHP, F20BEP**

mm (in)



S6AG2060

## Tightening torque

### Specified torque

Part to be tightened		Thread size	Tightening torques		
			N·m	kgf·m	ft·lb
<b>Fuel system</b>					
Fuel filter cup		—	2.5	0.25	1.84
Fuel filter assembly bracket bolt		M8	18	1.8	13.3
Fuel joint bolt		M6	8	0.8	5.9
Fuel pump screw		M4	2	0.2	1.5
Fuel pump valve screw		M3	0.5	0.05	0.37
Carburetor throttle lever screw		M4	1	0.1	0.7
<b>Power unit</b>					
Manual starter bolt (manual starter model)		M6	8	0.8	5.9
Drive plate screw (manual starter model)		M5	7	0.7	5.2
Manual starter drain cover screw (manual starter model)		M4	1.5	0.15	1.11
Power unit mounting bolt	1st	M8	27	2.7	19.9
	2nd		27	2.7	19.9
Apron screw		M6	2.5	0.25	1.84
Ground lead bolt		M6	8	0.8	5.9
Ignition coil bolt		M6	7	0.7	5.2
Rectifier Regulator nut (electric starter model)		—	4	0.4	3.0
Spark plug		—	17	1.7	12.5
Pulser coil bolt		M5	4	0.4	3.0
Terminal bolt (power tilt model)		M6	8	0.8	5.9
CDI unit bracket bolt		M6	8	0.8	5.9
CDI unit bolt		M6	8	0.8	5.9
Junction box bolt		M6	8	0.8	5.9
Power tilt unit coupler holder bolt (power tilt model)		M6	4	0.4	3.0
Stator coil assembly bolt		M6	8	0.8	5.9
Holder bracket bolt		M6	8	0.8	5.9
Starter motor bolt (electric starter model)		M8	30	3.0	22.1
Negative battery cable bolt (electric starter model)		M8	18	1.8	13.3
Starter motor lead nut (electric starter model)		—	4	0.4	3.0
Starter motor terminal nut (electric starter model)		—	0.4	0.04	0.30
Starter relay lead bolt (electric starter model)		M6	4	0.4	3.0
Thermoswitch bolt		M6	8	0.8	5.9
Rectifier Regulator bracket bolt		M6	8	0.8	5.9
Starter motor cover bolt (electric starter model)		M6	8	0.8	5.9
Oil pressure switch		—	8	0.8	5.9
Oil pressure switch lead bolt		M4	2	0.2	1.5

Part to be tightened		Thread size	Tightening torques		
			N-m	kgf-m	ft-lb
Wiring harness bracket bolt (manual starter model)		M8	18	1.8	13.3
Throttle cam bracket bolt		M6	8	0.8	5.9
Throttle cam bolt		M6	8	0.8	5.9
Throttle cable bracket bolt (tiller handle model)		M6	8	0.8	5.9
Flywheel magnet nut		—	108	10.8	79.7
Drive sprocket nut		—	110	11.0	81.1
Driven sprocket bolt		M8	22	2.2	16.2
Intake manifold bolt		M6	8	0.8	5.9
Cylinder head cover bolt		M6	8	0.8	5.9
Blowby plate screw		M4	2	0.2	1.5
Cylinder head bolt	1st	M6	6	0.6	4.4
	2nd		12	1.2	8.9
	1st	M9	15	1.5	11.1
	2nd		29	2.9	21.4
	3rd		60°		
Anode plug		—	18	1.8	13.3
Rocker arm locknut		—	14	1.4	10.3
Oil pump screw		M6	5	0.5	3.7
Anode screw		M5	2	0.2	1.5
Thermostat cover bolt		M6	8	0.8	5.9
Oil filter		—	18	1.8	13.3
Exhaust cover bolt	1st	M6	6	0.6	4.4
	2nd		12	1.2	8.9
Crankcase bolt	1st	M6	6	0.6	4.4
	2nd		12	1.2	8.9
	1st	M8	14	1.4	10.3
	2nd		27	2.7	19.9
Connecting rod cap bolt	1st	M6	6	0.6	4.4
	2nd		12	1.2	8.9
<b>Lower unit</b>					
Gear oil drain screw		—	9	0.9	6.6
Gear oil check screw		—	9	0.9	6.6
Lower case mounting bolt		M8	18	1.8	13.3
Propeller nut		—	17	1.7	12.5
Cooling water inlet cover screw		—	5	0.5	3.7
Anode bolt		M6	8	0.8	5.9
Trim tab bolt		M6	8	0.8	5.9
Water pump housing bolt		M8	18	1.8	13.3
Outer plate cartridge bolt		M8	18	1.8	13.3
Propeller shaft housing bolt		M6	8	0.8	5.9
Pinion nut		—	25	2.5	18.4
<b>Bracket unit</b>					
Steering bracket cover screw		M6	4	0.4	3.0

## Tightening torque

Part to be tightened		Thread size	Tightening torques		
			N·m	kgf·m	ft·lb
Grommet screw		M6	2	0.2	1.5
Throttle cable holder bolt (tiller handle model)		M6	8	0.8	5.9
Shift lever bolt (tiller handle model)		M6	8	0.8	5.9
Tiller handle bracket cover bolt (tiller handle model)		M6	8	0.8	5.9
Throttle pulley holder bolt (tiller handle model)		M6	8	0.8	5.9
Tiller handle throttle pulley screw (tiller handle model)		M5	3	0.3	2.2
Power tilt switch screw (power tilt model)		M6	4	0.4	3.0
Power tilt switch bracket screw (power tilt model)		M6	4	0.4	3.0
Engine stop lanyard switch nut (tiller handle model)		—	2	0.2	1.5
Friction plate bolt (tiller handle model)		M5	7	0.7	5.2
Friction plate bolt (tiller handle model)		M8	18	1.8	13.3
Friction self-locking nut (tiller handle model)		—	6	0.6	4.4
Flushing hose adapter screw		M6	2	0.2	1.5
Upper mounting nut		—	40	4.0	29.5
Mount housing nut	1st	—	15	1.5	11.1
	2nd		28	2.8	20.7
	3rd		32	3.2	23.6
Plate bolt		M6	8	0.8	5.9
Ground lead bolt		M5	5	0.5	3.7
Steering arm cover bolt (remote control model)		M6	8	0.8	5.9
Upper mount bolt		M8	30	3.0	22.1
Engine oil drain bolt		M14	27	2.7	19.9
Oil pan bolt		M8	18	1.8	13.3
Exhaust manifold bolt		M6	8	0.8	5.9
Oil pan assembly bolt		M8	18	1.8	13.3
Oil strainer bolt		M6	8	0.8	5.9
Self-locking nut		—	19	1.9	14.0
Tilt stopper plate bolt (manual tilt model)		—	8	0.8	5.9
Anode bolt (power tilt model)		M6	8	0.8	5.9
Tilt stopper nut (power tilt model)		—	24	2.4	17.7
Ground lead bolt (power tilt model)		M6	8	0.8	5.9
Power tilt unit mounting shaft bolt (power tilt model)		M8	18	1.8	13.3
Grease nipple		—	3	0.3	2.2
<b>Power tilt unit (power tilt model)</b>					
Power tilt motor base bolt		M5	5	0.5	3.7
Reservoir cap		—	5	0.5	3.7
Stator screw		M4	5	0.5	3.7
Armature plate screw		M4	5	0.5	3.7
Brush holder screw		M4	5	0.5	3.7

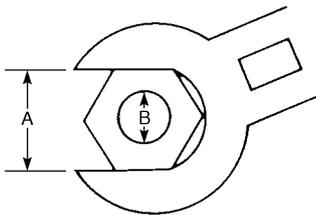


Part to be tightened	Thread size	Tightening torques		
		N·m	kgf·m	ft·lb
Gear housing bolt	M5	5	0.5	3.7
Tilt piston bolt	M6	7	0.7	5.2
Tilt cylinder end screw	—	60	6.0	44.3
Tilt ram	—	45	4.5	33.2

### General torque

This chart specifies tightening torques for standard fasteners with a standard ISO thread pitch. Tightening torque specifications 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 specifications 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	3.7
10 mm	M6	8	0.8	5.9
12 mm	M8	18	1.8	13.3
14 mm	M10	36	3.6	26.6
17 mm	M12	43	4.3	31.7



S69J2150

## Periodic check and adjustment

<b>Maintenance interval chart</b> .....	<b>3-1</b>
<b>Top cowling</b> .....	<b>3-2</b>
Checking the top cowling.....	3-2
<b>Fuel system</b> .....	<b>3-2</b>
Checking the fuel joint and fuel hose (fuel joint-to-carburetor) .....	3-2
Checking the fuel filter .....	3-3
Draining the fuel .....	3-3
<b>Power unit</b> .....	<b>3-3</b>
Checking the engine oil .....	3-3
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Replacing the oil filter .....	3-4
Checking the timing belt .....	3-5
Checking the spark plug .....	3-5
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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	Remarks	Initial		Every		Refer to page
		10 hours (1 month)	50 hours (3 months)	100 hours (6 months)	200 hours (1 year)	
Anodes (external)	Check/replace		○	○		3-16
Anodes (cylinder head, cylinder block, thermostat cover)	Check/replace				○	3-16
Battery	Check/charge	○				3-17
Cooling water passages	Clean		○	○		3-7
Top cowling	Check				○	3-2
Fuel filter	Check/replace	○	○	○		3-3
Fuel system	Check	○	○	○		3-2
Gear oil	Change	○		○		3-14
Lubrication points	Lubricate			○		3-18
Engine idle speed	Check	○		○		3-11
Power tilt unit	Check				○	3-13
Propeller and cotter pin	Check/replace		○	○		3-16
Shift link/shift cable	Check/adjust				○	3-9, 3-10
Thermostat	Check/replace				○	3-6
Throttle link/throttle cable/ throttle pick-up timing	Check/adjust				○	3-7, 3-8, 3-9
Water pump	Check/replace				○	6-5
Engine oil	Check/change	○		○		3-3
Oil filter (cartridge)	Change				○	3-4
Spark plugs	Clean/adjust/ replace	○			○	3-5
Timing belt	Check/replace			○	○	3-5
Valve clearance (OHC)	Check/ adjustment	○		○		5-2

### NOTE:

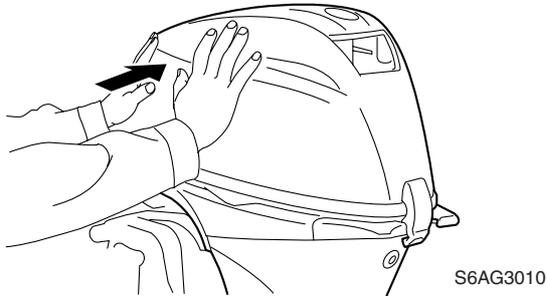
- When operating in salt water, turbid or muddy water, the engine should be flushed with clean water after each use.
- When using leaded or high-sulfur gasoline, checking the valve clearances may be required more frequently than every 100 hours.

Item	Remarks	Every		Refer to page
		500 hours (2.5 years)	1,000 hours (5 years)	
Timing belt	Replace		○	5-3
Exhaust guide, exhaust manifold	Check/replace		○	7-16

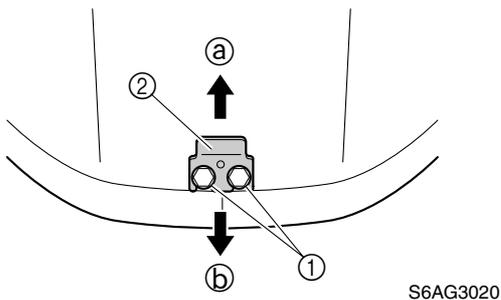
## Top cowling

### Checking the top cowling

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



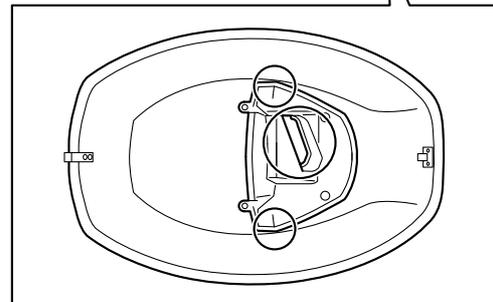
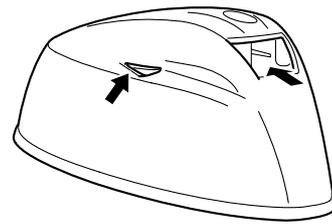
2. Loosen the bolts ①.
3. Move the hook ② up or down slightly to adjust its position.



**NOTE:**

- To tighten the fitting, move the hook ② in direction ①.
- To loosen 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.
6. Check the air intake duct. Clean if there are obstructions.

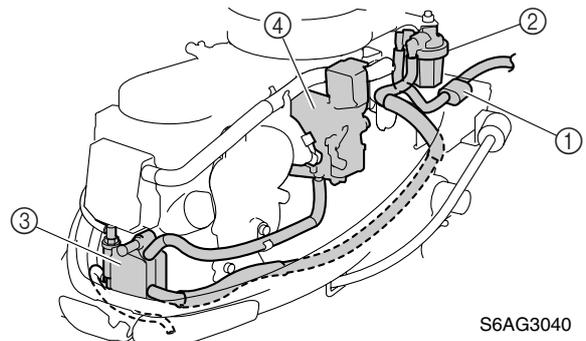


3

## Fuel system

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

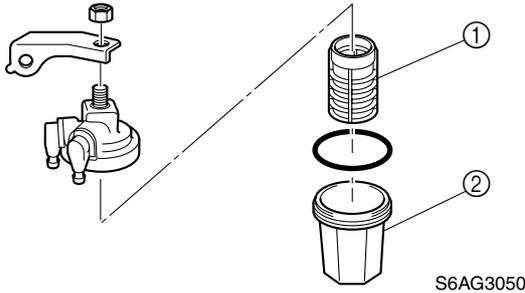
1. Check the fuel hose connections for leaks. Also, check the fuel joint ①, fuel hoses, fuel filter ②, fuel pump ③, and carburetor ④. Replace if there is leakage or deterioration.





### Checking the fuel filter

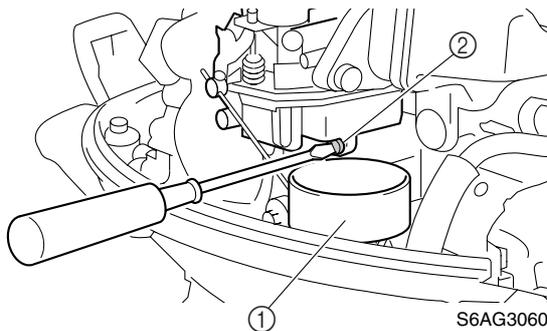
1. Check the fuel filter element ①. Clean if there is dirt or residue and replace if damaged.
2. Check the fuel filter cup ②. Clean with straight gasoline if there are foreign substances and replace if cracked.



**NOTE:** \_\_\_\_\_  
Be sure not to spill any fuel when removing the fuel filter cup.

### Draining the fuel

1. Place a container ① or rag under the carburetor fuel drain hole, and then remove the fuel drain screw ② and let the fuel drain completely.

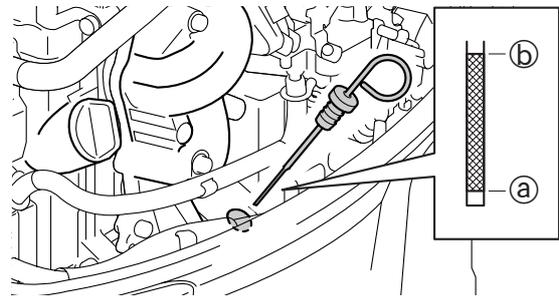


### Power unit

#### Checking the engine oil

1. Place the outboard motor in an upright position.
2. Remove the oil dipstick, wipe it clean, and then insert it back into the oil dipstick hole.

3. Remove the oil dipstick again to check the oil level and to check the oil for discoloration and its viscosity.

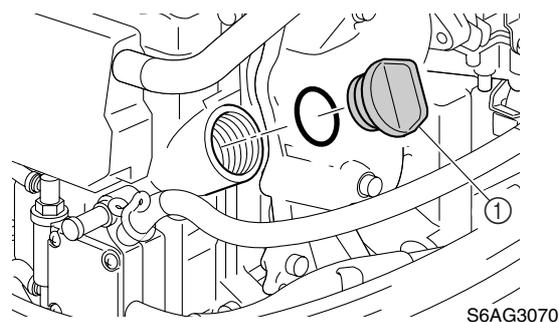


**NOTE:** \_\_\_\_\_

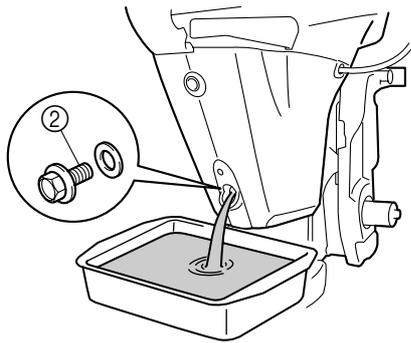
- If the oil appears milky or dirty, check for and repair the cause, and then change the oil.
- If the engine oil is below the minimum level mark (a), add sufficient oil until the level is between (a) and (b).

### Changing the engine oil

1. Start the engine, warm it up, and then turn it off.
2. Remove the oil dipstick and oil filler cap ①.



3. Place a drain pan under the drain hole, and then remove the engine oil drain bolt ② and let the oil drain completely.



S6AG3080

**NOTE:**

- Be sure to clean up any oil spills.
- When using an oil changer to change the engine oil, insert the oil changer hose into the oil dipstick hole.

4. Install the engine oil drain bolt ②, and then tighten it to the specified torque.



Engine oil drain bolt ②:  
27 N·m (2.7 kgf·m, 19.9 ft·lb)

5. Pour the specified amount of the recommended engine oil into the oil filler hole.

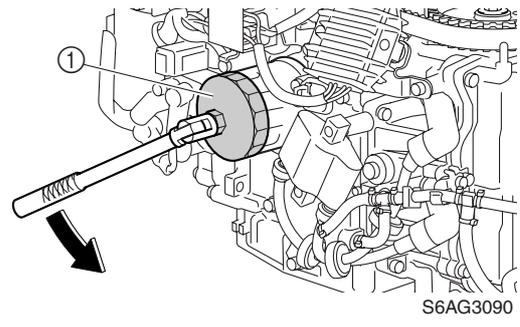


Recommended engine oil:  
4-stroke motor oil  
API: SE, SF, SG, SH, SJ, or SL  
SAE: 5W-30, 10W-30, or 10W-40  
Engine oil quantity:  
Without oil filter replacement:  
1.6 L (1.69 US qt, 1.41 Imp qt)

6. Install the oil filler cap and oil dipstick, and then start the engine and warm it up.
7. Turn the engine off, and then check the oil level and that there is no oil leakage. If the oil level is low, add engine oil to the correct level.

**Replacing the oil filter**

1. Drain the engine oil or use an oil changer to extract it.
2. Place a rag under the oil filter, and then remove the oil filter using a 64 mm (2.5 in) oil filter wrench ①.



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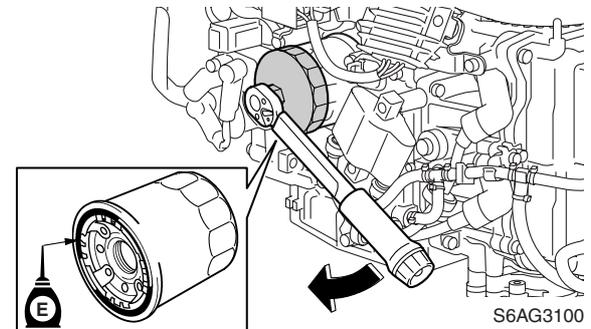
**NOTE:**

- Wait more than 5 minutes after turning the engine off to replace the oil filter.
- Be sure to clean up any oil spills.



Oil filter wrench ①: 90890-01426

3. Apply a thin coat of engine oil to the O-ring of the new oil filter.
4. Install the oil filter, and then tighten it to the specified torque using a 64 mm (2.5 in) oil filter wrench.



S6AG3100



Oil filter:  
18 N·m (1.8 kgf·m, 13.3 ft·lb)

5. Pour the specified amount of the recommended engine oil into the oil filler hole.



Recommended engine oil:  
4-stroke motor oil  
API: SE, SF, SG, SH, SJ, or SL  
SAE: 5W-30, 10W-30, or 10W-40  
Engine oil quantity:  
With oil filter replacement:  
1.8 L (1.90 US qt, 1.58 Imp qt)



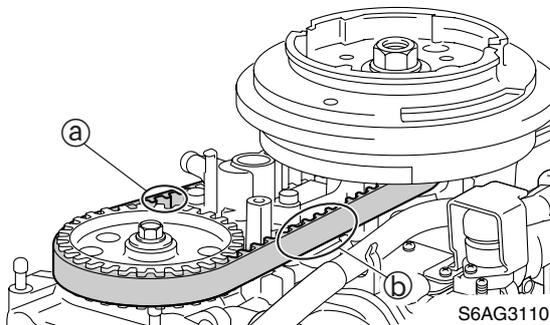
6. Install the oil filler cap and oil dipstick, and then start the engine and warm it up.
7. Turn the engine off, and then check the oil level and that there is no oil leakage. If the oil level is low, add engine oil to the correct level.

### Checking the timing belt

**CAUTION:**

**Do not turn the flywheel magnet counter-clockwise, otherwise the water pump impeller may be damaged.**

1. Remove the sprocket cover and manual starter. (Manual starter model)  
Remove the sprocket cover and flywheel magnet cover. (Electric starter model)
2. While turning the flywheel magnet clockwise, check the interior (a) and the exterior (b) of the timing belt. Replace the timing belt if cracked, damaged, or worn.

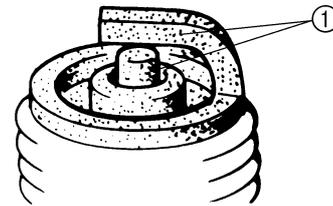


**NOTE:**

To replace the timing belt, see "Replacing the timing belt" (5-3).

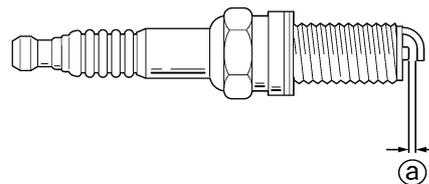
### Checking the spark plug

1. Disconnect the spark plug caps and remove the spark plugs.
2. Clean the electrodes (1) with a spark plug cleaner or wire brush.



S69J3190

3. Check the spark plug. Replace if the electrodes are eroded or there is excessive carbon or other deposits, or if the gasket is damaged.
4. Check the spark plug gap (a). Adjust the spark plug gap if out of specification.



S69J3200

**NOTE:**

Perform steps 2–4 for each spark plug.



Specified spark plug:  
DPR6EB-9 (NGK)  
Spark plug gap (a):  
0.8–0.9 mm (0.031–0.035 in)

5. Install the spark plugs, tighten them temporarily, and then tighten them to the specified torque using a spark plug wrench.



Spark plug:  
17 N·m (1.7 kgf·m, 12.5 ft·lb)

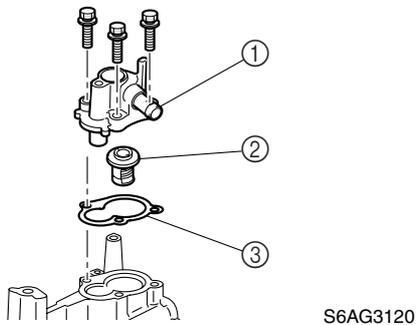
6. Connect the spark plug caps.

**Checking the thermostat**

1. Remove the sprocket cover and manual starter. (Manual starter model)  
Remove the sprocket cover and flywheel magnet cover. (Electric starter model)
2. Remove the thermostick and disconnect the cooling water hose.

**NOTE:** \_\_\_\_\_  
To remove the manual starter or flywheel magnet cover, see "Removing the timing belt and sprocket" (5-30).

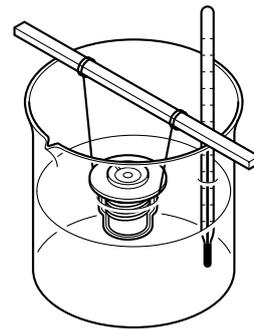
3. Remove the thermostat cover ① and thermostat ②.



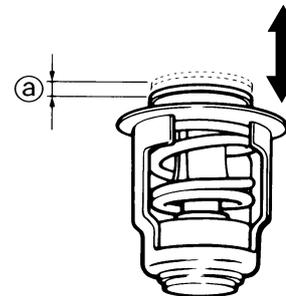
**CAUTION:** \_\_\_\_\_  
**Do not reuse the gasket ③, always replace it with a new one.**

**NOTE:** \_\_\_\_\_  
It is recommended to check the thermostat cover anode before installing the thermostat cover.

4. Suspend the thermostat in a container of water.
5. Place a thermometer in the water and slowly heat the water.



6. Measure the thermostat valve opening ① at the specified water temperatures. Replace the thermostat if out of specification.



 Water temperature	Valve opening ①
58–62 °C (136–144 °F)	0.05 mm (0.0020 in) (valve begins to open)
above 70 °C (158 °F)	more than 3.0 mm (0.12 in)

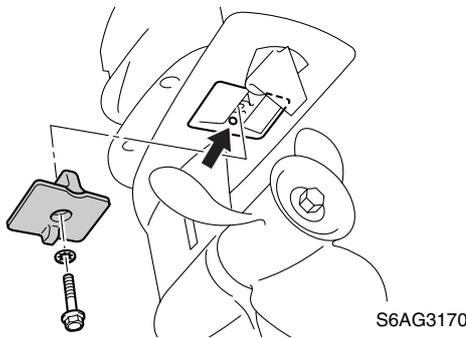
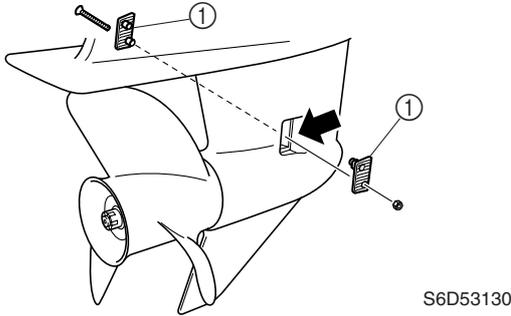
7. Install the new gasket, thermostat, and thermostat cover, and then tighten the thermostat cover bolts to the specified torque.

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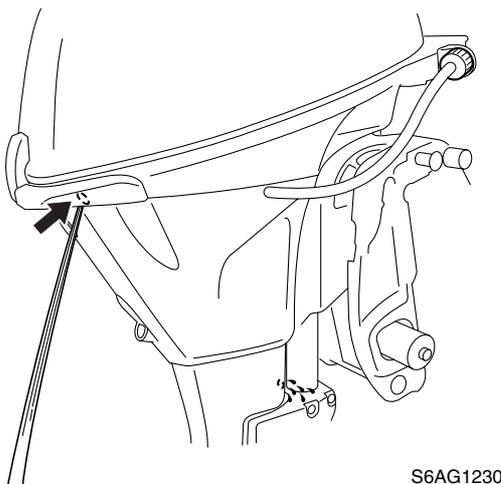


**Checking the cooling water passage**

1. Check the cooling water inlet covers ① and cooling water inlets, clean if clogged.



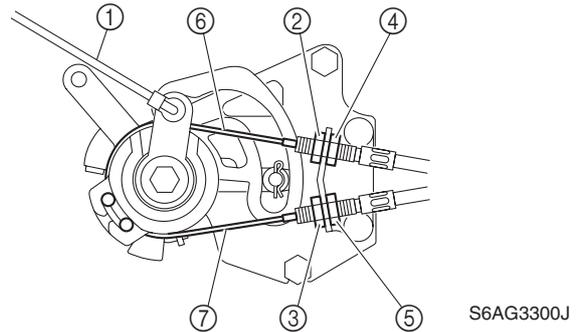
2. Place the lower unit in water, and then start the engine.
3. Check for water flow at the cooling water pilot hole. If there is no water flow, check the cooling water passages inside the outboard motor.



**Control system**

**Adjusting the throttle cable (tiller handle model)**

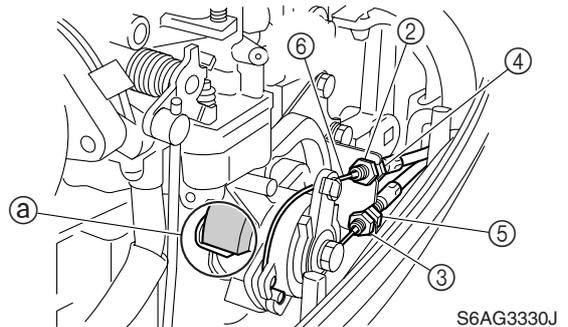
1. Disconnect the throttle link rod ① from the free accel lever.
2. Loosen the locknuts ② and ③, and then turn the adjusting nuts ④ and ⑤ to loosen the throttle cables ⑥ and ⑦.



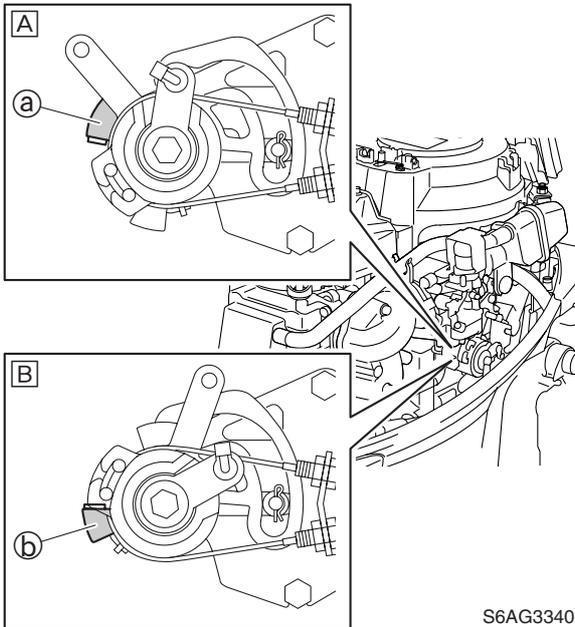
3. Turn the throttle grip to the fully open position and hold it in place.
4. Turn the adjusting nut ⑤ so that the fully open stopper ① on the throttle cam contacts the throttle cam bracket as shown, and then tighten the locknut ③.

**NOTE:** Be careful not to pull the outer cables too much towards the power unit as they could be pulled out of the grommet. If the outer cables are pulled out of the grommet, see "Assembling the tiller handle" (7-3).

5. Turn the adjusting nut ④ to remove the slack in the throttle cable ⑥, and then tighten the locknut ②.



- Turn the throttle grip to the fully open and fully closed positions and check that the fully open stopper **a** and fully closed stopper **b** on the throttle cam contact throttle cam bracket as shown. Repeat steps 2–5 if necessary.



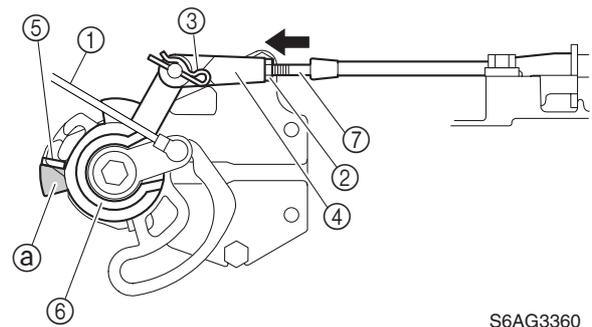
- A** Fully open position
- B** Fully closed position

- Connect the throttle link rod **1** to the free accel lever.

**NOTE:** \_\_\_\_\_  
 After adjusting the throttle cables, adjust the throttle link. (Tiller handle model)  
 After adjusting the throttle cable, adjust the throttle link. (Remote control model)

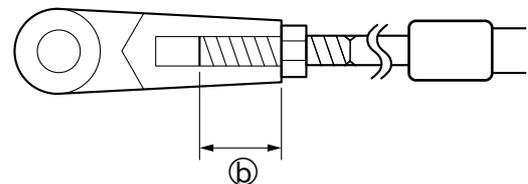
**Adjusting the throttle cable (remote control model)**

- Disconnect the throttle link rod **1** from the free accel lever.
- Loosen the locknut **2**, remove the clip **3**, and then disconnect the throttle cable joint **4**.



S6AG3360

- Set the remote control lever to the neutral position.
- Check that the fully closed stopper **a** on the cam contacts the throttle cam bracket **5**.
- Adjust the position of the throttle cable joint **4** until its hole is aligned with the set pin on the throttle cam **6**.



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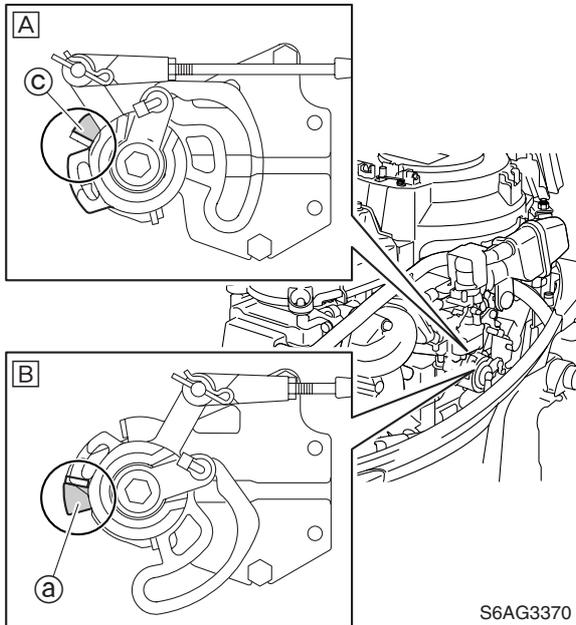
**WARNING** \_\_\_\_\_  
**The throttle cable joint must be screwed in a minimum of 8.0 mm (0.31 in) **b**.**

**NOTE:** \_\_\_\_\_  
 Pull the throttle cable **7** towards the engine to remove any free play in the cable before adjusting the position of the throttle cable joint.

- Connect the throttle cable joint **4**, install the clip **3**, and then tighten the locknut **2**.



- Set the remote control lever to the fully open and fully closed positions and check that the fully open stopper ③ and fully closed stopper ④ on the throttle cam contact the throttle cam bracket as shown.



- A** Fully open position
- B** Fully closed position

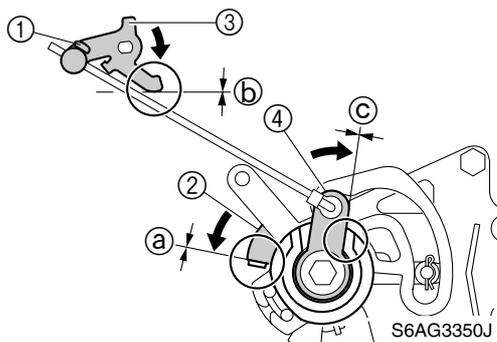
S6AG3370

- Connect the throttle link rod to the free accel lever.

**NOTE:** \_\_\_\_\_  
 After adjusting the throttle cables, adjust the throttle link. (Tiller handle model)  
 After adjusting the throttle cable, adjust the throttle link. (Remote control model)

**Adjusting the throttle link**

- Loosen the throttle link stopper screw ①.



S6AG3350J

- Turn the throttle grip (tiller handle model) or remote control lever (remote control model) to the fully open position and hold it in place. Check that the fully open stopper ② on the throttle cam contacts the throttle cam bracket ⑤.

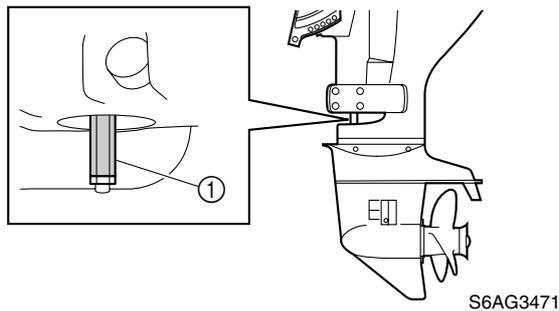
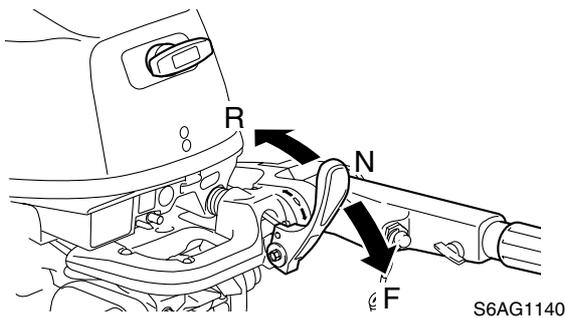
**NOTE:** \_\_\_\_\_  
 If the fully open stopper ② does not contact the throttle cam bracket ⑤, adjust the throttle cable(s). See “Adjusting the throttle cable (tiller handle model)” (3-7) or “Adjusting the throttle cable (remote control model)” (3-8).

- Turn the carburetor throttle lever ③ clockwise so that it contacts the carburetor body ⑥ as shown.
- Turn the free accel lever ④ clockwise until it contacts the throttle cam ⑦.
- Tighten the throttle link stopper screw ①.
- Turn the throttle grip (tiller handle model) or remote control lever (remote control model) to the fully open and fully closed positions and check that the throttle cam operates smoothly.

**NOTE:** \_\_\_\_\_  
 After adjusting the throttle link, adjust the engine idle speed. See “Checking the engine idle speed” (3-11).

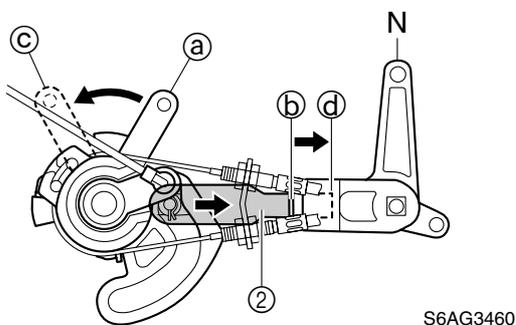
**Checking the gear shift operation (tiller handle model)**

- Check that the gear shift operates smoothly when the shift lever is shifted from the neutral position to forward or reverse. Adjust the shift rod adjusting nut ① if necessary.

**NOTE:**

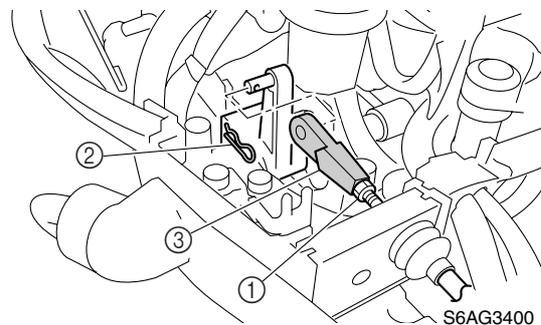
To adjust the shift rod adjusting nut ①, see "Installing the lower unit" (6-17).

- Turn the throttle grip to the fully closed position so that the throttle cam is in position ①, and then check that the shift stopper ② is pulled in to position ③ and that the shift lever can be operated. Next, turn the throttle grip to the fully open position so that the throttle cam is in position ④, and then check that the shift stopper ② is pushed out to position ⑤ and that the shift lever cannot be operated.

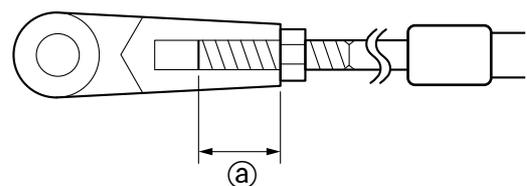


### Checking the gear shift operation (remote control model)

- Check that the gear shift operates smoothly when the remote control lever is shifted from neutral position to forward or reverse. Adjust the shift cable length and shift rod adjusting nut if necessary.
- Set the remote control lever to the neutral position.
- Loosen the locknut ①, remove the clip ②, and then disconnect the shift cable joint ③.



- Adjust the position of the shift cable joint until its hole is aligned with the set pin on the shift rod lever joint.



S6AG3130

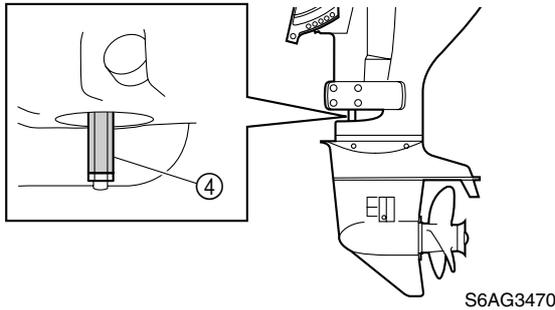
**⚠ WARNING**

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

- Connect the shift cable joint ③, install the clip ②, and then tighten the locknut ①.



6. Adjust the shift rod adjusting nut ④.



**NOTE:**

To adjust the shift rod adjusting nut, see "Installing the lower unit" (6-17).

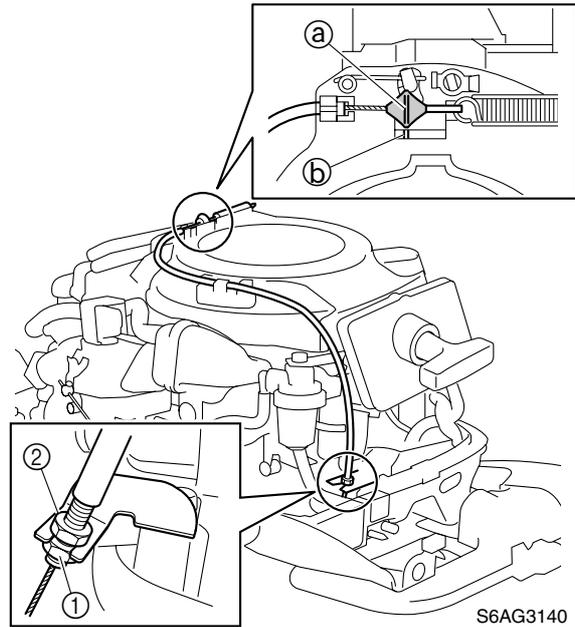
7. Check the gear shift for smooth operation.

**Checking the start-in-gear protection (manual starter model)**

**CAUTION:**

Be sure to remove the clip from the engine stop lanyard switch before checking the start-in-gear protection.

1. Set the shift lever to the forward or reverse position, and then check that the starter handle cannot be pulled. If the starter rope can be pulled out normally, adjust the start-in-gear protection cable.
2. Set the shift lever to the neutral position and loosen the locknut ①. Align the cable end ② with the mark ③ on the manual starter cover by turning the adjusting nut ④.
3. Tighten the locknut ①.



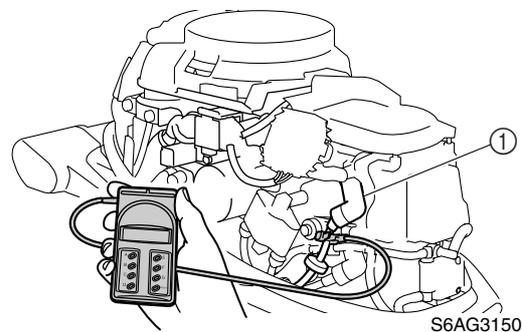
**Checking the engine idle speed**

1. Start the engine and warm it up for 10 minutes.

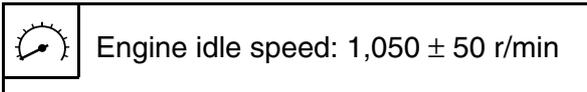
**NOTE:**

Because the Prime Start operates when the engine is started, the engine idle speed will be above specification. Therefore, check and adjust the engine idle speed after the engine has been warmed up.

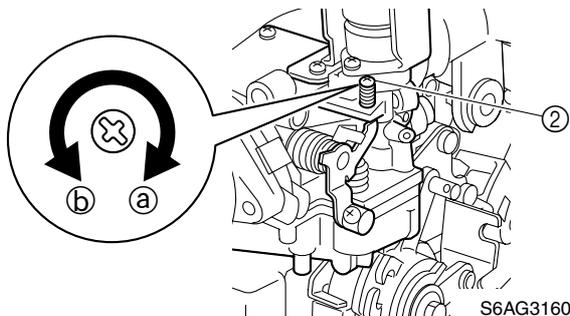
2. Attach the special service tool to spark plug wire #1 ①, and then check the engine idle speed. Adjust if out of specification.



Digital tachometer: 90890-06760



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

**NOTE:**

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

- After adjusting the engine idle speed, rev the engine a few times and let it idle to check the stability of the engine.

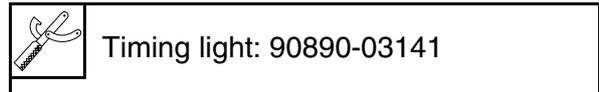
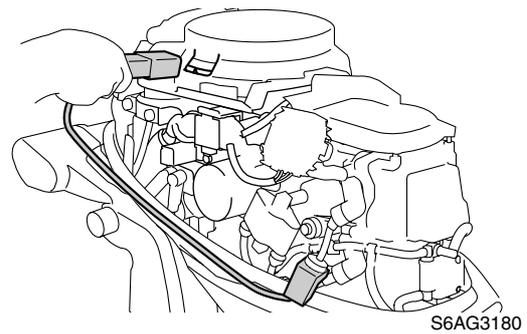
**Checking the ignition timing**

- Start the engine and warm it up for 10 minutes.

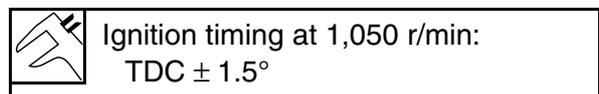
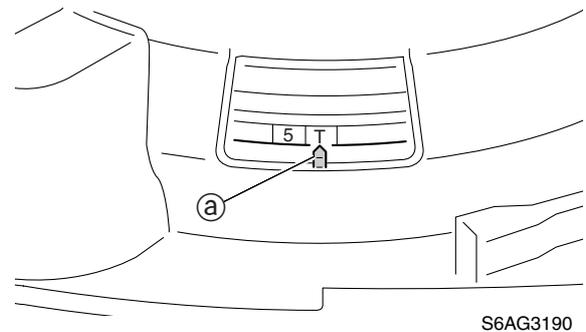
**NOTE:**

Because the Prime Start operates when the engine is started, the engine idle speed will be above specification. Therefore, check and adjust the engine idle speed after the engine has been warmed up.

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



- Check that the pointer ① is aligned with the "T" mark on the flywheel magnet as shown.



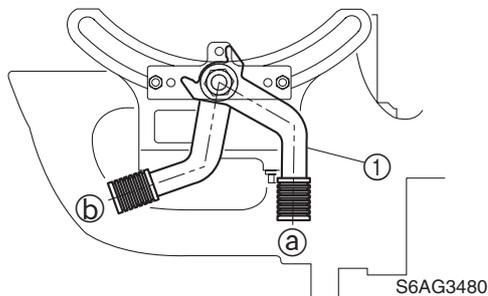


## Bracket unit

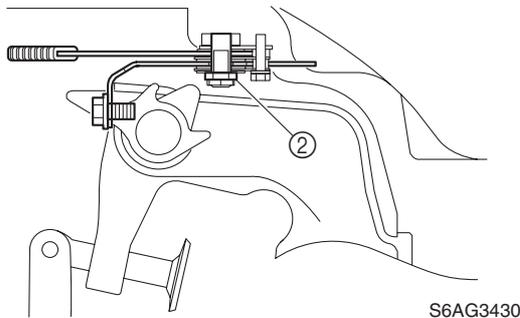
### Checking the steering operation (tiller handle model)

**NOTE:** \_\_\_\_\_  
Lubricate the swivel bracket before checking the steering operation.

1. Move the steering lock lever ① to position ① and check that the steering is locked.  
Move the steering lock lever ① to position ② and check that the steering operates smoothly.



2. Adjust the self-locking nut ③ until steering operation is properly.



### Checking the tilt operation (manual tilt model)

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

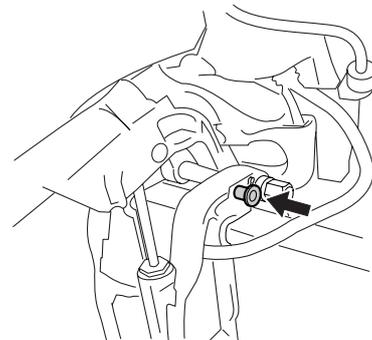
**NOTE:** \_\_\_\_\_  
To check the tilt operation, see "Checking the tilt system (manual tilt model)" (1-17).

### Checking the tilt operation (power tilt model)

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

**NOTE:** \_\_\_\_\_  
• To check the power tilt fluid level, see "Checking the power tilt fluid level" (3-13).  
• Be sure to listen to the winding sound of the power tilt motor for smooth operation.

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



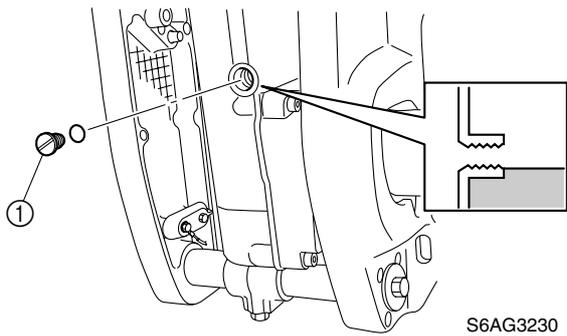
### Checking the power tilt fluid level

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

**⚠ 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 power tilt unit should lose fluid pressure.**

2. Remove the reservoir cap ①, and then check the fluid level in the reservoir.



S6AG3230

**NOTE:**  
If the fluid is at the correct level, a small amount of fluid should overflow out of the filler hole when the cap is removed.

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

 Recommended power tilt fluid:  
ATF Dexron II

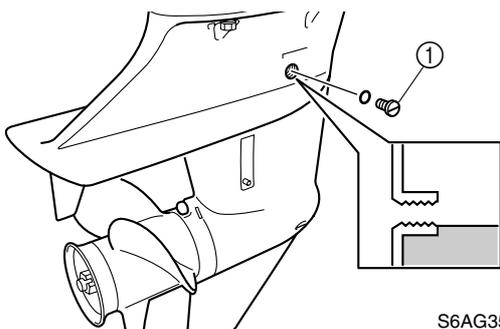
4. Install a new O-ring and the reservoir cap **①**, and then tighten the cap to the specified torque.

 Reservoir cap **①**:  
5 N·m (0.5 kgf·m, 3.7 ft·lb)

## Lower unit

### Checking the gear oil

1. Fully tilt the outboard motor down.
2. Remove the gear oil check screw **①**, and then check the gear oil level in the lower case. Also, check the oil for discoloration and its viscosity.



S6AG3500

**NOTE:**

- If the oil is at the correct level, a small amount of oil should overflow out of the check hole when the gear oil check screw is removed.
- If the oil appears milky or dirty, check for and repair the cause, and then change the oil.

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

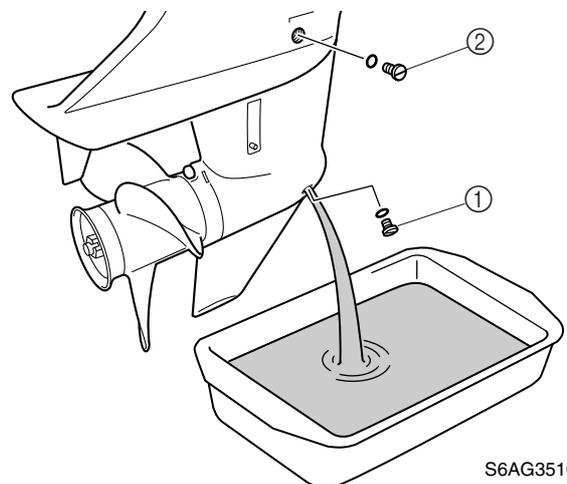
 Recommended gear oil:  
Hypoid gear oil  
API: GL-4  
SAE: 90

4. Install a new gasket and the gear oil check screw **①**, and then tighten the gear oil check screw to the specified torque.

 Gear oil check screw **①**:  
9 N·m (0.9 kgf·m, 6.6 ft·lb)

### Changing the gear oil

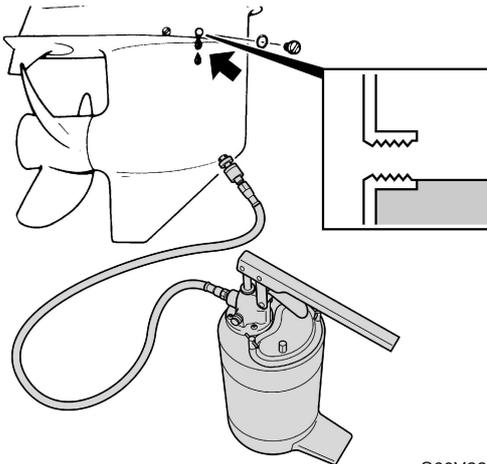
1. Fully tilt the outboard motor down.
2. Place a drain pan under the gear oil drain hole, remove the gear oil drain screw **①**, then the gear oil check screw **②**, and let the oil drain completely.



S6AG3510



3. Check the oil for metal, 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 with gear oil until oil flows out of the check hole and no air bubbles are visible.



S60V3350



**Recommended gear oil:**  
 Hypoid gear oil  
 API: GL-4  
 SAE: 90  
 Gear oil quantity:  
 300 cm<sup>3</sup>  
 (10.14 US oz, 10.58 Imp oz)

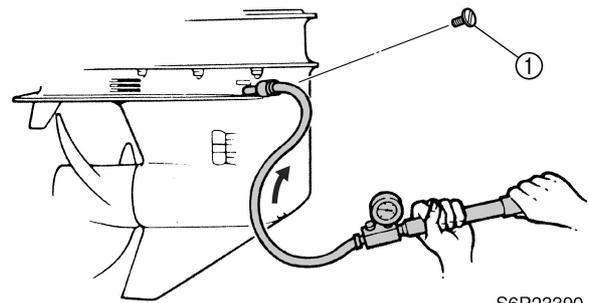
5. Install new gaskets and gear oil check screw ②, and quickly install the gear oil drain screw ①, and then tighten them to the specified torque.



Gear oil check screw ② and drain screw ①: 9 N·m (0.9 kgf·m, 6.6 ft·lb)

### Checking the lower unit for air leakage

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



S6P23390



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.

### CAUTION:

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

### NOTE:

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



Lower unit holding pressure:  
 100 kPa (1.0 kgf/cm<sup>2</sup>, 14.5 psi)

3. If the specified pressure cannot be maintained, check the propeller shaft, drive shaft, shift rod, O-rings, and oil seals for damage. If necessary, check each shaft for bends and damage.

### Checking the propeller

1. Check the propeller blades and splines. Replace the propeller if cracked, damaged, or worn.

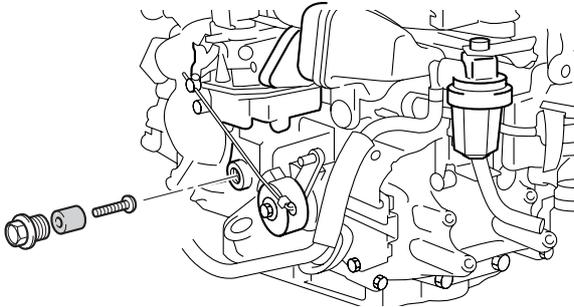
### NOTE:

When replacing the propeller, see "Propeller selection" (1-12) and select a propeller of the same size as originally installed.

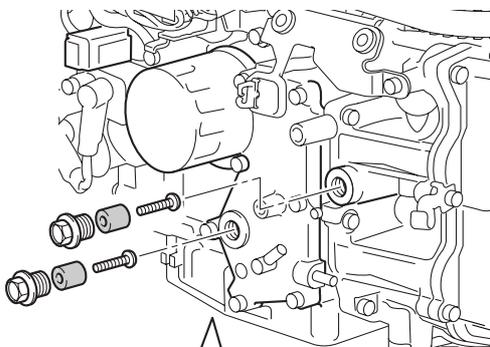
**General**

**Checking the anode**

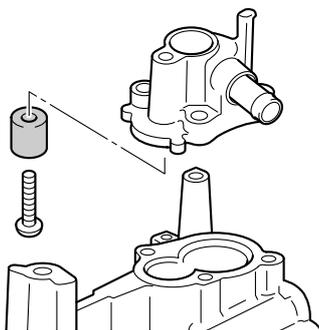
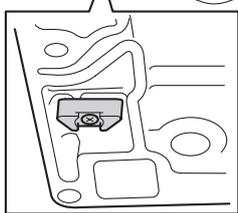
1. Check the anodes. Clean the anodes if there are scales, grease, or oil.



S6AG3260

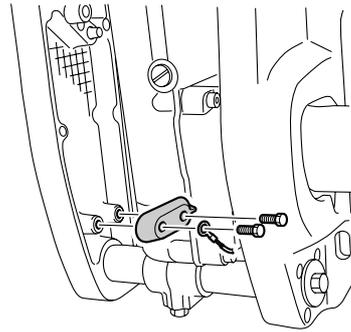


S6AG3250



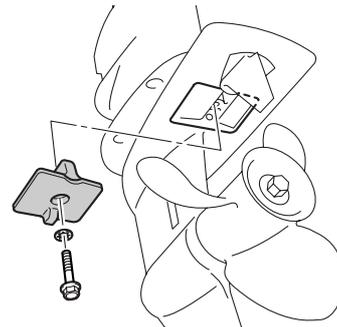
S6AG3270

A



S6AG3280

A Power tilt model



S6AG3320

**CAUTION:**

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

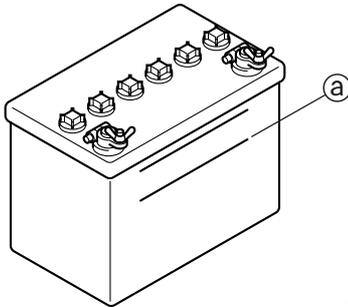
**NOTE:**

- Replace the anodes if excessively eroded. In addition, check the ground lead.
- If it is necessary to disassemble the outboard motor to check an anode, refer to the applicable disassembly procedure in this manual.



**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.



S69J3620

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.**

**Always follow these preventive measures:**

- **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.**

**Batteries generate explosive, hydrogen gas. Always follow these preventive measures:**

- **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:**

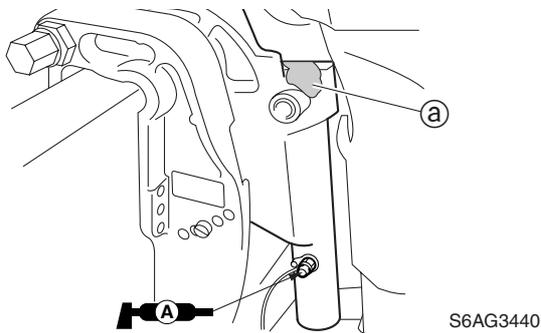
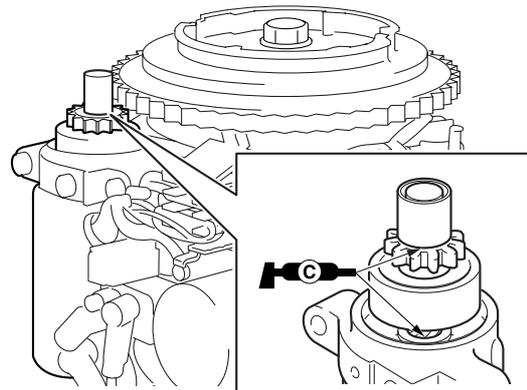
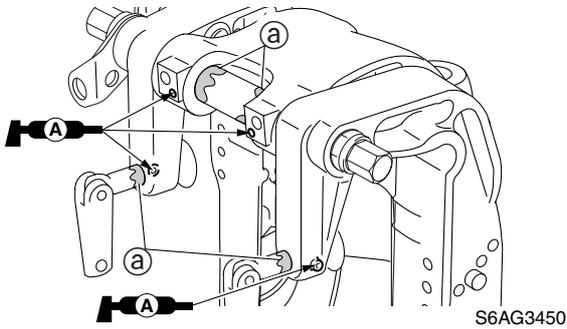
- **Batteries vary per manufacturer. The procedures mentioned in this manual may not always apply, therefore, consult the instruction manual of the battery.**
- **Disconnect the negative battery cable first, then the positive battery cable.**



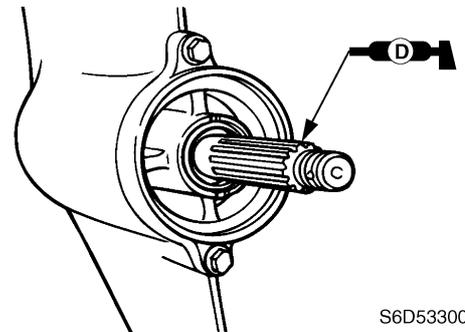
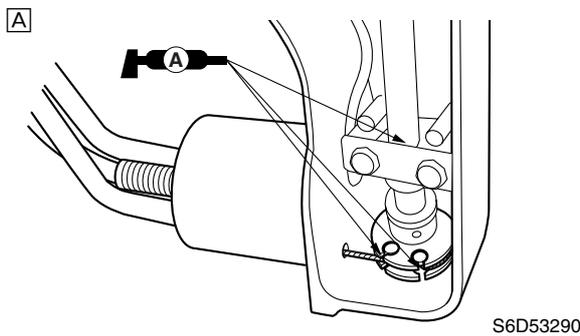
**Electrolyte specific gravity:  
1.280 at 20 °C (68 °F)**

### Lubricating the outboard motor

1. Apply water resistant grease to the areas shown.



3. Apply corrosion resistant grease to the area shown.



**A** Tiller handle model

**NOTE:** \_\_\_\_\_  
Apply grease until it flows from the bushings **a**.  
\_\_\_\_\_

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

**CHK**  
**ADJ**



Periodic check and adjustment

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**— MEMO —**

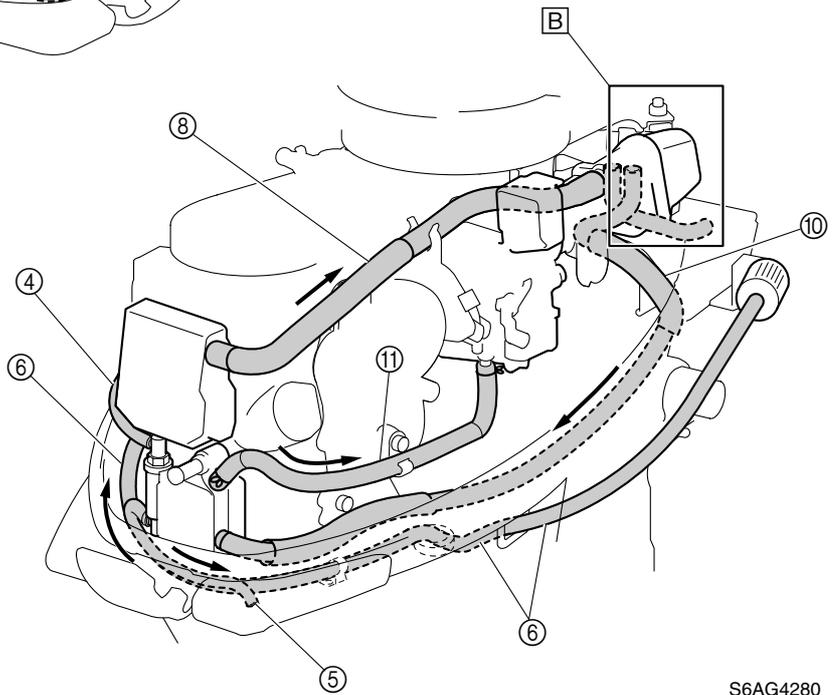
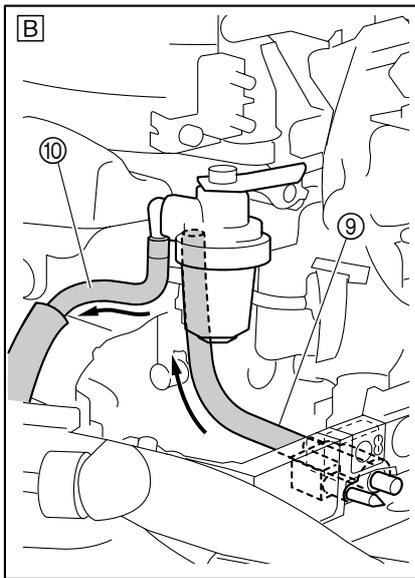
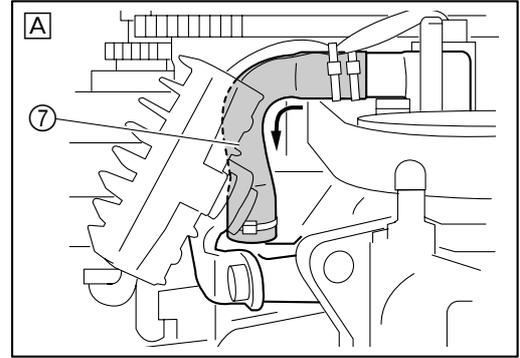
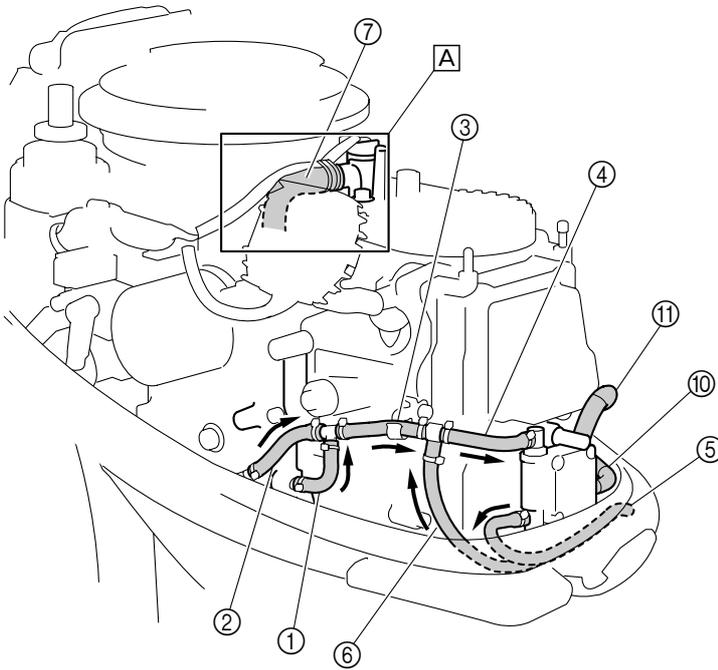
## Fuel system

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**Hose routing**

**Fuel hose, blowby hose, and cooling water hose**

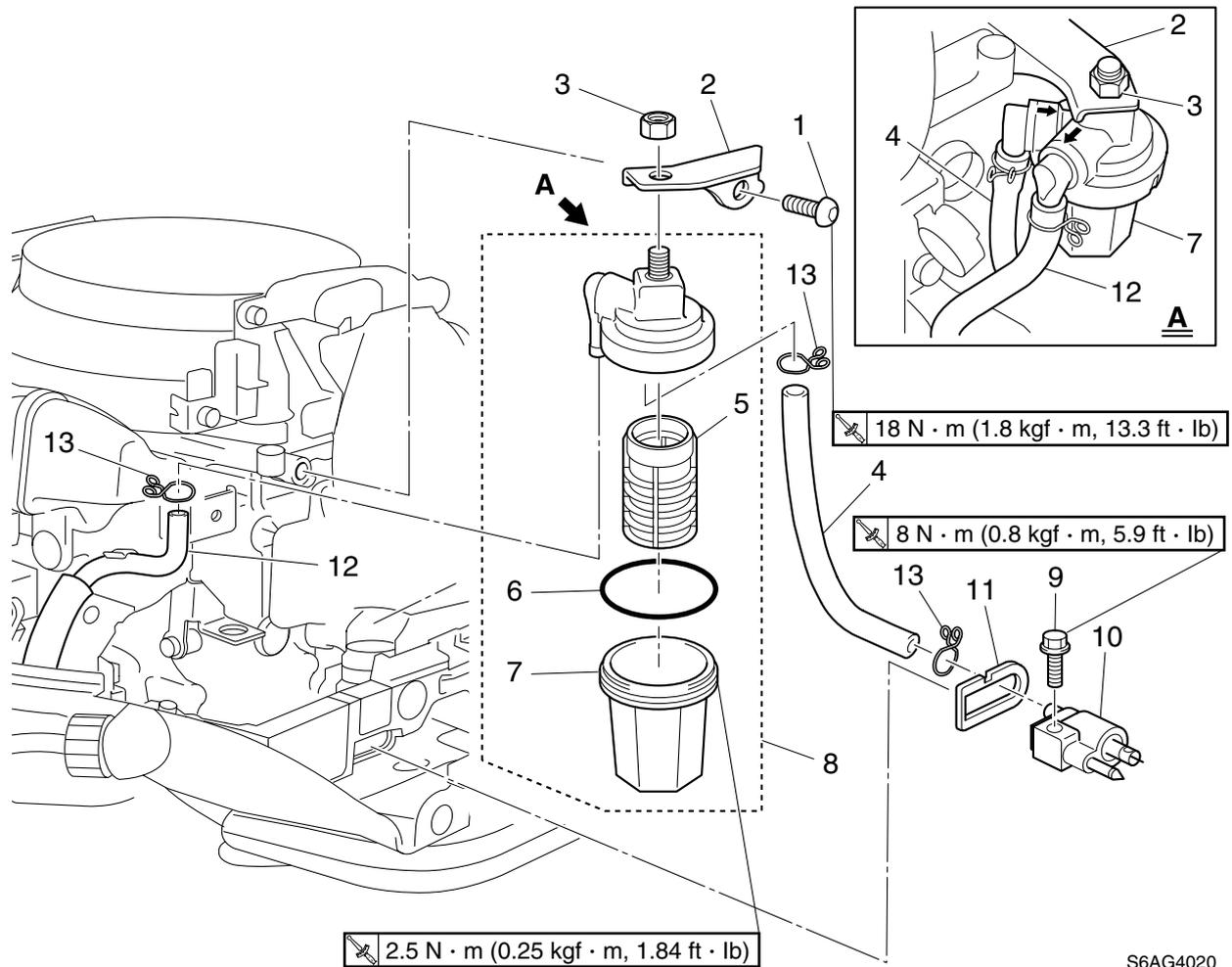


S6AG4280

- ① Cooling water hose (exhaust cover-to-joint)
- ② Cooling water hose (exhaust cover-to-joint)
- ③ Cooling water hose (joint-to-joint)
- ④ Cooling water hose (joint-to-fuel pump)
- ⑤ Cooling water hose (fuel pump-to-cooling water pilot hole)
- ⑥ Cooling water hose (flushing hose adapter-to-joint)
- ⑦ Cooling water hose (thermostat cover-to-cylinder block)
- ⑧ Blowby hose (cylinder head cover-to-intake silencer)
- ⑨ Fuel hose (fuel joint-to-fuel filter assembly)

- ⑩ Fuel hose (fuel filter assembly-to-fuel pump)
- ⑪ Fuel hose (fuel pump-to-carburetor assembly)

Fuel filter



4

S6AG4020

No.	Part name	Q'ty	Remarks
1	Bolt	1	M8 × 14 mm
2	Bracket	1	
3	Nut	1	
4	Fuel hose	1	
5	Fuel filter element	1	
6	O-ring	1	<b>Not reusable</b>
7	Fuel filter cup	1	
8	Fuel filter assembly	1	
9	Bolt	1	M6 × 25 mm
10	Fuel joint	1	
11	Seal	1	
12	Fuel hose	1	
13	Clamp	3	

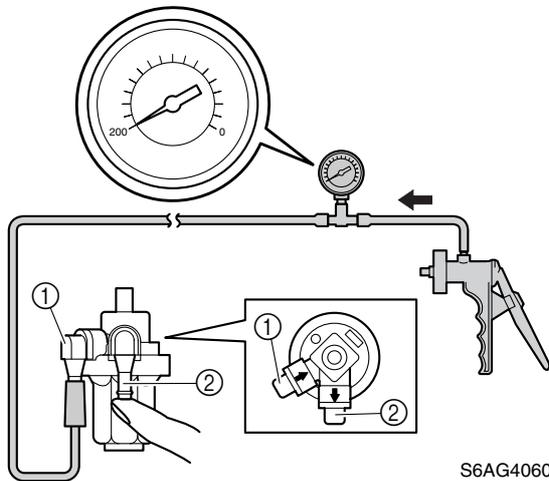


**Checking the fuel filter assembly**

**NOTE:**

To check the fuel filter element, see “Checking the fuel filter” (3-3).

1. Connect a vacuum/pressure pump gauge and a meter to the fuel inlet ①.
2. Cover the fuel outlet ② with your finger, and then apply the specified positive pressure. Replace the O-ring, fuel filter cup, or fuel filter assembly if the specified pressure cannot be maintained for at least 15 seconds.



S6AG4060

**NOTE:**

Use a commercially available vacuum/pressure pump gauge and meter that can be pressurized up to 200 kPa (2.0 kgf/cm<sup>2</sup>, 29.0 psi).

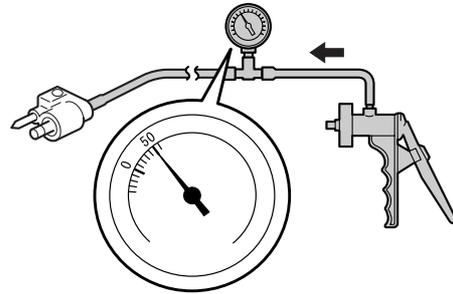


Vacuum/pressure pump gauge:  
(commercially available)



Specified positive pressure:  
200 kPa (2.0 kgf/cm<sup>2</sup>, 29.0 psi)

3. Apply the specified positive pressure. Replace the fuel joint if the specified pressure cannot be maintained for at least 10 seconds.



S6AG4070



Vacuum/pressure pump gauge set:  
90890-06756

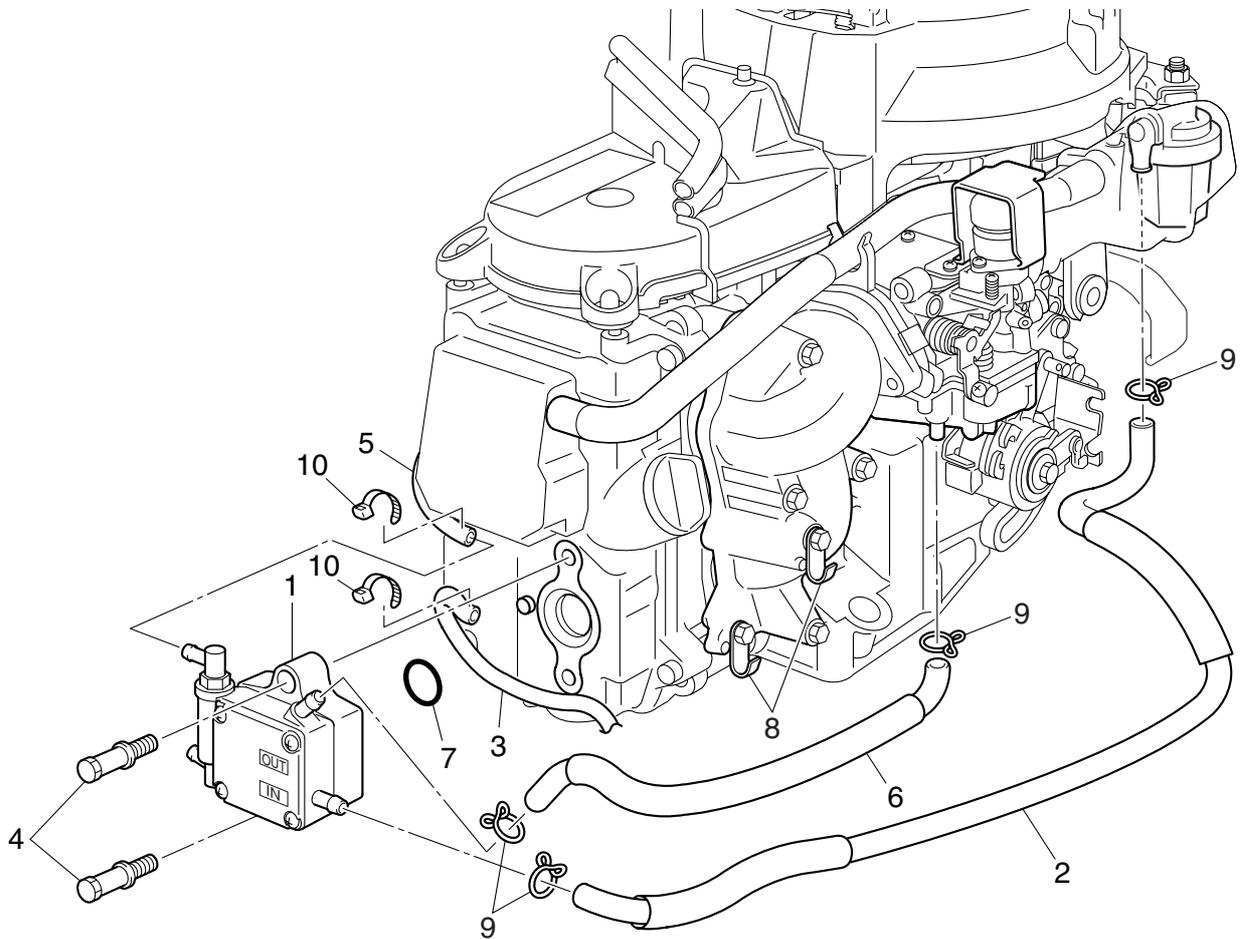


Specified positive pressure:  
50 kPa (0.5 kgf/cm<sup>2</sup>, 7.3 psi)

**Checking the fuel joint**

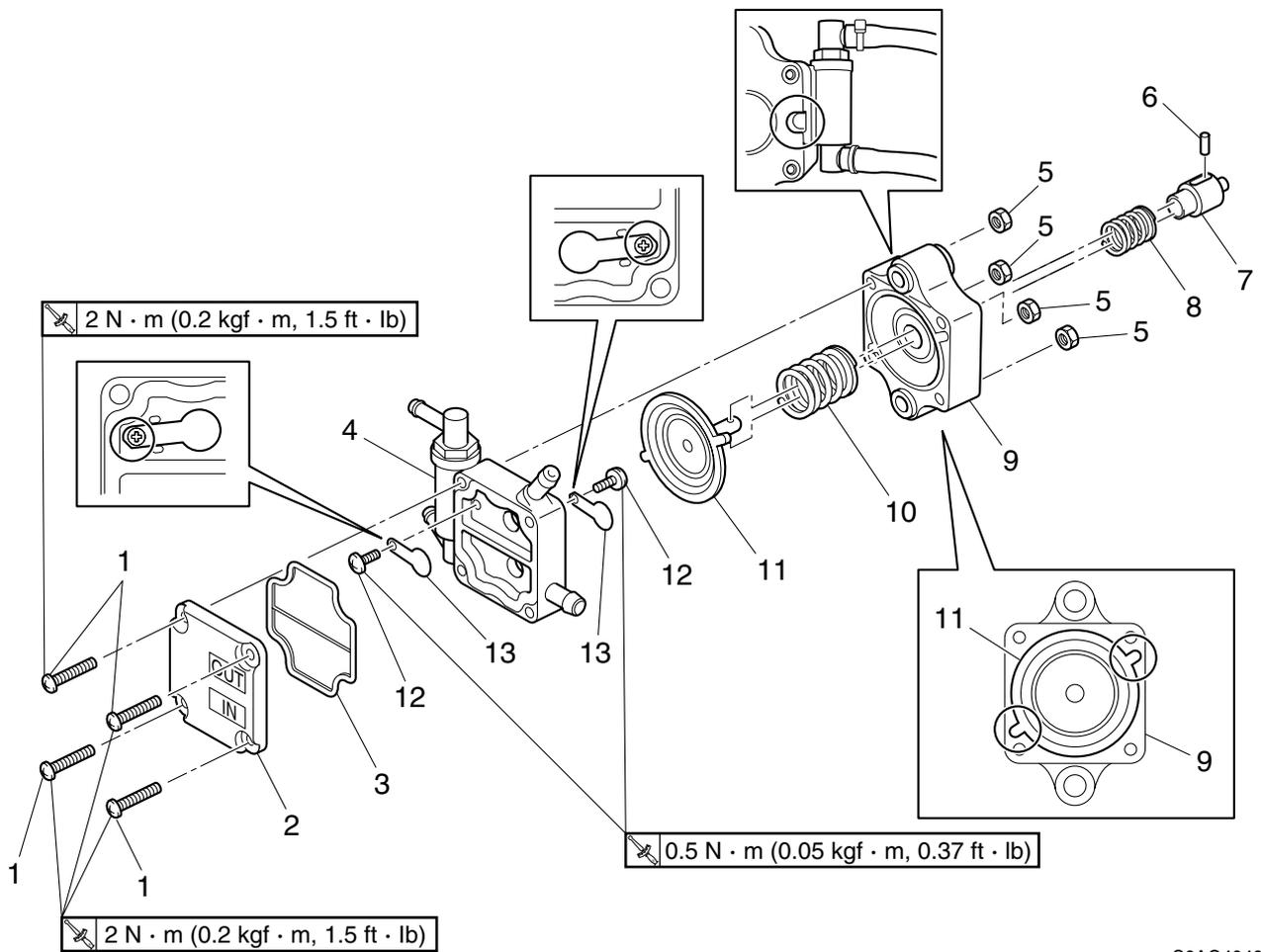
1. Check the fuel joint. Replace if cracked or damaged.
2. Connect the special service tool to the fuel joint outlet.

Fuel pump



S6AG4030

No.	Part name	Q'ty	Remarks
1	Fuel pump	1	
2	Fuel hose	1	
3	Cooling water hose	1	
4	Bolt	2	M6 × 30 mm
5	Cooling water hose	1	
6	Fuel hose	1	
7	O-ring	1	<b>Not reusable</b>
8	Holder	2	
9	Clamp	4	
10	Plastic tie	2	

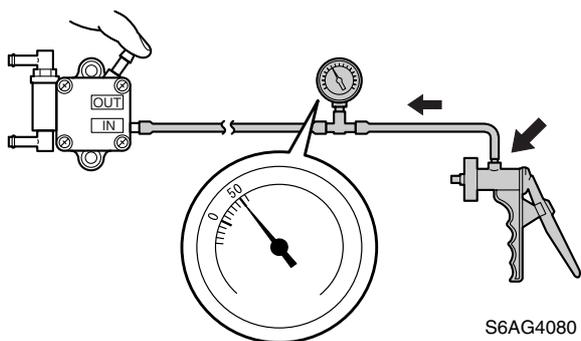


S6AG4040

No.	Part name	Q'ty	Remarks
1	Screw	4	ø4 × 30 mm
2	Cover	1	
3	Diaphragm	1	<b>Not reusable</b>
4	Fuel pump body 2	1	
5	Nut	4	
6	Pin	1	
7	Plunger	1	
8	Spring	1	
9	Fuel pump body 1	1	
10	Spring	1	
11	Diaphragm	1	
12	Screw	2	ø3 × 5 mm
13	Check valve	2	

### Checking the fuel pump

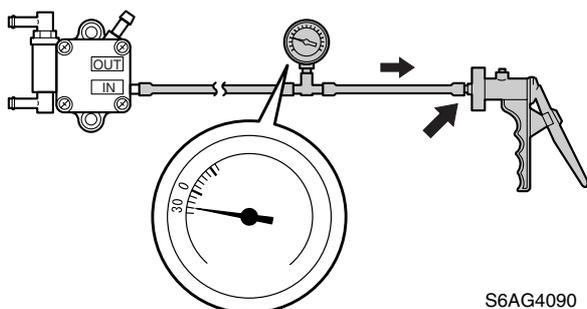
1. Connect the special service tool to the fuel pump inlet.
2. Cover the fuel pump outlet with your finger, and then apply the specified positive pressure. Check that there is no air leakage.



 Vacuum/pressure pump gauge set:  
90890-06756

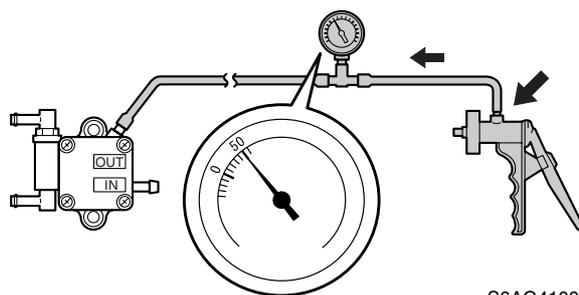
 Specified positive pressure:  
50 kPa (0.5 kgf/cm<sup>2</sup>, 7.3 psi)

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



 Specified negative pressure:  
30 kPa (0.3 kgf/cm<sup>2</sup>, 4.4 psi)

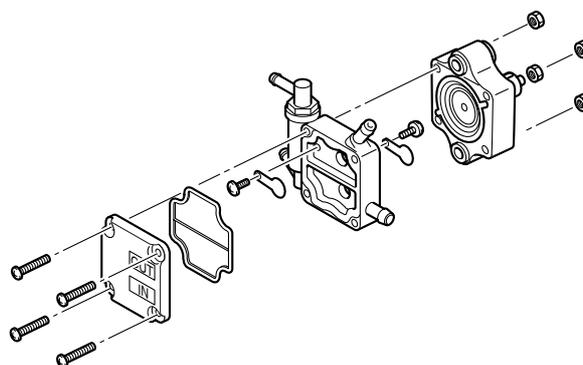
4. Connect the special service tool to the fuel pump outlet.
5. Apply the specified positive pressure and check that there is no air leakage.



 Specified positive pressure:  
50 kPa (0.5 kgf/cm<sup>2</sup>, 7.3 psi)

### Disassembling the fuel pump

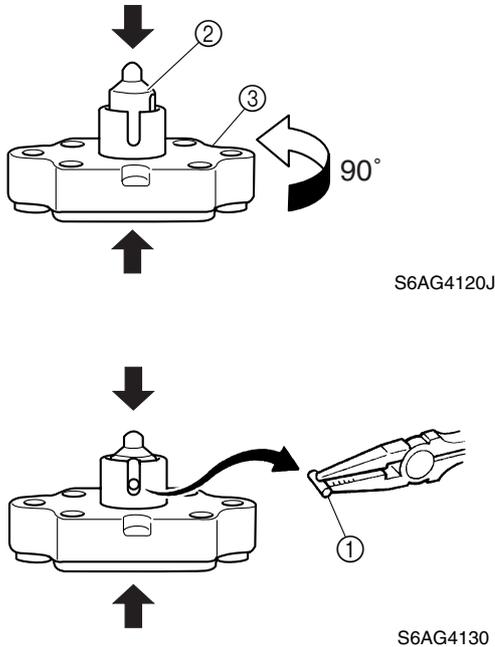
1. Disassemble the fuel pump as shown.



4



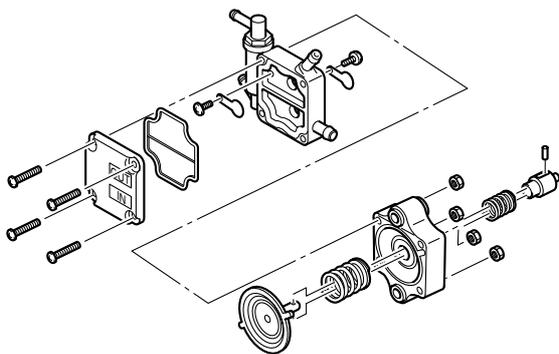
- Remove the pin ① from the plunger ②, and then disassemble the fuel pump body 1 ③.



- NOTE:**
- Push down on the plunger ② and the diaphragm, turn fuel pump body 1 ③ approximately 90° to a position where the pin ① can be removed easily.
  - Slowly release on the plunger ② and diaphragm, and then remove them.

**Checking the diaphragm and valve**

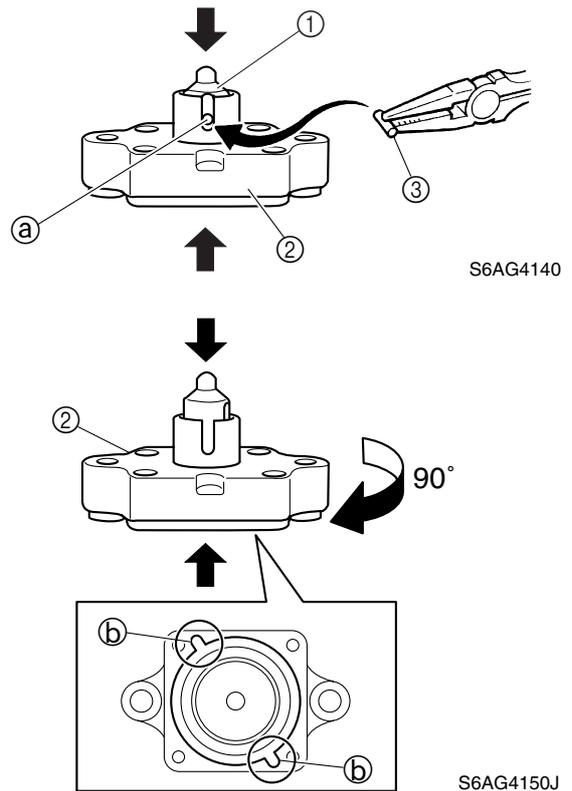
- Check the diaphragms and valves. Replace the diaphragms if torn and the valves if cracked.



**Assembling the fuel pump**

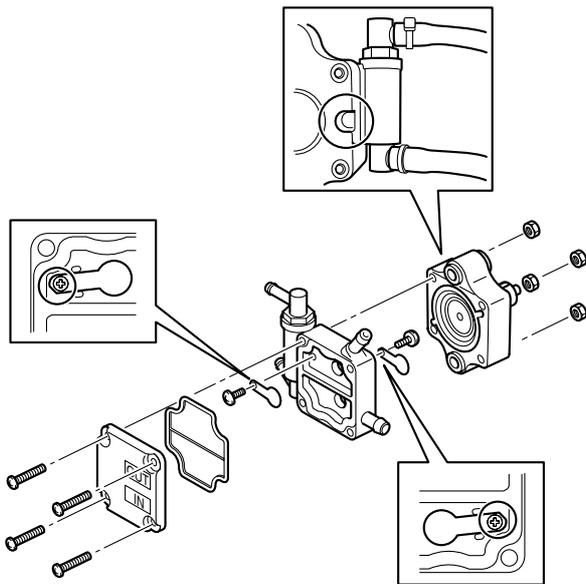
**NOTE:**  
Clean the parts and soak the valves and the diaphragms in gasoline before assembly.

- Install the plunger ① and diaphragm into fuel pump body 1 ② and then install the pin ③ to the plunger ①.



- NOTE:**
- Align the pin installation holes ④ with the slot in fuel pump body 1 ②, and then install the pin ③ while pushing the plunger ① and diaphragm completely inward.
  - Turn fuel pump body 1 ② until the pin ③ is 90° from the slots in fuel pump body 1 ②.
  - Make sure that the projections ⑥ on the diaphragm fit correctly into fuel pump body 1 ②.

- Assemble the fuel pump as shown.



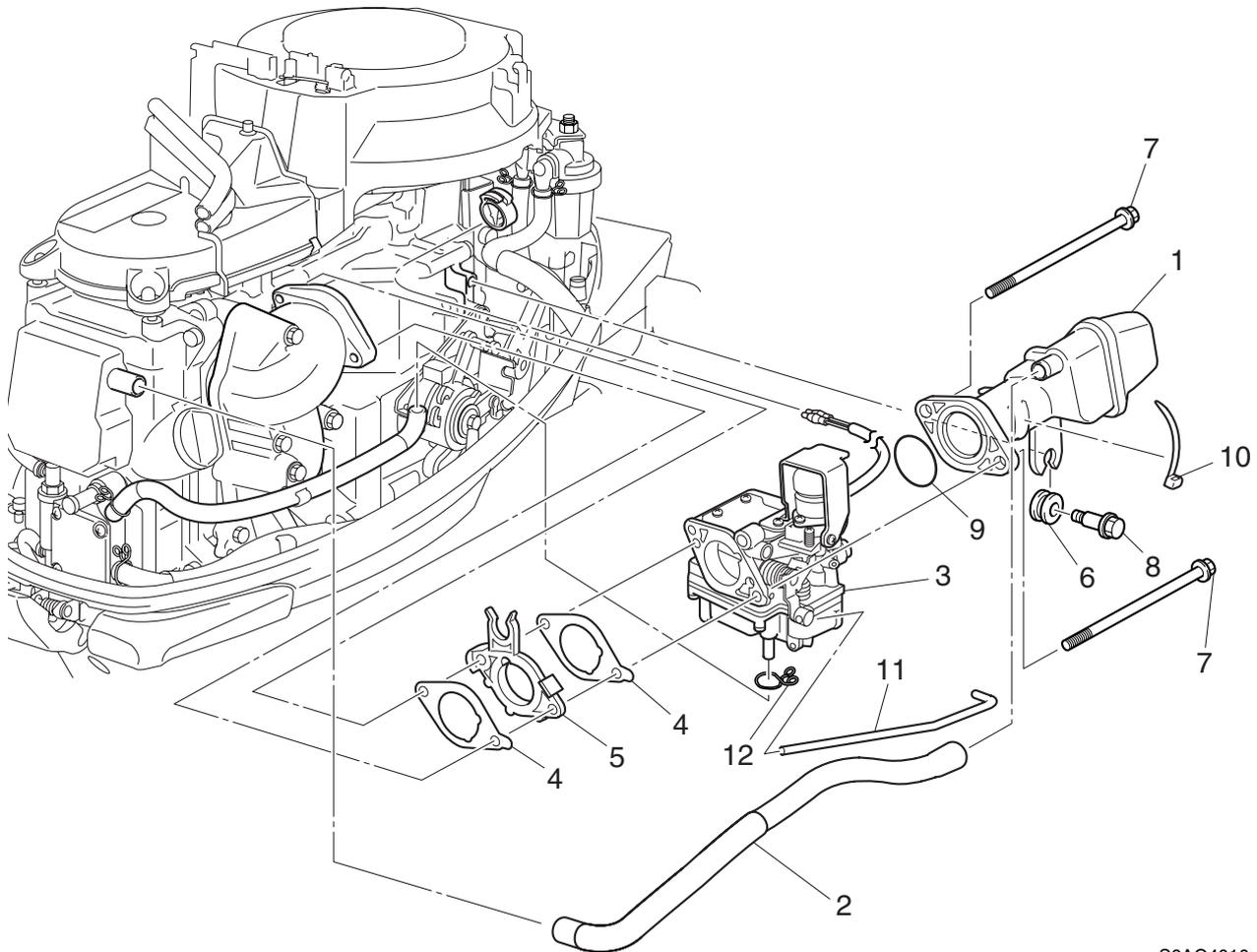
S6AG4160

**NOTE:**

- Moisten the inside of the fuel pump with gasoline to ensure a good seal.
- Make sure that the diaphragms are kept in place through the assembly process.
- After disassembling and assembling the fuel pump, check it for air leaks. See "Checking the fuel pump" (4-6).



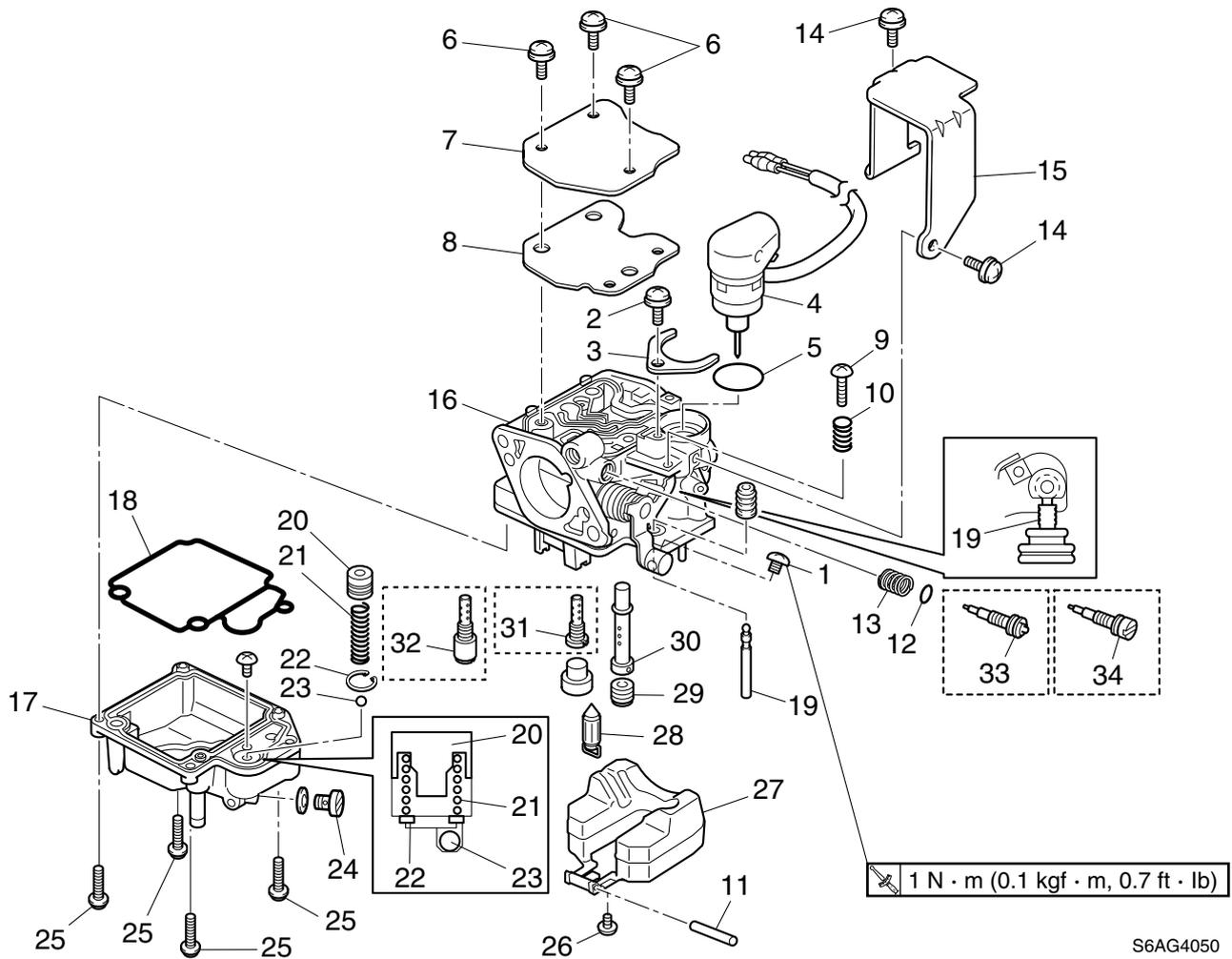
Carburetor unit



S6AG4010

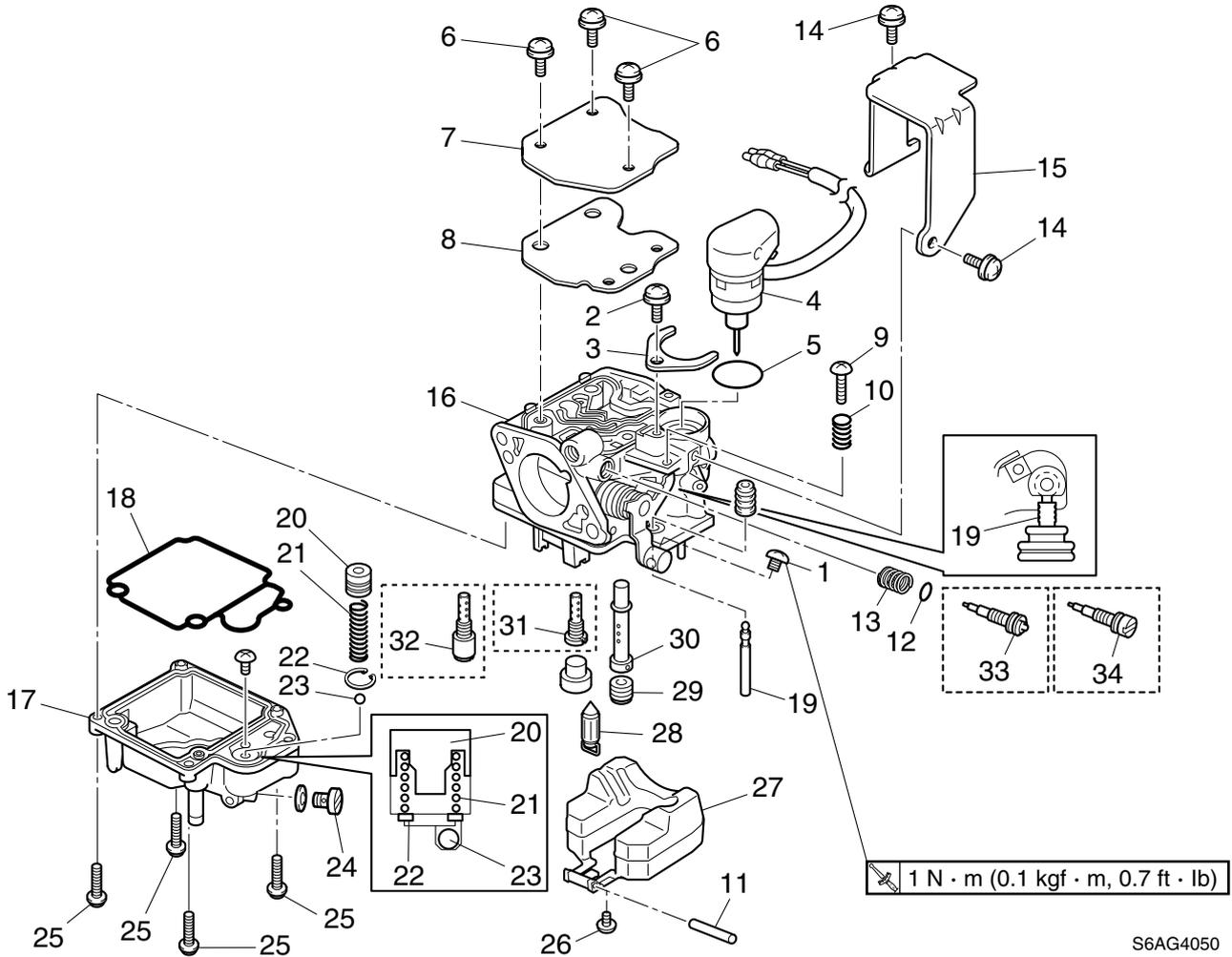
No.	Part name	Q'ty	Remarks
1	Intake silencer	1	
2	Blowby hose	1	
3	Carburetor assembly	1	
4	Gasket	2	<b>Not reusable</b>
5	Spacer	1	
6	Grommet	1	
7	Bolt	2	M6 × 100 mm
8	Bolt	1	
9	O-ring	1	<b>Not reusable</b>
10	Plastic tie	1	
11	Throttle link rod	1	
12	Clamp	1	

Carburetor



S6AG4050

No.	Part name	Q'ty	Remarks
1	Screw	1	ø4 × 5 mm
2	Screw	1	ø4 × 10 mm
3	Retainer	1	
4	Prime Start	1	
5	O-ring	1	<b>Not reusable</b>
6	Screw	3	ø4 × 10 mm
7	Cover	1	
8	Gasket	1	<b>Not reusable</b>
9	Throttle stop screw	1	
10	Spring	1	
11	Pin	1	
12	O-ring	1	<b>Not reusable</b>
13	Spring	1	
14	Screw	2	ø4 × 8 mm
15	Protector	1	
16	Carburetor body	1	
17	Float chamber	1	

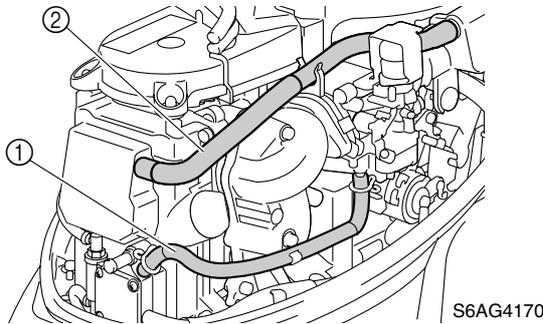


S6AG4050

No.	Part name	Q'ty	Remarks
18	Gasket	1	<b>Not reusable</b>
19	Plunger rod	1	
20	Plunger	1	
21	Spring	1	
22	Circlip	1	
23	Ball	1	
24	Drain screw	1	
25	Screw	4	ø4 × 13 mm
26	Screw	1	ø4 × 7 mm
27	Float	1	
28	Needle valve	1	
29	Main jet	1	
30	Main nozzle	1	
31	Pilot jet	1	For F20
32	Pilot jet	1	For F15
33	Pilot screw	1	For Europe
34	Pilot screw	1	For Oceania

### Removing the carburetor

1. Disconnect the fuel hose ①, and the blowby hose ②.

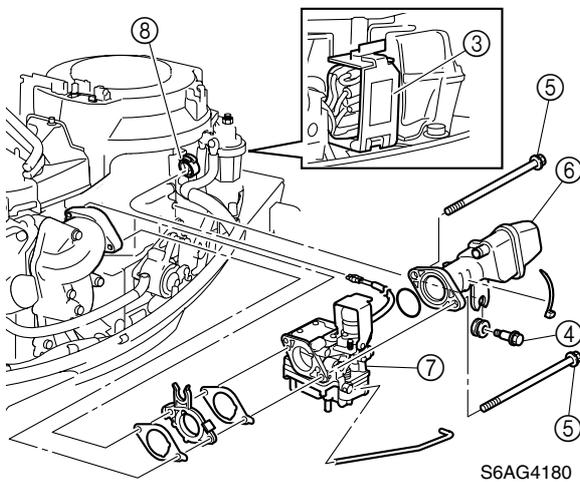


2. Disconnect the throttle link rod and Prime Start connectors.

**NOTE:**

The Prime Start connectors are located in the junction box ③.

3. Remove the bolts ④ and ⑤, and then remove the intake silencer ⑥ and carburetor assembly ⑦.



**NOTE:**

Before removing the bolts ⑤, remove the fuel filter and remove the Prime Start lead from the holder ⑧.

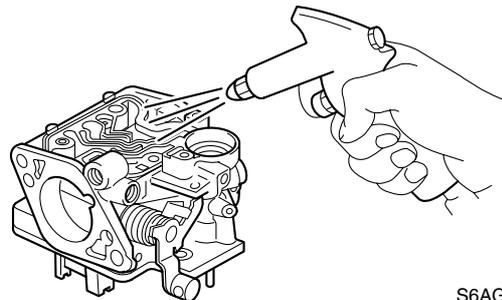
### Disassembling the carburetor

**NOTE:**

See the exploded diagram for disassembly (4-10).

### Checking the carburetor

1. Check the air and fuel passages and jets. Clean the carburetor body if there is dirt or foreign material.
2. Blow compressed air into all passages and jets.



**WARNING**

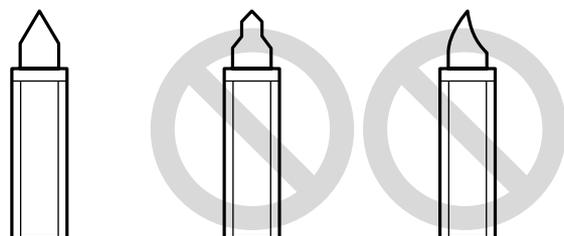
Wear appropriate protective eye gear during the cleaning process to prevent any eye injury by the blown-off debris or liquid.

3. Check the main jet, pilot jet, and main nozzle. Clean if there is dirt or residue.

**CAUTION:**

Do not use steel wire for cleaning the jets, otherwise the jet diameters may be enlarged, which may seriously affect performance.

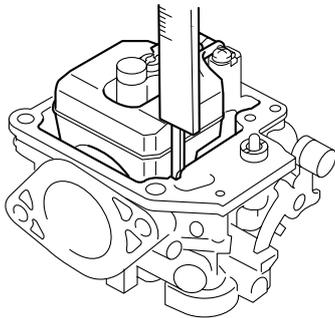
4. Check the pilot screw and needle valve. Replace if worn or deformed.



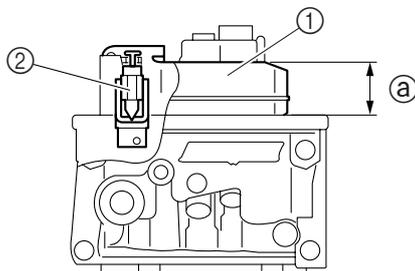
5. Check the float. Replace if cracked or deformed.



6. Measure the float height (a). Replace the float (1) or needle valve (2) if out of specification.



S6AG4220



S6AG4210

**NOTE:**

- Measure the float height when it is resting on the needle valve (2). Do not push down on the float.
- Take measurements at the float position shown opposite its pivoted side.



Float height (a):  
15.0 ± 1.0 mm (0.59 ± 0.04 in)

**Checking the Prime Start**

1. Measure the Prime Start resistance when the Prime Start is cold.

**NOTE:**

Ambient temperature 24 °C (75 °F), with no power supplied.



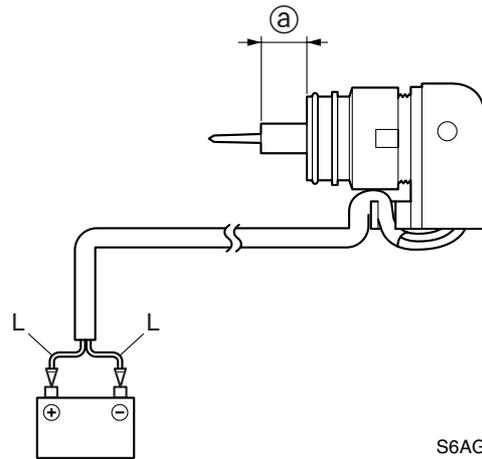
Prime Start resistance (reference data):  
Blue (L) – Blue (L)  
16.4–24.8 Ω at 24 °C (75 °F)

2. Measure the length of the Prime Start plunger before supplying power.



Prime Start plunger length before supplying power (reference data):  
10.7 mm (0.42 in) at 24 °C (75 °F)

3. Connect the Prime Start blue (L) leads to a 12 V battery as shown. Measure the plunger length (a) after supplying power for 10 minutes.



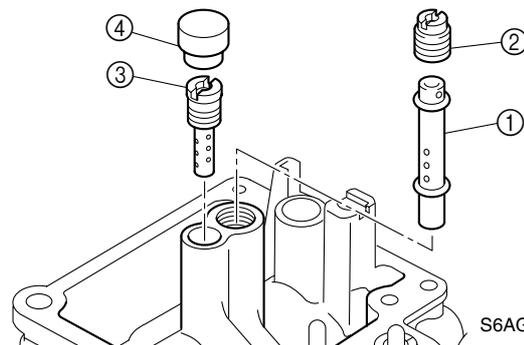
S6AG4230



Prime Start plunger length (a) after supplying power (reference data):  
15.0 mm (0.59 in) at 24 °C (75 °F)

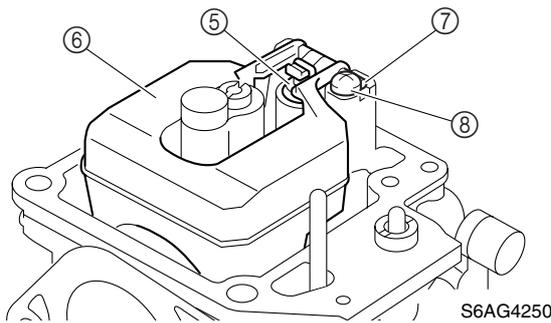
**Assembling the carburetor**

1. Install the main nozzle (1), main jet (2), pilot jet (3), and plug (4) to the carburetor body as shown.



S6AG4240

2. Install the needle valve (5), float (6), float pin (7), and screw (8) as shown, and then check the float for smooth operation.



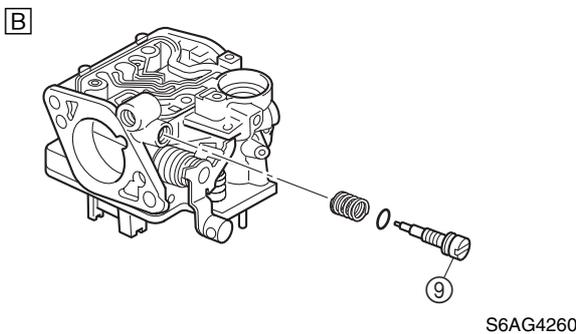
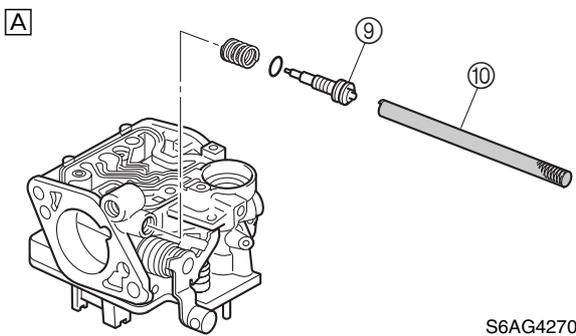
### Installing the carburetor

1. Install the new gaskets ①, spacer ②, carburetor assembly ③, and intake silencer ④ with the bolts ⑤.

**NOTE:**

Install the fuel filter after tightening the bolts and fastening the Prime Start lead with the holder.

3. Install the pilot screw ⑨, turn it in until it is lightly seated, and then turn it out the specified number of turns.

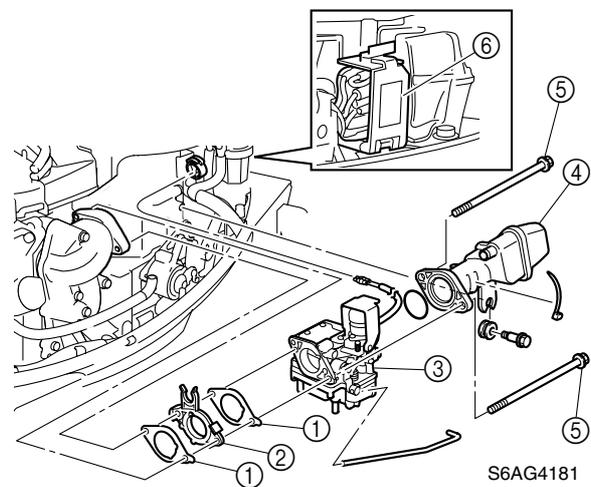


- A For Europe
- B For Oceania

 Pilot screw adjusting tool ⑩ (for Europe): 90890-03154

 Pilot screw setting:  
 F15: 1 ± 1/2 turns out (for Europe)  
 F15: 3 1/8 ± 1/2 turns out (for Oceania)  
 F20: 3 1/2 ± 1/2 turns out (6AH10)  
       3 3/8 ± 1/2 turns out (6AH50) (for Europe)  
 F20: 2 3/4 ± 1/2 turns out (for Oceania)

2. Connect the throttle link rod to the carburetor throttle lever and the Prime Start connectors.



4

**NOTE:**

- To adjust the throttle link rod, see “Adjusting the throttle link” (3-9).
- Place the Prime Start connectors in the junction box ⑥ after connecting them.

3. Adjust the engine idle speed.

**NOTE:**

If the carburetor has been disassembled and assembled, adjust the pilot screw, and then adjust the engine idle speed. See “Adjusting the pilot screw” (4-15).



**Adjusting the pilot screw**

1. Adjust the throttle stop screw.

**NOTE:**

If the carburetor was disassembled, turn the throttle stop screw in until it contacts the carburetor throttle lever, and then turn it in about 1 3/4 turns to tighten it temporarily.

2. Start the engine and warm it up for 10 minutes.

**NOTE:**

- Because the Prime Start operates when the engine is started, the engine idle speed will be above specification. Therefore, check and adjust the engine idle speed after the engine has been warmed up.
- If the engine idle speed does not decrease after the engine has been warmed up for 10 minutes or more, check the Prime Start system as it may be malfunctioning.

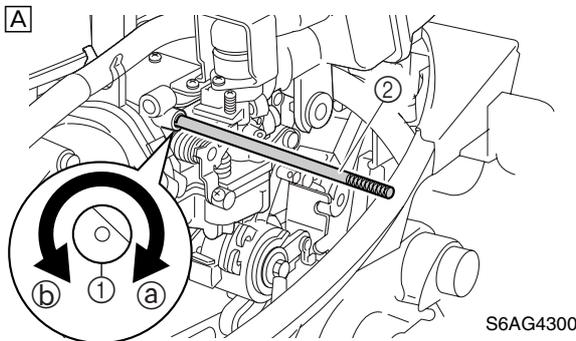
3. Attach the special service tool to spark plug wire #1.



Digital tachometer: 90890-06760

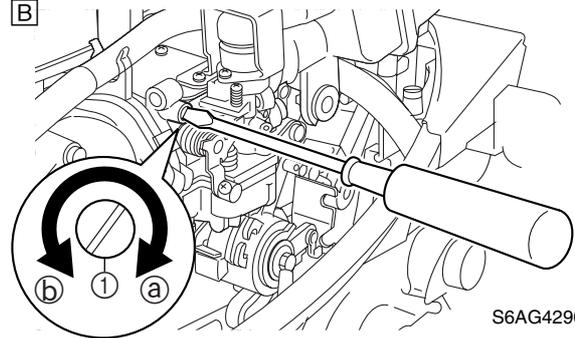
4. Turn the pilot screw ① in direction ③ until it is lightly seated, and then turn it in direction ④ the specified number of turns.

A



S6AG4300

B



S6AG4290

A For Europe

B For Oceania

**NOTE:**

Adjust the pilot screw setting within the specified number of turns out so that the engine idle speed is stable.



Pilot screw adjusting tool ② (for Europe): 90890-03154



Pilot screw setting:

F15: 1 ± 1/2 turns out

(for Europe)

F15: 3 1/8 ± 1/2 turns out

(for Oceania)

F20: 3 1/2 ± 1/2 turns out (6AH10)

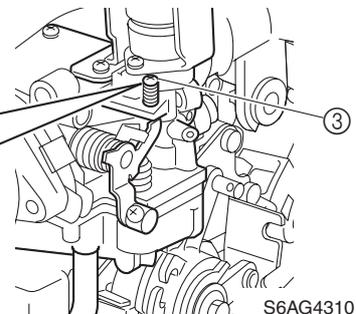
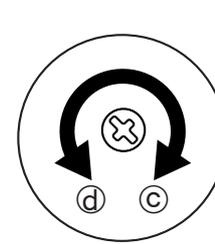
3 3/8 ± 1/2 turns out (6AH50)

(for Europe)

F20: 2 3/4 ± 1/2 turns out

(for Oceania)

5. Turn the throttle stop screw ③ in direction ③ or ④ until the specified engine idle speed is obtained.



S6AG4310

**NOTE:** \_\_\_\_\_

- To increase the engine idle speed, turn the throttle stop screw ③ in direction ㉞.
- To decrease the engine idle speed, turn the throttle stop screw ③ in direction ㉟.



Engine idle speed: 1,050 ± 50 r/min

6. After adjusting the engine idle speed, rev the engine a few times and let it idle to check the stability of the engine.



## Power unit

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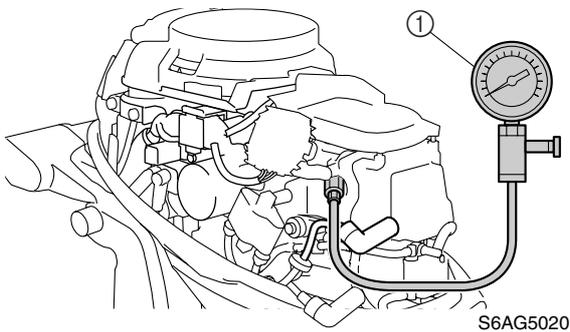
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**Power unit (check and adjustment)**

**Checking the compression pressure**

1. Start the engine, warm it up, and then turn it off.
2. Remove the clip from the engine stop lanyard switch.
3. Disconnect the spark plug caps, remove the spark plugs, and then install the special service tool ① into a spark plug hole.



**CAUTION:**

**Before removing the spark plugs, remove any dirt or dust in the spark plug wells that may fall into the cylinders.**



Compression gauge ①:  
90890-03160

4. Fully open the throttle.
5. Crank the engine until the reading on the compression gauge stabilizes, and then measure the compression pressure.

**NOTE:**

Since this outboard motor is equipped with an automatic decompression mechanism, the compression pressure may vary depending on the speed at which the starter handle is pulled when using the manual starter to crank the engine. (Manual starter model)



Minimum compression pressure (reference data):  
730 kPa (7.3 kgf/cm<sup>2</sup>, 105.9 psi)  
(Manual starter model)  
860 kPa (8.6 kgf/cm<sup>2</sup>, 124.7 psi)  
(Electric starter model)

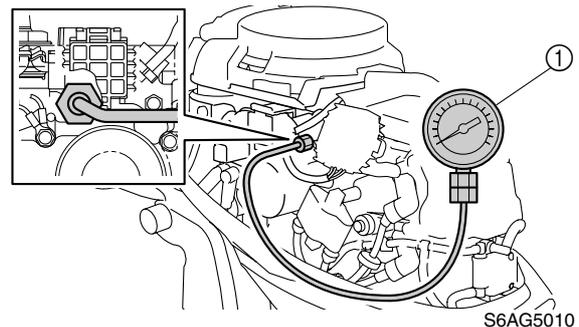
6. If the compression pressure is below specification or the compression pressure for each cylinder is unbalanced, add a small amount of engine oil to the cylinder, and then measure the pressure again.

**NOTE:**

- If the compression pressure increases, check the pistons and piston rings. Replace if worn.
- If the compression pressure does not increase, check the valve clearances, valves, valve seats, cylinder sleeves, cylinder head gasket, and cylinder head. Adjust or replace if necessary.

**Checking the oil pressure**

1. Remove the oil pressure switch, and then install an oil pressure gauge ① to the oil pressure switch installation hole.



**NOTE:**

Use a commercially available oil pressure gauge ①.

2. Start the engine and warm it up for 10 minutes.

**NOTE:** \_\_\_\_\_

Because the Prime Start operates when the engine is started, the engine idle speed will be above specification. Therefore, measure the oil pressure after the engine has been warmed up.

3. Measure the oil pressure. Check the oil pump and oil strainer, and for oil leakage if out of specification.

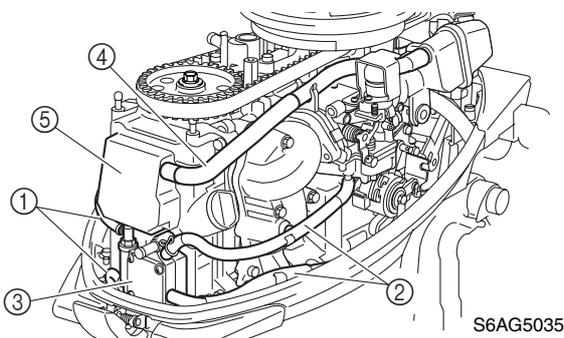
	Oil pressure (reference data): 400 kPa (4.0 kgf/cm <sup>2</sup> , 58.0 psi) at engine idle speed
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**Checking the valve clearance**

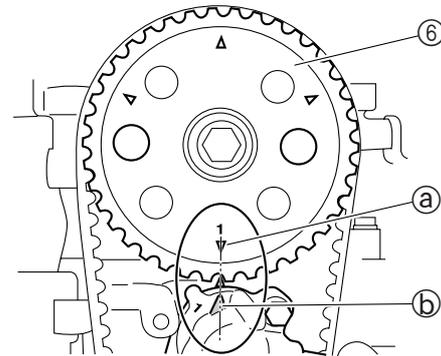
**NOTE:** \_\_\_\_\_

Measure the valve clearances when the engine is cold.

1. Remove the sprocket cover and manual starter. (Manual starter model)  
Remove the sprocket cover and flywheel magnet cover. (Electric starter model)
2. Disconnect the spark plug caps and remove the spark plugs.
3. Remove the cooling water hoses ①, fuel hoses ②, fuel pump ③, blowby hose ④, and cylinder head cover ⑤.

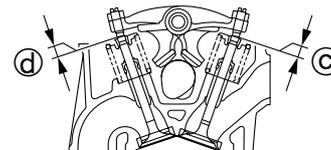
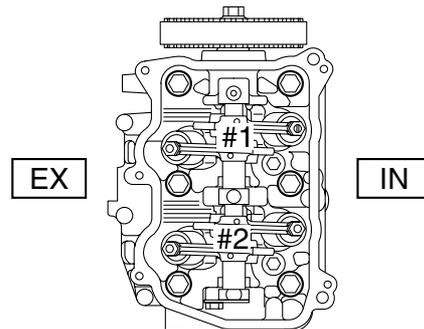


4. Turn the flywheel magnet clockwise and align the “1 ▲” mark ① on the driven sprocket ② with the “▲” mark ③ on the cylinder head.



S6AG5050

5. Measure the intake and exhaust valve clearances for cylinder #1. Adjust if out of specification.



S6AG5G10

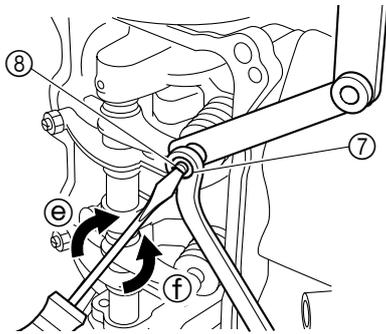
**NOTE:** \_\_\_\_\_

Note the measurement data.

	Valve clearance: Intake ③: 0.15–0.25 mm (0.006–0.010 in) Exhaust ④: 0.25–0.35 mm (0.010–0.014 in)
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- Loosen the rocker arm locknut (7), and then turn the adjusting screw (8) until the specified valve clearance is obtained.



S6AG5060

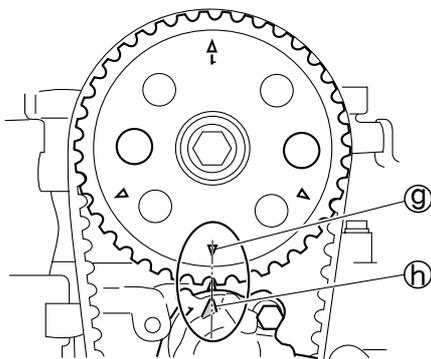
**NOTE:**

- To decrease the valve clearance, turn the adjusting screw in direction (e).
- To increase the valve clearance, turn the adjusting screw in direction (f).

- Tighten the rocker arm locknut to the specified torque.

	<p>Rocker arm locknut (7): 14 N·m (1.4 kgf·m, 10.3 ft·lb)</p>
---	---

- Turn the flywheel magnet an additional 360° clockwise and align the “▲” mark (g) on the driven sprocket with the “▲” mark (h) on the cylinder head.



S6AG5051

- Repeat steps 5–7 for cylinder #2.
- Install all parts removed during removal.

**Replacing the timing belt**

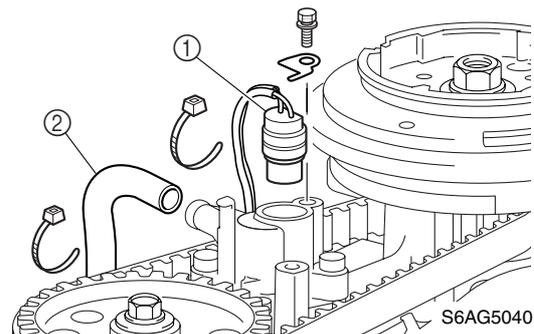
**CAUTION:**

Do not turn the flywheel magnet counter-clockwise, otherwise the water pump impeller may be damaged.

**NOTE:**

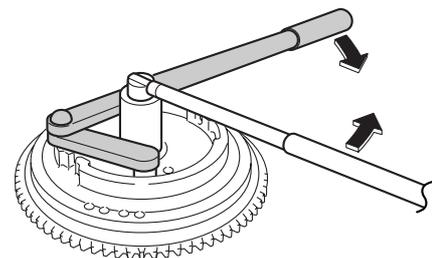
To remove and install the timing belt, drive sprocket, and driven sprocket, see “Removing the timing belt and sprocket” (5-30) and “Installing the sprocket and timing belt” (5-31).

- Disconnect the spark plug caps and remove the spark plugs.
- Remove the thermostat (1) and cooling water hose (2) from the thermostat cover.



S6AG5040

- Remove the flywheel magnet nut.



S6AG5G30

**WARNING**

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

## Power unit (check and adjustment)

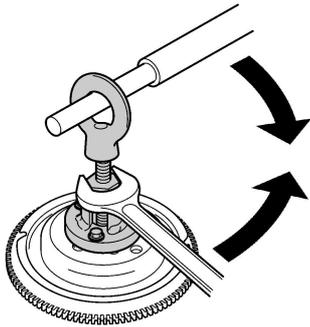
### NOTE:

Use a 24 mm socket to loosen the flywheel magnet nut.

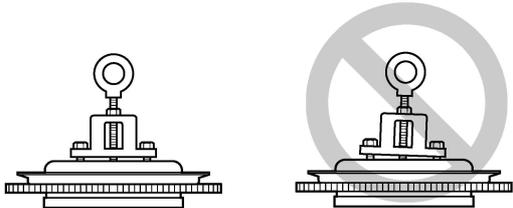


Flywheel holder: 90890-06522

4. Remove the flywheel magnet and Woodruff key.



S63P5280



S63P5290

### CAUTION:

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

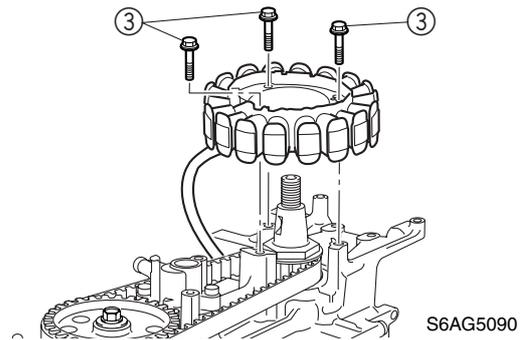
### NOTE:

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



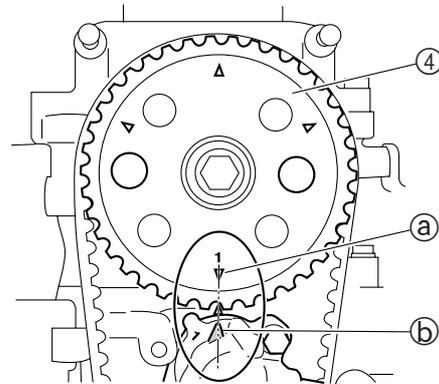
Flywheel puller: 90890-06521

5. Remove the stator coil assembly bolts ③, and then remove the stator coil assembly.

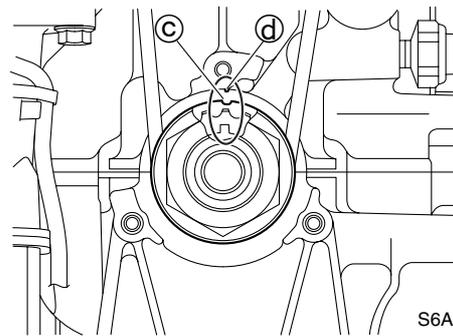


S6AG5090

6. Align the “1 ▲” mark ④ on the driven sprocket with the “▲” mark ⑥ on the cylinder head.



S6AG5055



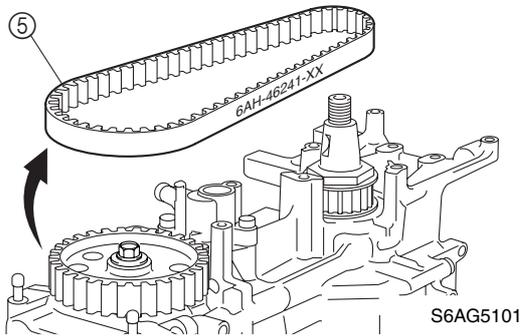
S6AG5B25

### NOTE:

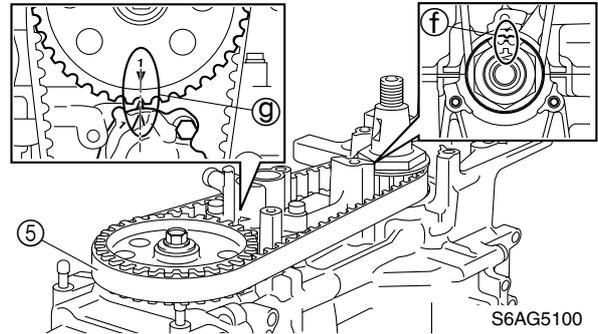
Check that the mark ④ on the drive sprocket and the mark ④ on the cylinder block are aligned.



- Remove the timing belt ⑤ from the driven sprocket, and then remove it from the drive sprocket.



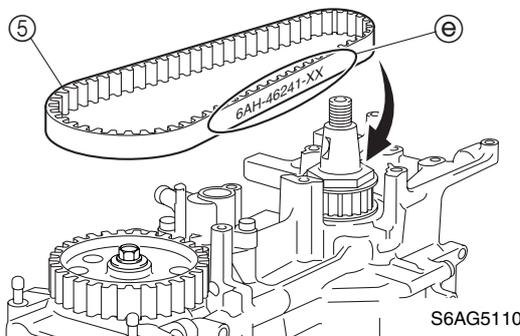
- Turn the drive sprocket clockwise 2 turns, and then check that the alignment marks ⑆ and ⑨ are aligned.



**CAUTION:**

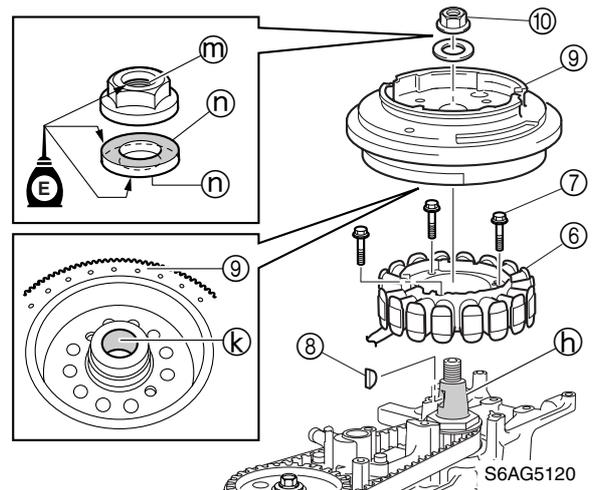
Unless directed to do so in the following instructions, do not turn the drive sprocket or driven sprocket when the timing belt is not installed. Otherwise the pistons and valves will collide with each other and be damaged.

- Install a new timing belt ⑤ onto the drive sprocket, and then install it onto the driven sprocket with its part number in the upright position ⑥.



- Install the stator coil assembly ⑥ with bolts ⑦.

- Install the Woodruff key ⑧, and then install the flywheel magnet ⑨.



**CAUTION:**

- Do not twist, turn inside out, or bend the timing belt beyond the maximum limit of 25 mm (1.0 in), otherwise it can be damaged.
- Do not get oil or grease on the timing belt.

**NOTE:**

- Be sure to remove any grease from the tapered portion of the crankshaft ④ and flywheel magnet ⑤.
- Apply engine oil to the threads ③ of the flywheel magnet nut ⑩ and washer ④ before installation.

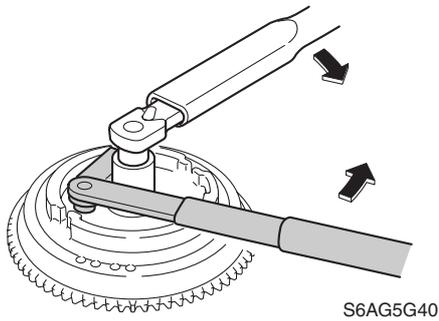


Stator coil assembly bolt ⑦:  
8 N·m (0.8 kgf·m, 5.9 ft·lb)

**NOTE:**

Before installing the timing belt, make sure that the marks on the drive sprocket and driven sprocket are aligned with the marks on the cylinder block and cylinder head.

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



**⚠ WARNING**

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



Flywheel holder: 90890-06522

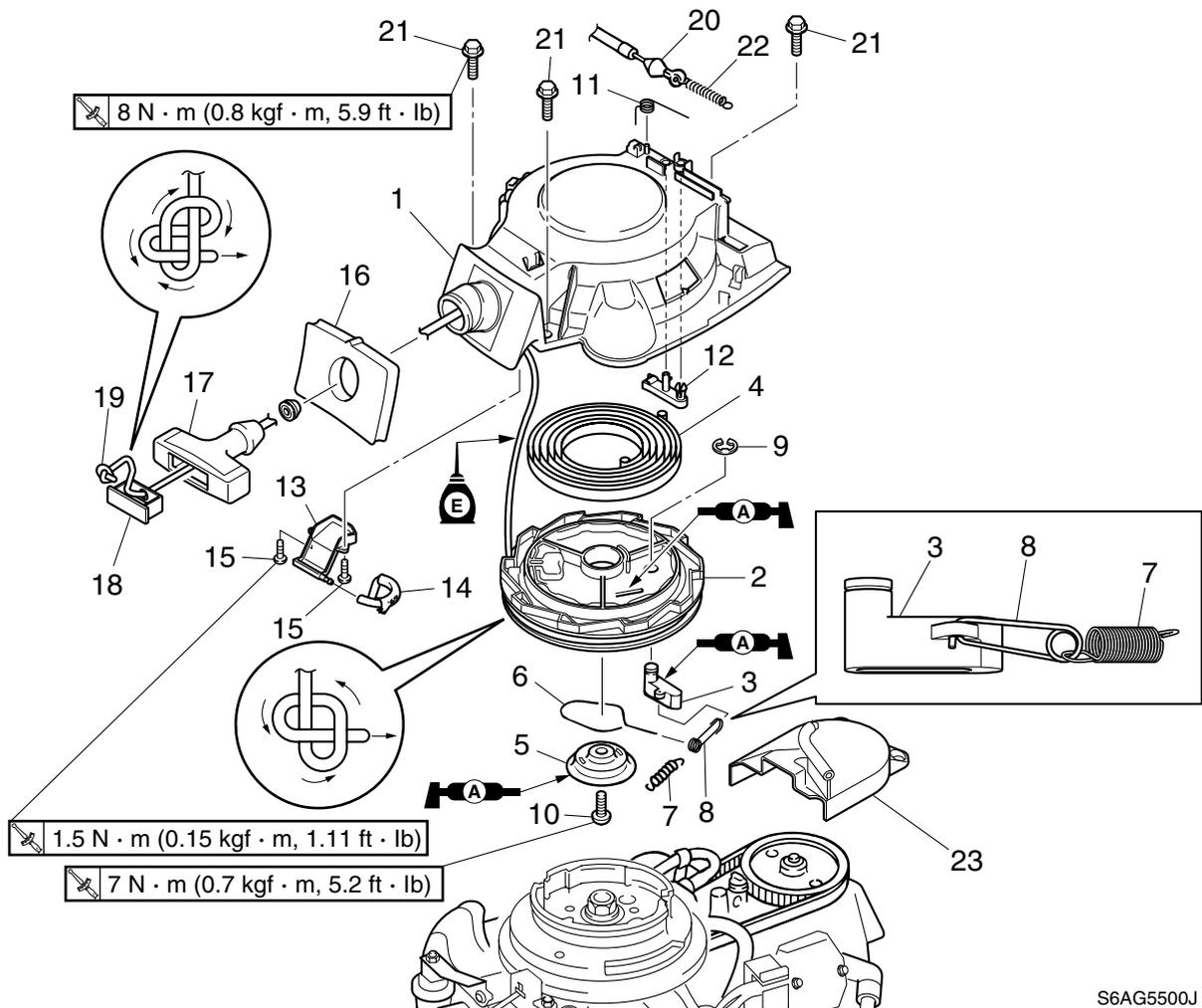


Flywheel magnet nut ⑩:  
108 N·m (10.8 kgf·m, 79.7 ft·lb)

13. Install all parts removed during disassembly.

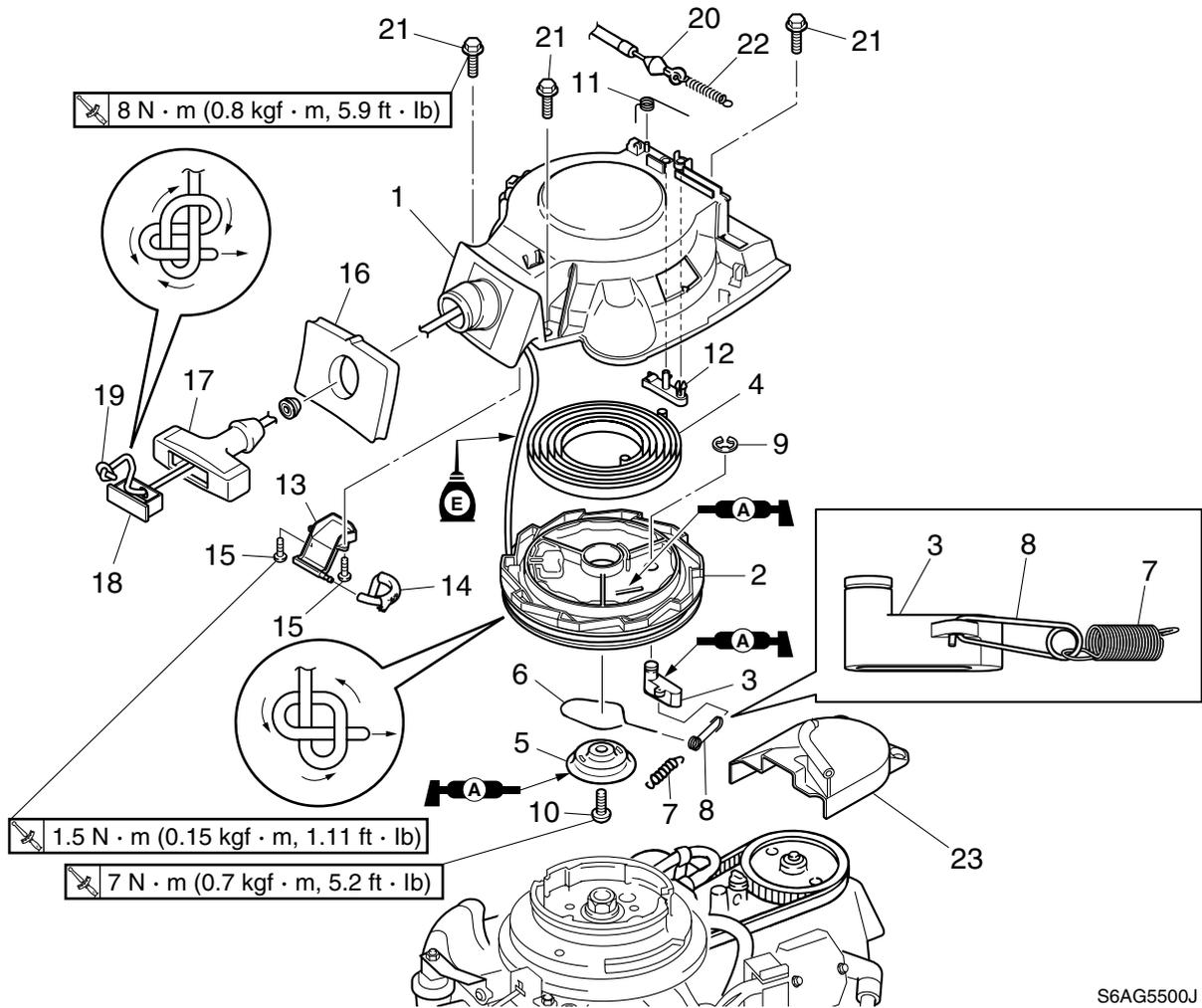


Manual starter (manual starter model)



S6AG5500J

No.	Part name	Q'ty	Remarks
1	Cover	1	
2	Sheave drum	1	
3	Drive pawl	1	
4	Spiral spring	1	
5	Drive plate	1	
6	Drive pawl spring 1	1	
7	Spring	1	
8	Drive pawl spring 2	1	
9	E-clip	1	
10	Screw	1	ø5 × 20 mm
11	Spring	1	
12	Starter plunger	1	
13	Cover	1	
14	Drain hose	1	
15	Screw	2	ø4 × 16 mm
16	Packing	1	<b>Not reusable</b>
17	Starter handle	1	



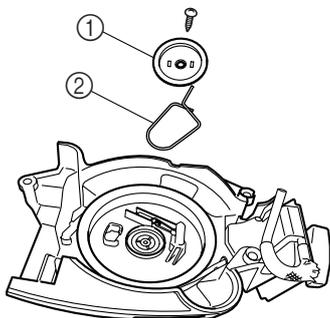
S6AG5500J

No.	Part name	Q'ty	Remarks
18	Cap	1	
19	Starter rope	1	1,800 mm (70.9 in)
20	Start-in-gear protection cable	1	
21	Bolt	3	M6 × 20 mm
22	Spring	1	
23	Driven sprocket cover	1	



**Disassembling the manual starter**

1. Remove the drive plate ① and drive pawl spring 1 ②.

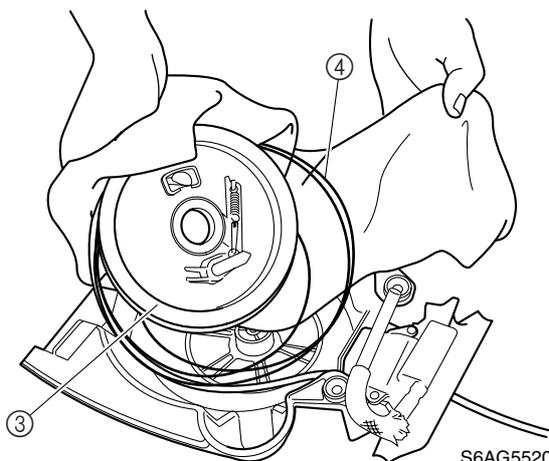


S6AG5510

**⚠ WARNING**

The sheave drum can pop out. Hold the sheave drum with your hand, and then remove the drive plate.

2. Remove the sheave drum ③.



S6AG5520

**⚠ WARNING**

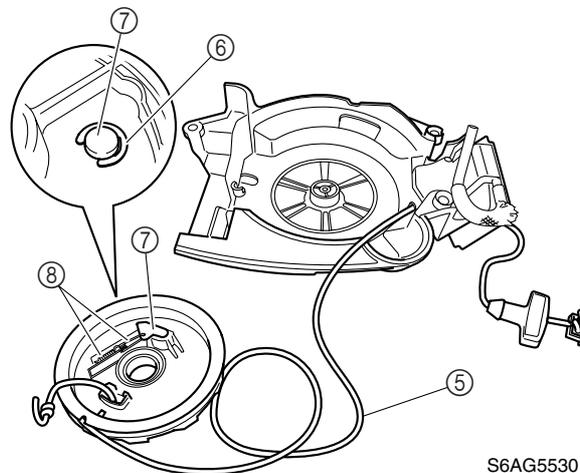
The spiral spring can pop out. Cover the spiral spring with rags, and then pull out the sheave drum.

3. Remove the spiral spring ④ from the manual starter cover.

**⚠ WARNING**

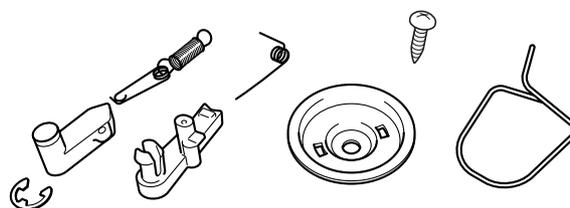
The spiral spring can pop out. Cover the spiral spring with rags when removing it.

4. Remove the starter rope ⑤ and E-clip ⑥, and then remove the drive pawl ⑦ and springs ⑧ from the sheave drum.



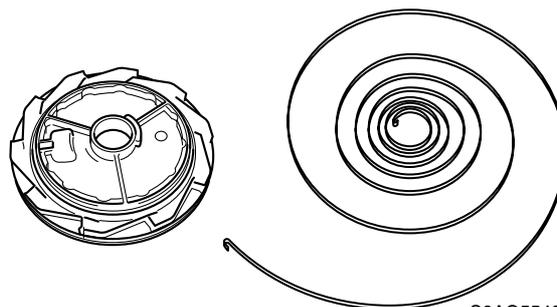
S6AG5530

5. Check the drive pawl, E-clip, starter plunger, and drive plate. Replace if cracked or damaged.
6. Check the springs. Replace if bent, cracked, or damaged.



S6AG5550

7. Check the sheave drum. Replace if cracked or damaged.
8. Check the spiral spring. Replace if cracked, bent, or damaged.



S6AG5540

### Manual starter (manual starter model)

9. Check the starter handle. Replace if cracked or damaged.
10. Check the starter rope. Replace if damaged.

**NOTE:** \_\_\_\_\_

- When replacing the starter rope with a new one, make sure that the length is approximately 1,800 mm (70.9 in).
- Be sure to use a genuine Yamaha starter rope.

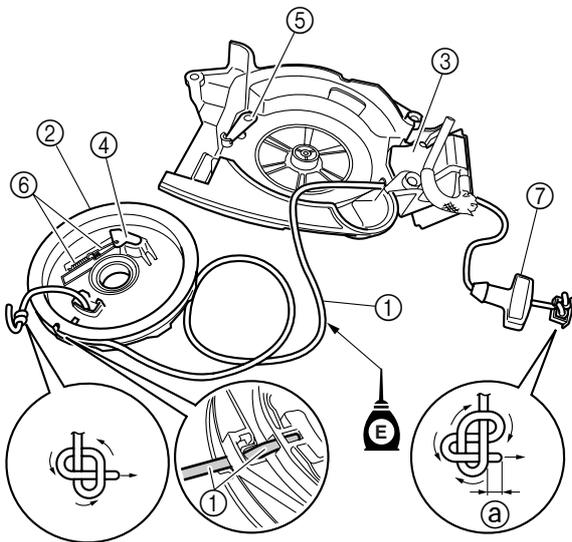
### Assembling the manual starter

1. Install the starter rope ① into the sheave drum ②.

**NOTE:** \_\_\_\_\_

Before installing the cover ③, route the starter rope through the manual starter cover.

2. Install the drive pawl ④, starter plunger ⑤, springs ⑥, and E-clip.
3. Install the starter handle ⑦.

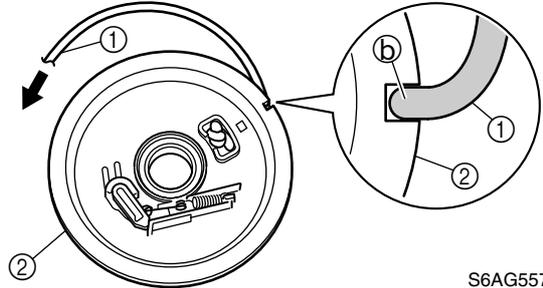


S6AG5560

**NOTE:** \_\_\_\_\_

- Tie a knot at the end of the starter rope as shown in the illustration.
- Be sure to leave 12–20 mm (0.47–0.79 in) at the end (a) of the starter rope.

4. Wind the starter rope ① twice around the sheave drum ② in the direction of the arrow shown in the illustration.

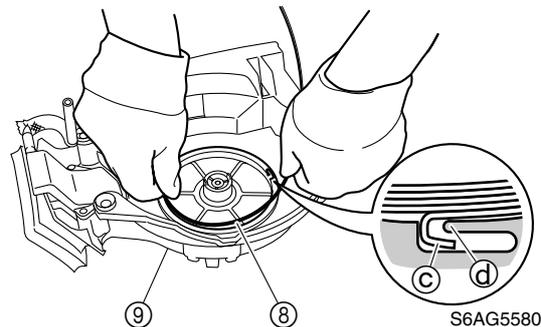


S6AG5570

**NOTE:** \_\_\_\_\_

After winding the starter rope ① around the sheave drum ②, install the starter rope in the notch (b).

5. Install the spiral spring ⑧ into the manual starter cover ⑨.



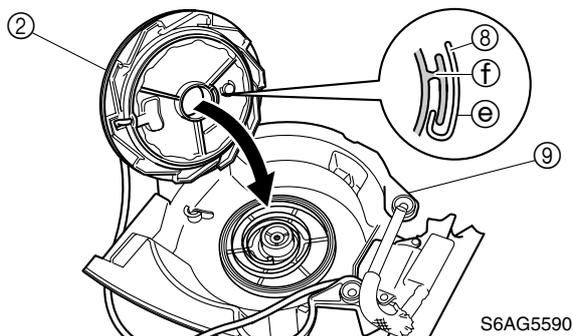
S6AG5580

**NOTE:** \_\_\_\_\_

Hook the end (c) of the spiral spring ⑧ onto the cut-out (d) in the starter cover.

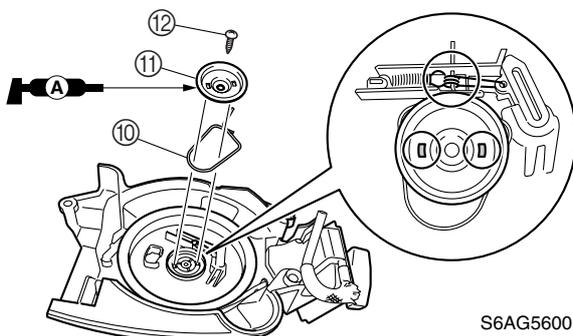


6. Install the sheave drum ② into the manual starter cover ⑨.



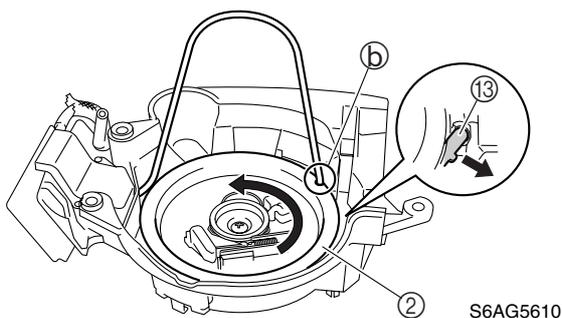
- NOTE:**
- When installing the sheave drum, set the spiral spring by turning the sheave drum.
  - Hook the end ⑥ of the spiral spring ⑧ onto the cut-out ① in the sheave drum ②.

7. Install drive pawl spring 1 ⑩ and the drive plate ⑪, and then tighten the screw ⑫ to the specified torque.



	<p>Drive plate screw ⑫: 7 N·m (0.7 kgf·m, 5.2 ft·lb)</p>
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8. Turn the sheave drum ② 4 turns in the direction of the arrow shown.

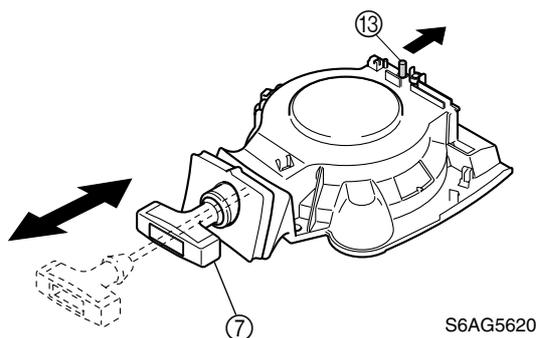


- NOTE:**
- Hold the starter plunger ⑬ while turning the sheave drum as shown.

9. Remove the starter rope from the notch ⑬, and then fit the starter rope into the groove in the sheave drum.

- NOTE:**
- Be sure to hold the sheave drum with your hand so that it turns slowly.
  - Allow the spring force to slowly turn the drum as the starter rope winds around the drum.

10. Pull the starter handle ⑦ several times to check that the sheave drum turns smoothly and to check the starter rope for slack. Repeat steps 4–9 if necessary.



- NOTE:**
- Hold the starter plunger ⑬ while pulling the starter handle ⑦.

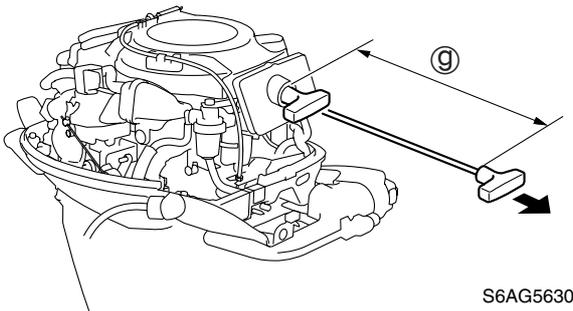
11. Install the manual starter onto the power unit, tighten the bolts to the specified torque, and then connect the start-in-gear protection cable.

	<p>Manual starter bolt: 8 N·m (0.8 kgf·m, 5.9 ft·lb)</p>
--	--

**NOTE:** \_\_\_\_\_

- Route the start-in-gear protection cable in its original position.
- To adjust the start-in-gear protection cable, see “Checking the start-in-gear protection (manual starter model)” (3-11).

12. Pull the starter handle completely, and then measure the starter rope length ⑨.



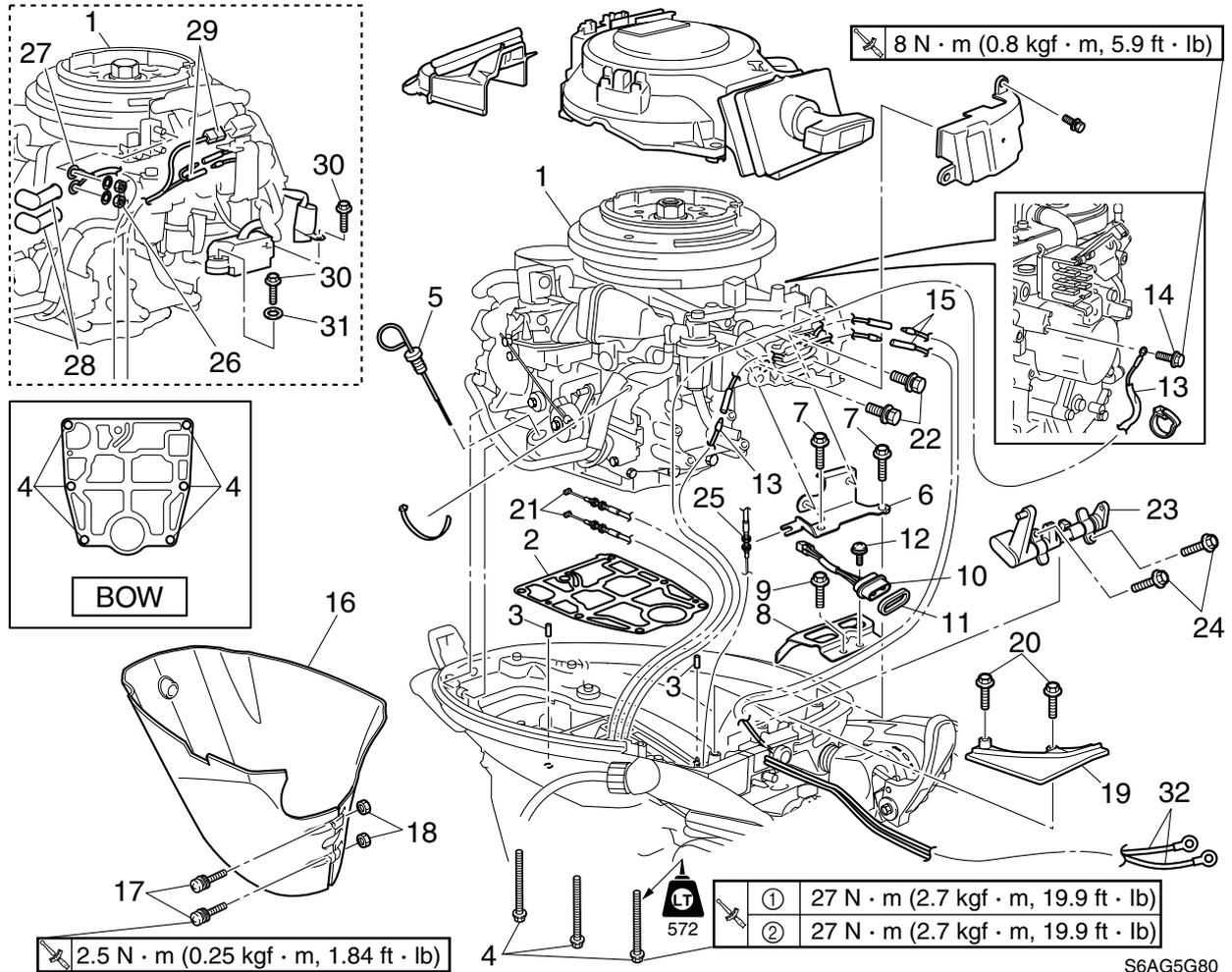
S6AG5630

	<b>Starter rope pulling length ⑨:</b> 1,400–1,600 mm (55.12–62.99 in)
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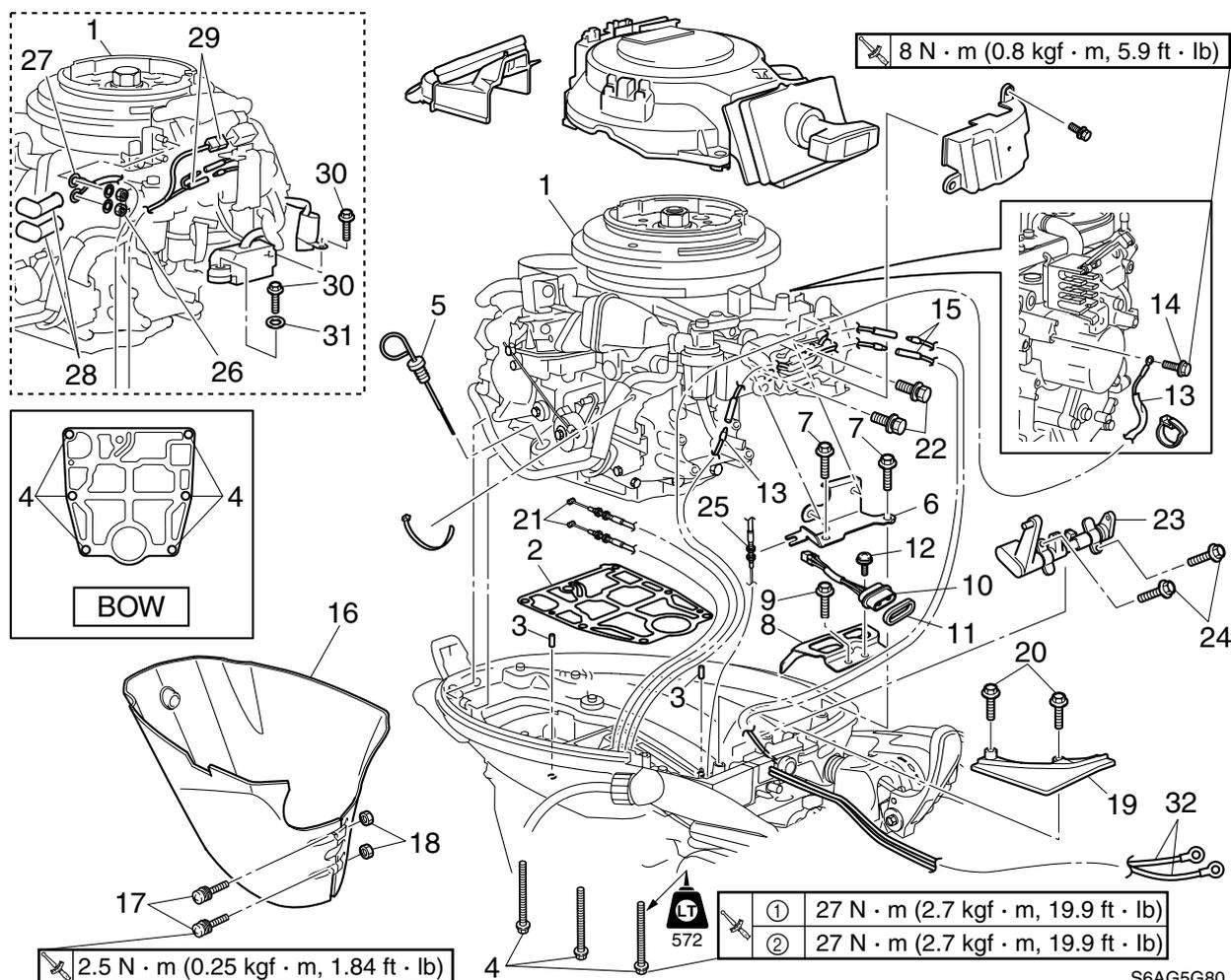
Power unit

Power unit assembly (tiller handle model)



S6AG5G80

No.	Part name	Q'ty	Remarks
1	Power unit	1	
2	Gasket	1	<b>Not reusable</b>
3	Dowel	2	
4	Bolt	6	M8 × 85 mm
5	Oil dipstick	1	
6	Bracket	1	
7	Bolt	2	M6 × 20 mm/Except for power tilt model
8	Bracket	1	
9	Bolt	1	M6 × 20 mm
10	Warning indicator assembly	1	
11	Packing	1	
12	Screw	1	ø6 × 12 mm
13	Engine stop lanyard switch lead	2	
14	Bolt	1	M6 × 15 mm
15	Engine start button lead	2	Electric starter model
16	Apron	1	
17	Screw	2	ø6 × 30 mm

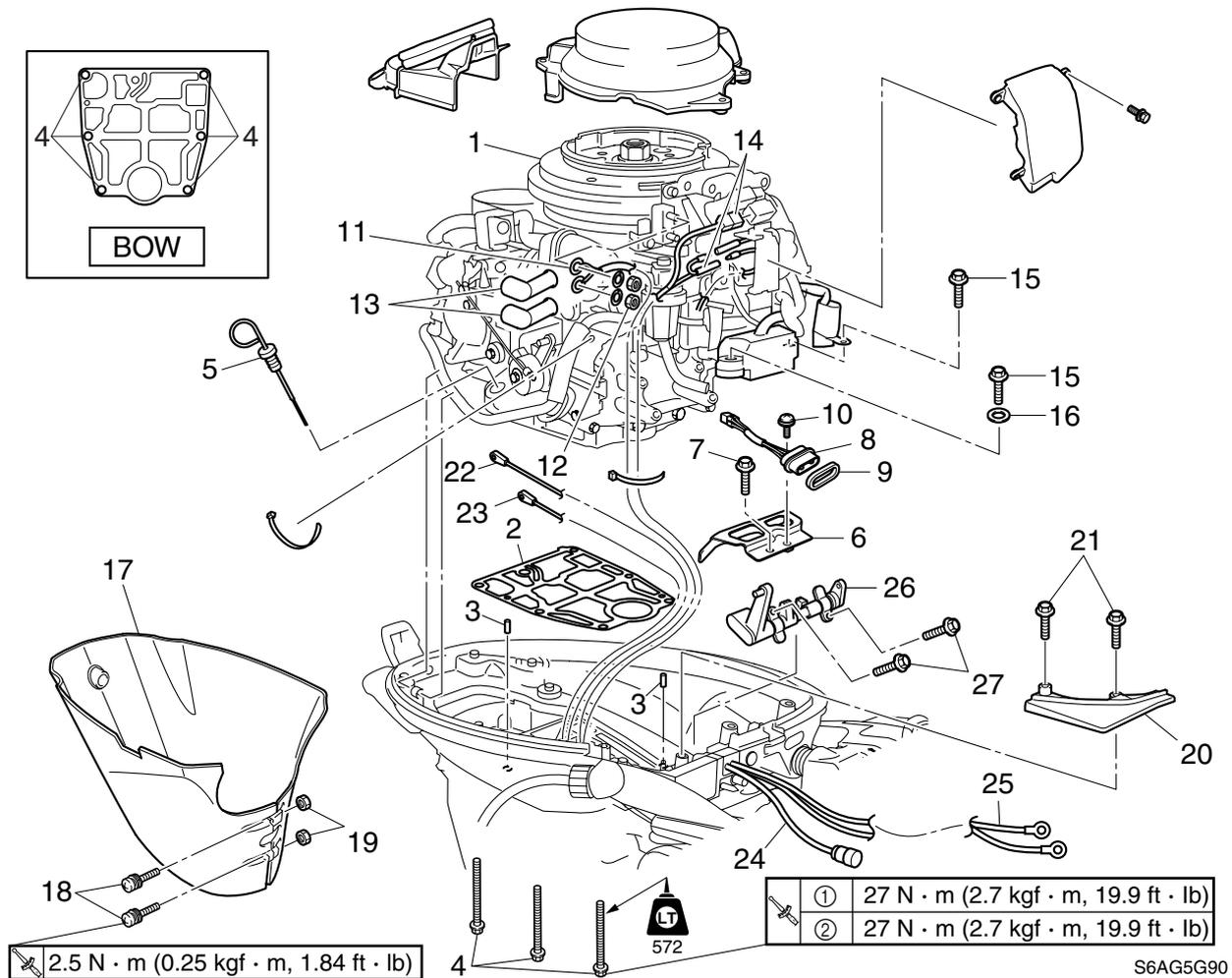


5

No.	Part name	Q'ty	Remarks
18	Nut	2	
19	Retaining plate	1	
20	Bolt	2	M6 × 30 mm
21	Throttle cable	2	
22	Bolt	2	M6 × 14 mm/Except for power tilt model
23	Shift rod cam	1	
24	Bolt	2	M6 × 20 mm
25	Start-in-gear protection cable	1	Manual starter model
26	Nut	2	Power tilt model
27	Power tilt motor lead	1	Power tilt model
28	Cap	2	Power tilt model
29	Power tilt switch lead	2	Power tilt model
30	Bolt	2	M6 × 35 mm/Power tilt model
31	Washer	1	Power tilt model
32	Battery cable	1	Electric starter model

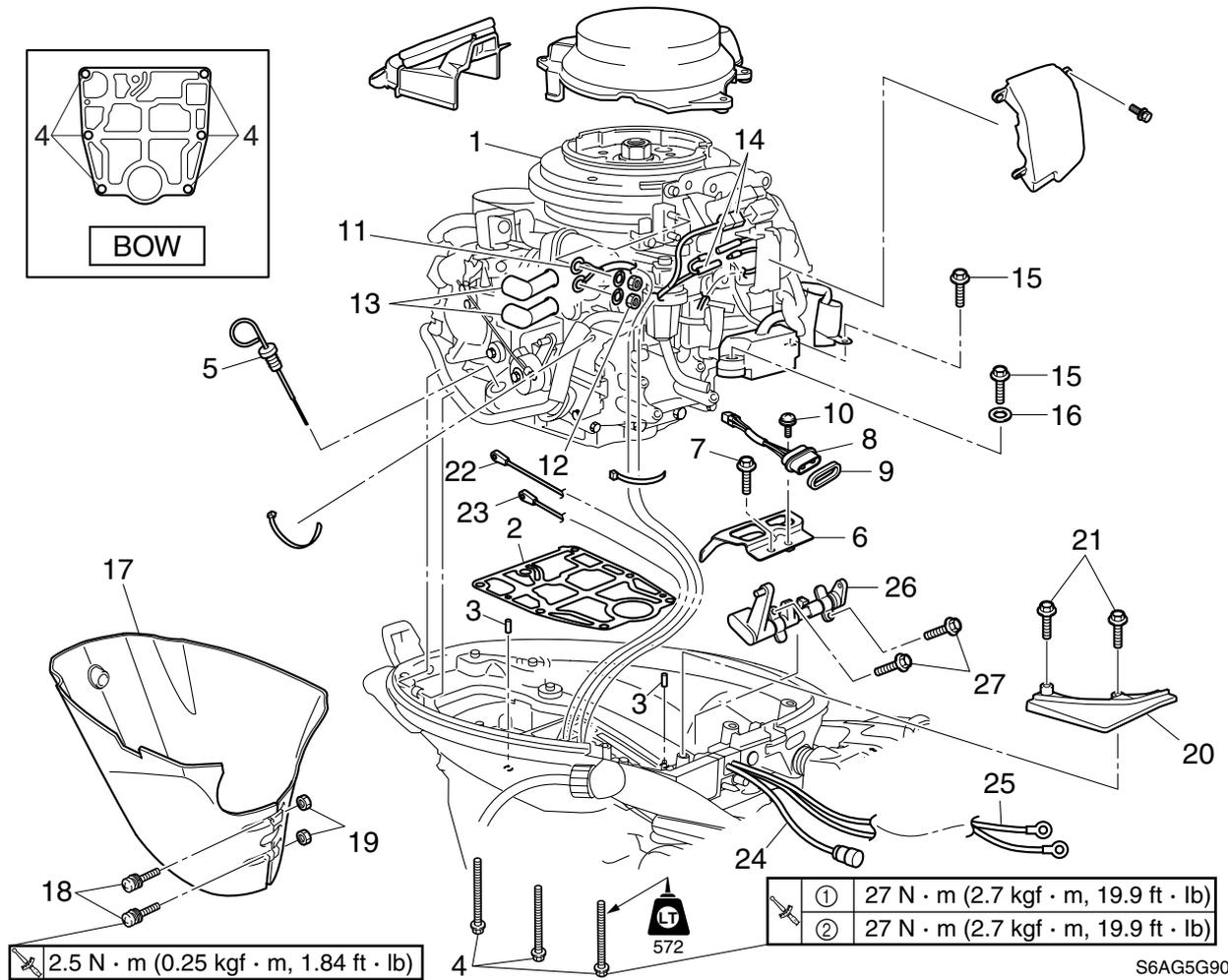


Power unit assembly (remote control model)



S6AG5G90

No.	Part name	Q'ty	Remarks
1	Power unit	1	
2	Gasket	1	<b>Not reusable</b>
3	Dowel	2	
4	Bolt	6	M8 × 85 mm
5	Oil dipstick	1	
6	Bracket	1	
7	Bolt	1	M6 × 20 mm
8	Warning indicator assembly	1	
9	Packing	1	
10	Screw	1	∅6 × 12 mm
11	Power tilt motor lead	1	Power tilt model
12	Nut	2	Power tilt model
13	Cap	2	Power tilt model
14	Power tilt switch lead	1	Power tilt model
15	Bolt	2	M6 × 35 mm/Power tilt model
16	Washer	1	Power tilt model
17	Apron	1	

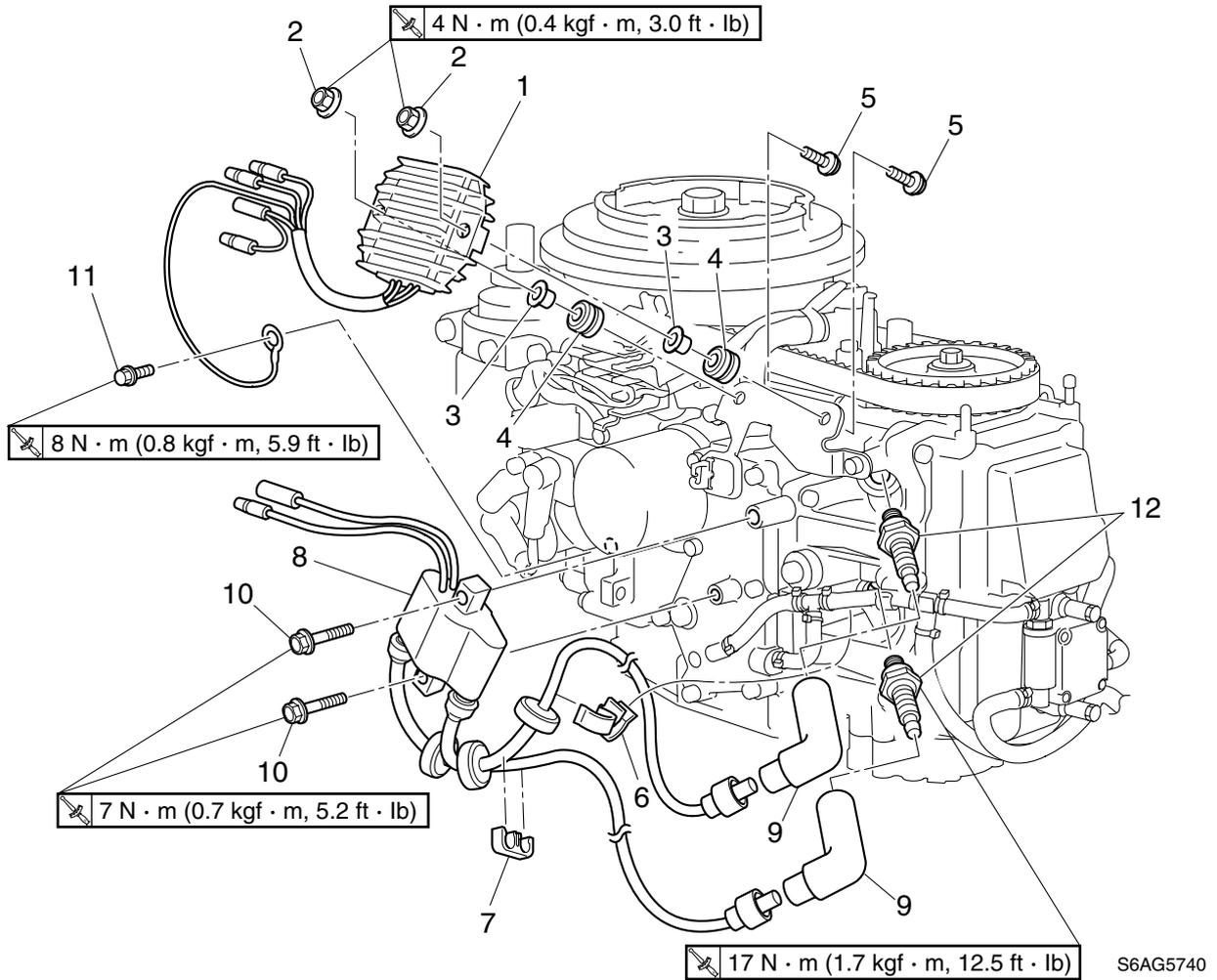


5

No.	Part name	Q'ty	Remarks
18	Screw	2	ø6 × 30 mm
19	Nut	2	
20	Retaining plate	1	
21	Bolt	2	M6 × 30 mm
22	Throttle cable	1	
23	Shift cable	1	
24	10-pin main harness	1	
25	Battery cable	1	
26	Shift rod cam	1	
27	Bolt	2	M6 × 20 mm

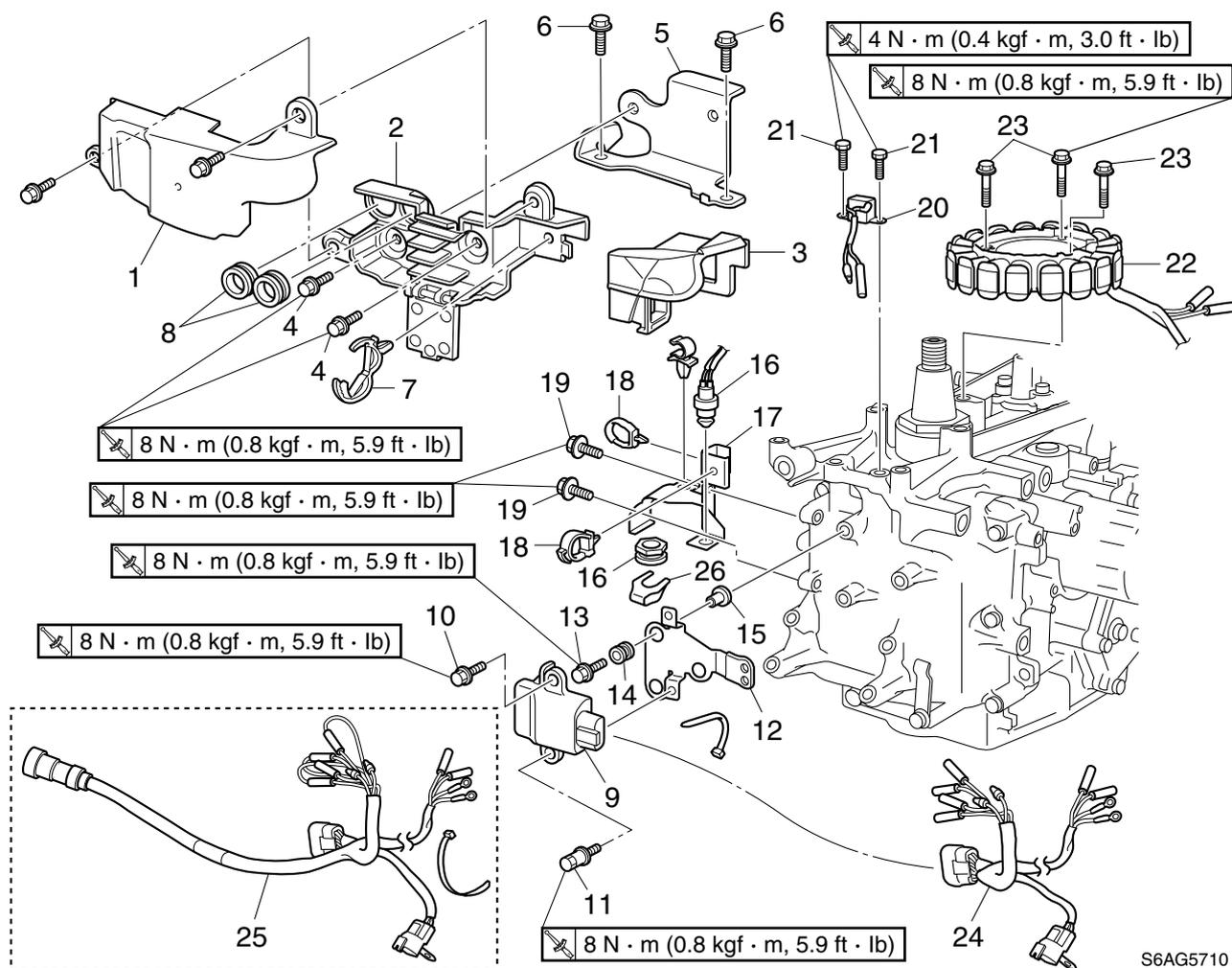


### Ignition coil and Rectifier Regulator



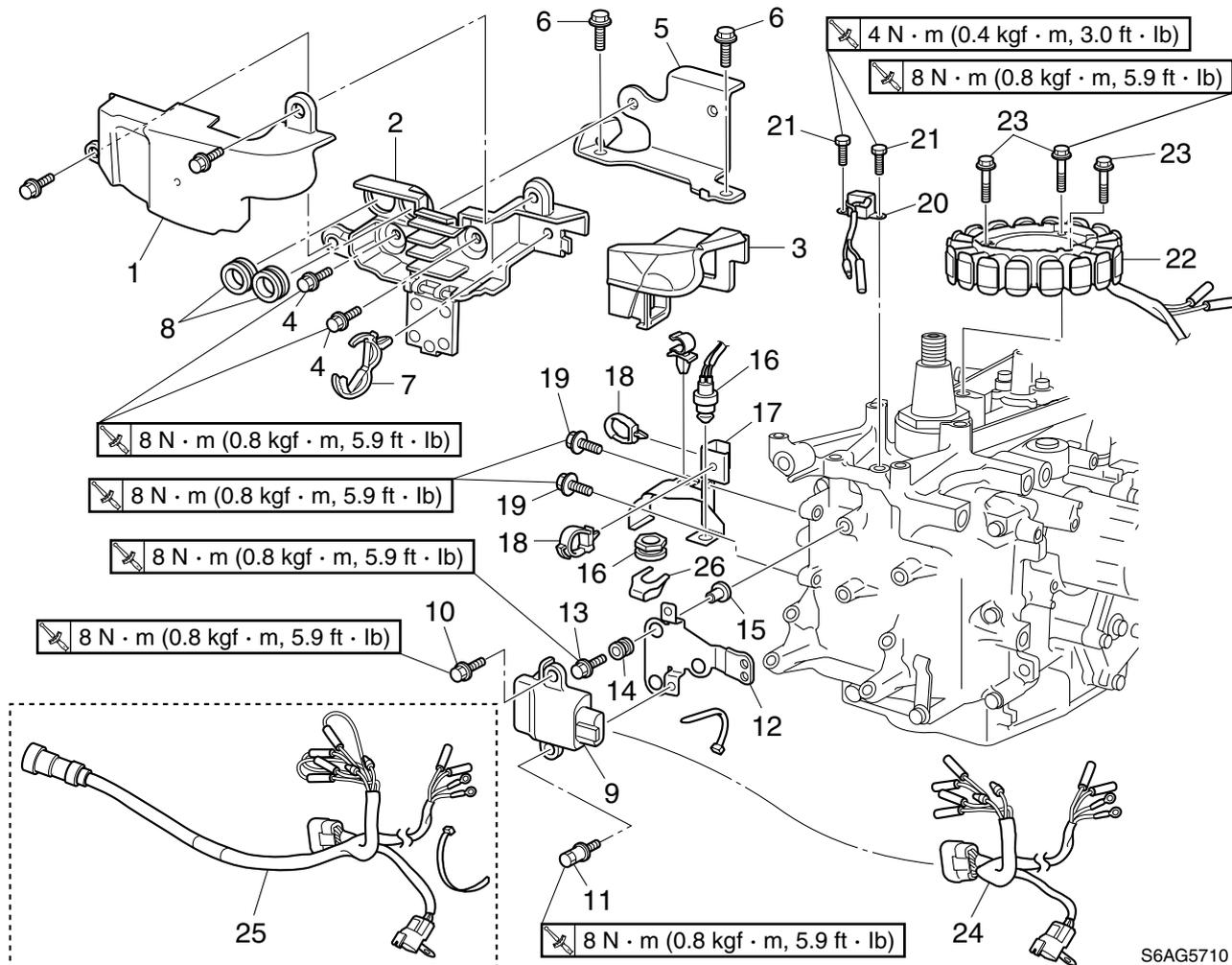
No.	Part name	Q'ty	Remarks
1	Rectifier Regulator	1	Electric starter model
2	Nut	2	Electric starter model
3	Collar	2	Electric starter model
4	Grommet	2	Electric starter model
5	Screw	2	ø6 × 30 mm/Electric starter model
6	Holder	1	
7	Holder	1	
8	Ignition coil	1	
9	Spark plug cap	2	
10	Bolt	2	M6 × 25 mm
11	Bolt	1	M6 × 15 mm
12	Spark plug	2	

CDI unit and junction box (manual tilt model)



S6AG5710

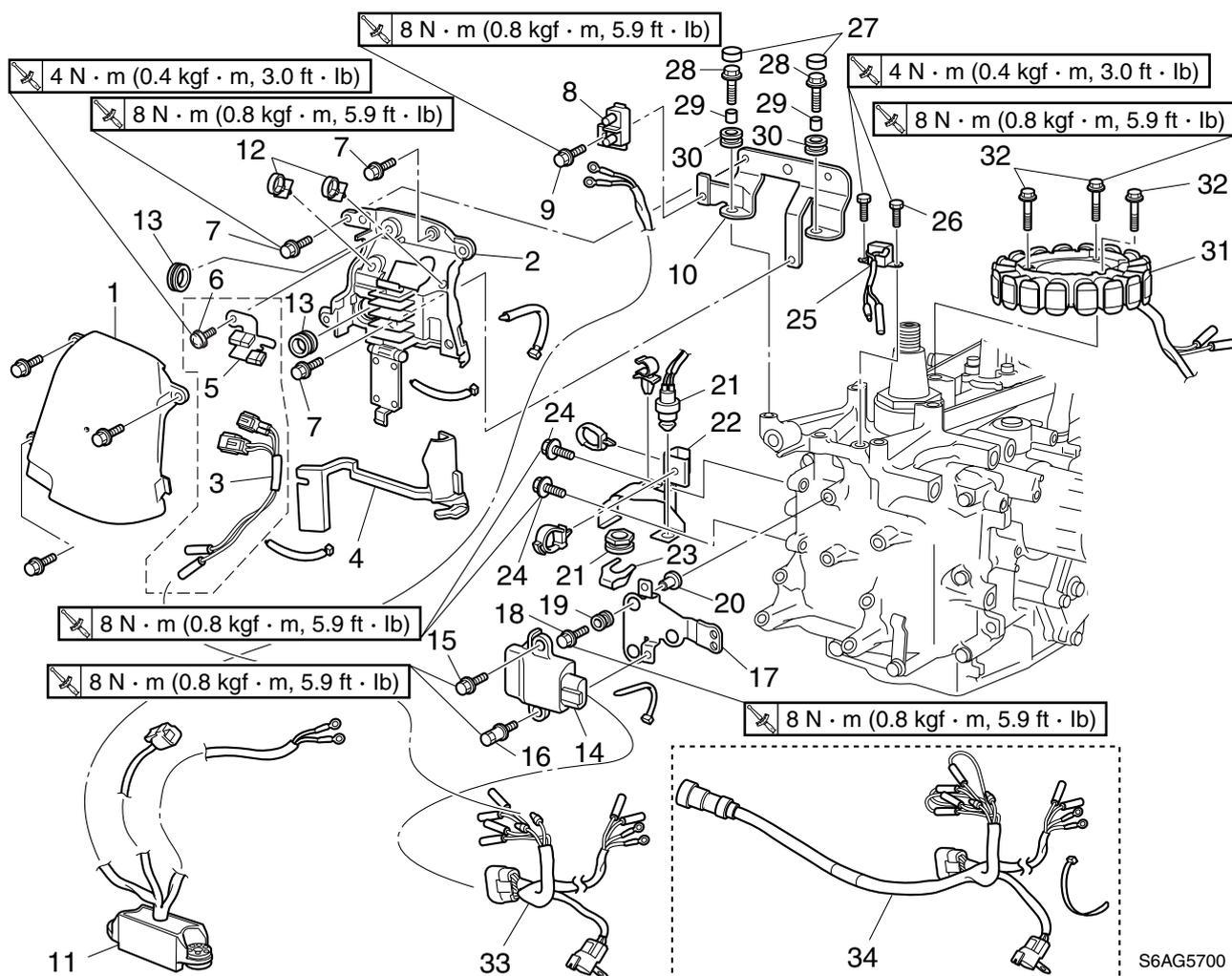
No.	Part name	Q'ty	Remarks
1	Junction box cover	1	
2	Junction box	1	
3	Damper	1	
4	Bolt	2	M6 × 14 mm
5	Bracket	1	
6	Bolt	2	M6 × 20 mm
7	Holder	1	
8	Grommet	2	
9	CDI unit	1	
10	Bolt	1	M6 × 20 mm
11	Bolt	1	M6 × 20 mm
12	Bracket	1	
13	Bolt	3	M6 × 25 mm
14	Grommet	3	
15	Collar	3	
16	Neutral switch	1	Tiller handle model with electric starter
17	Bracket	1	



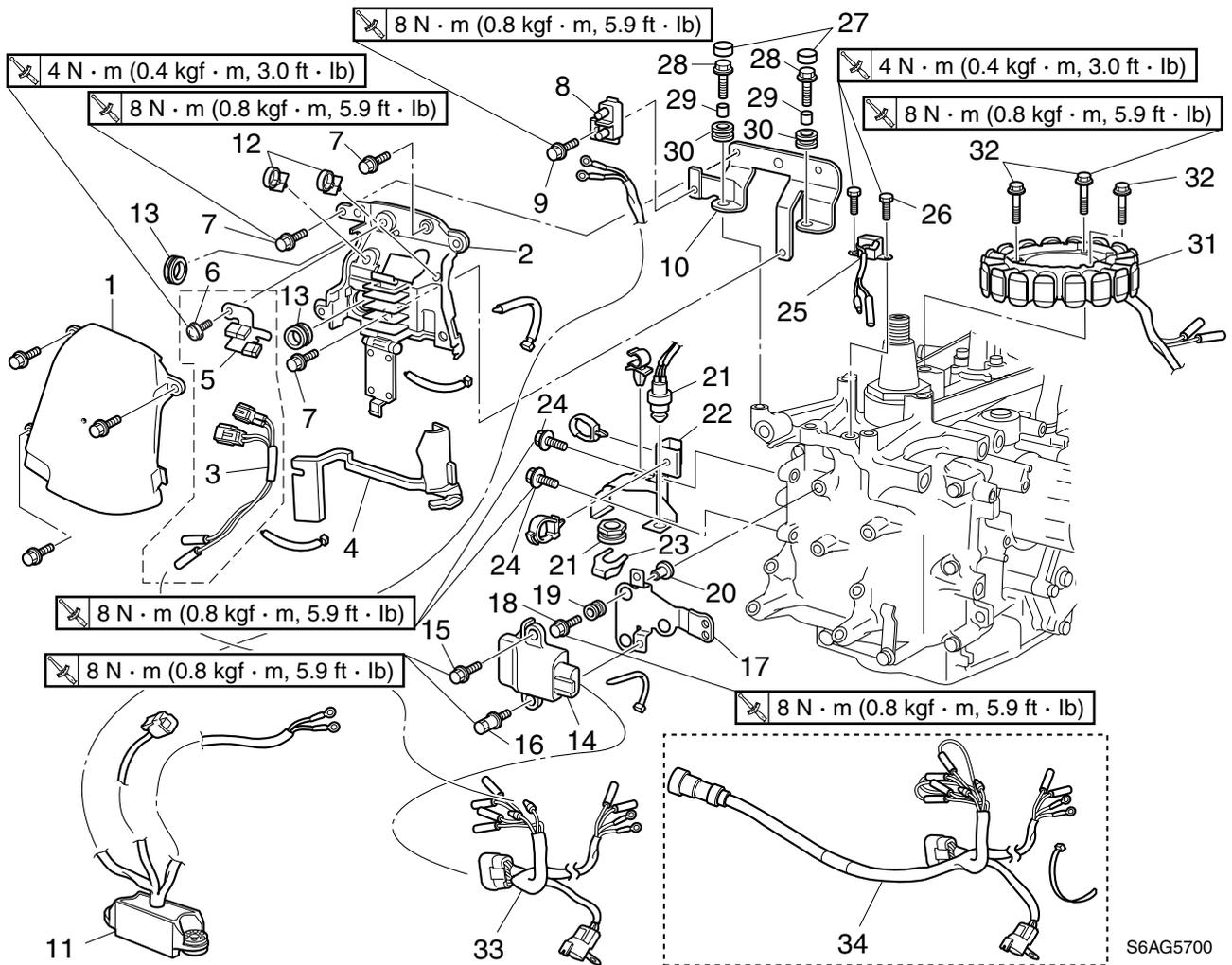
S6AG5710

No.	Part name	Q'ty	Remarks
18	Holder	2	
19	Bolt	2	M6 × 16 mm
20	Pulser coil	1	
21	Bolt	2	M5 × 12 mm
22	Stator coil assembly	1	
23	Bolt	3	M6 × 30 mm
24	Wiring harness	1	Tiller handle model
25	Wiring harness	1	Remote control model
26	Plate spring	1	

CDI unit and junction box (power tilt model)

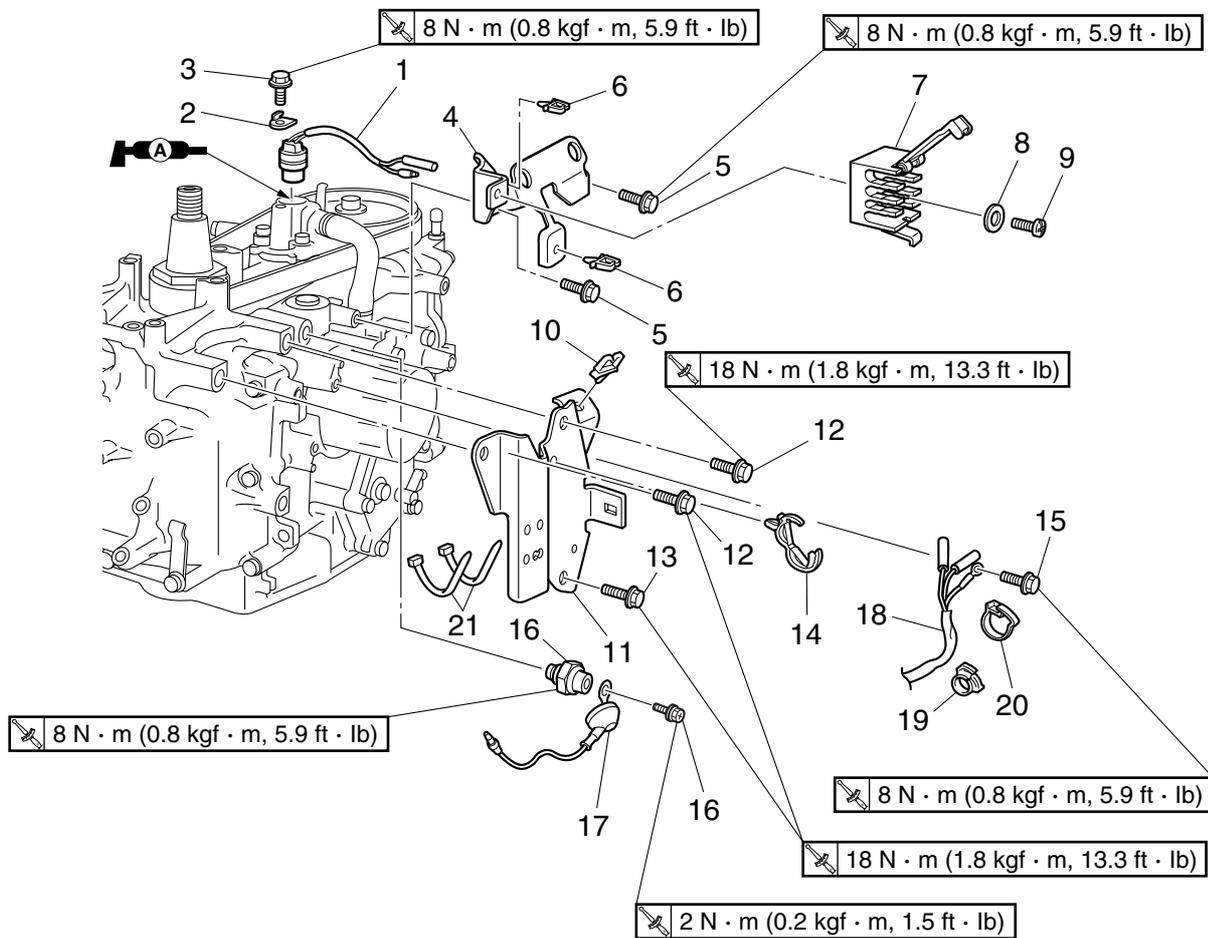


No.	Part name	Q'ty	Remarks
1	Junction box cover	1	
2	Junction box	1	
3	Power tilt sub-wiring harness	1	Remote control model
4	Damper	1	
5	Holder	1	Remote control model
6	Screw	1	ø6 × 12 mm/Remote control model
7	Bolt	3	M6 × 14 mm
8	Terminal	1	
9	Bolt	1	M6 × 12 mm
10	Bracket	1	
11	Power tilt relay	1	
12	Holder	2	
13	Grommet	2	
14	CDI unit	1	
15	Bolt	1	M6 × 20 mm
16	Bolt	1	M6 × 20 mm
17	Bracket	1	



No.	Part name	Q'ty	Remarks
18	Bolt	3	M6 × 25 mm
19	Grommet	3	
20	Collar	3	
21	Neutral switch	1	Tiller handle model
22	Bracket	1	
23	Plate spring	1	
24	Bolt	2	M6 × 16 mm
25	Pulser coil	1	
26	Bolt	2	M5 × 12 mm
27	Cap	2	
28	Bolt	2	M6 × 30 mm
29	Collar	2	
30	Grommet	2	
31	Stator coil assembly	1	
32	Bolt	3	M6 × 30 mm
33	Wiring harness	1	Tiller handle model
34	Wiring harness	1	Remote control model

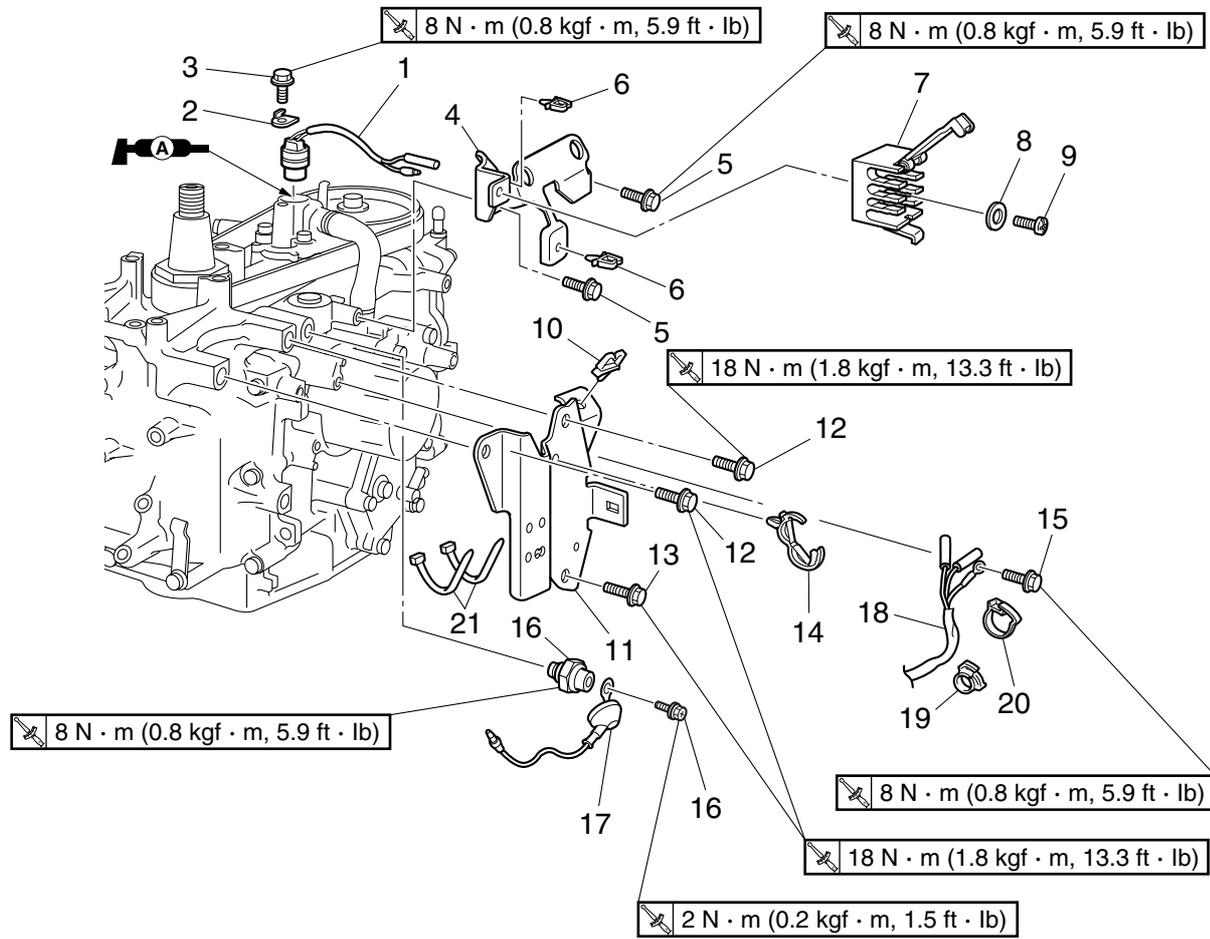
Bracket (manual starter model)



S6AG5730

5

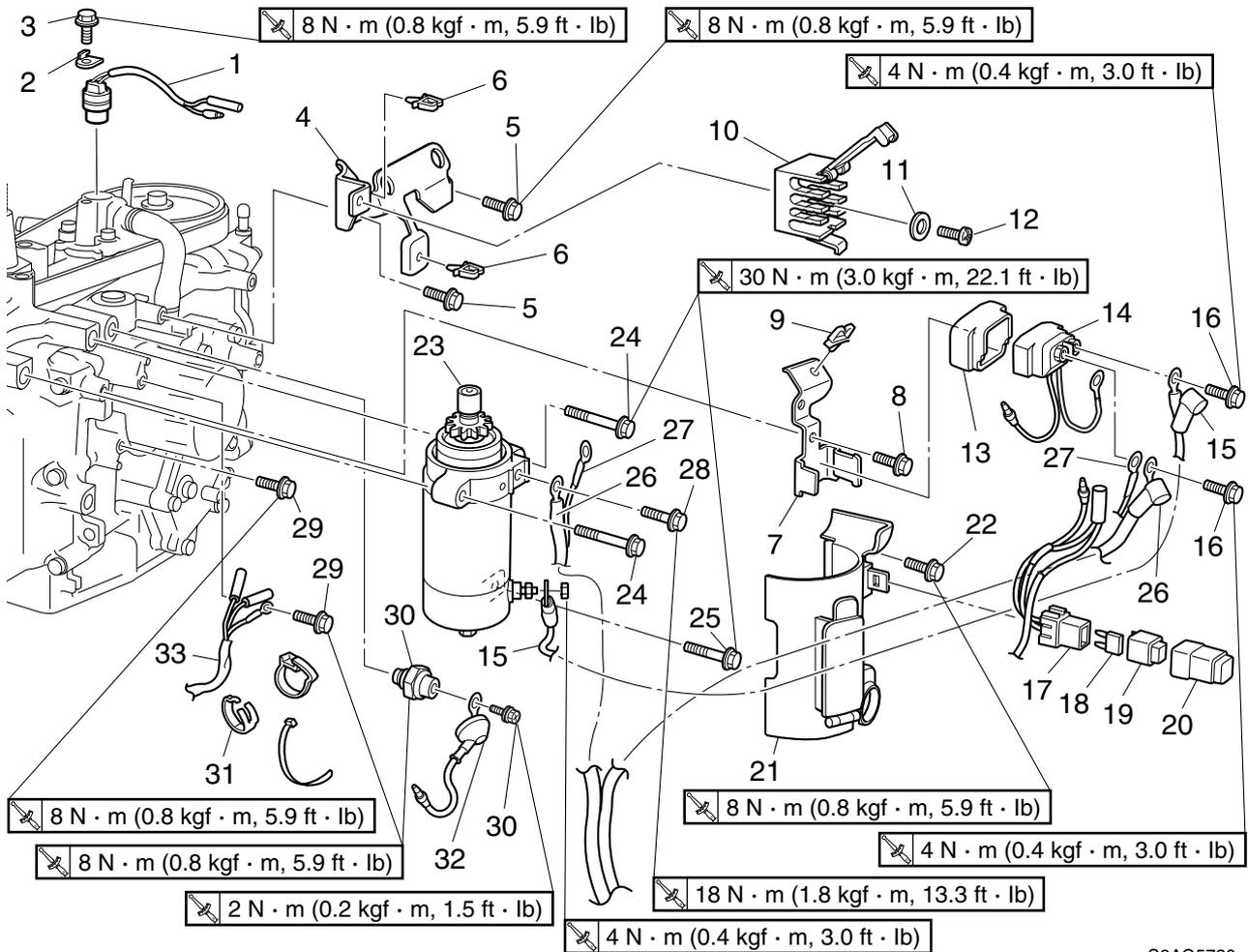
No.	Part name	Q'ty	Remarks
1	Thermoswitch	1	
2	Plate	1	
3	Bolt	1	M6 × 10 mm
4	Bracket	1	
5	Bolt	2	M6 × 14 mm
6	Holder	2	
7	Holder	1	
8	Washer	1	
9	Screw	1	∅6 × 10 mm
10	Holder	1	
11	Bracket	1	
12	Bolt	2	M8 × 25 mm
13	Bolt	1	M8 × 16 mm
14	Holder	1	
15	Bolt	1	M6 × 15 mm
16	Oil pressure switch	1	
17	Oil pressure switch lead	1	



S6AG5730

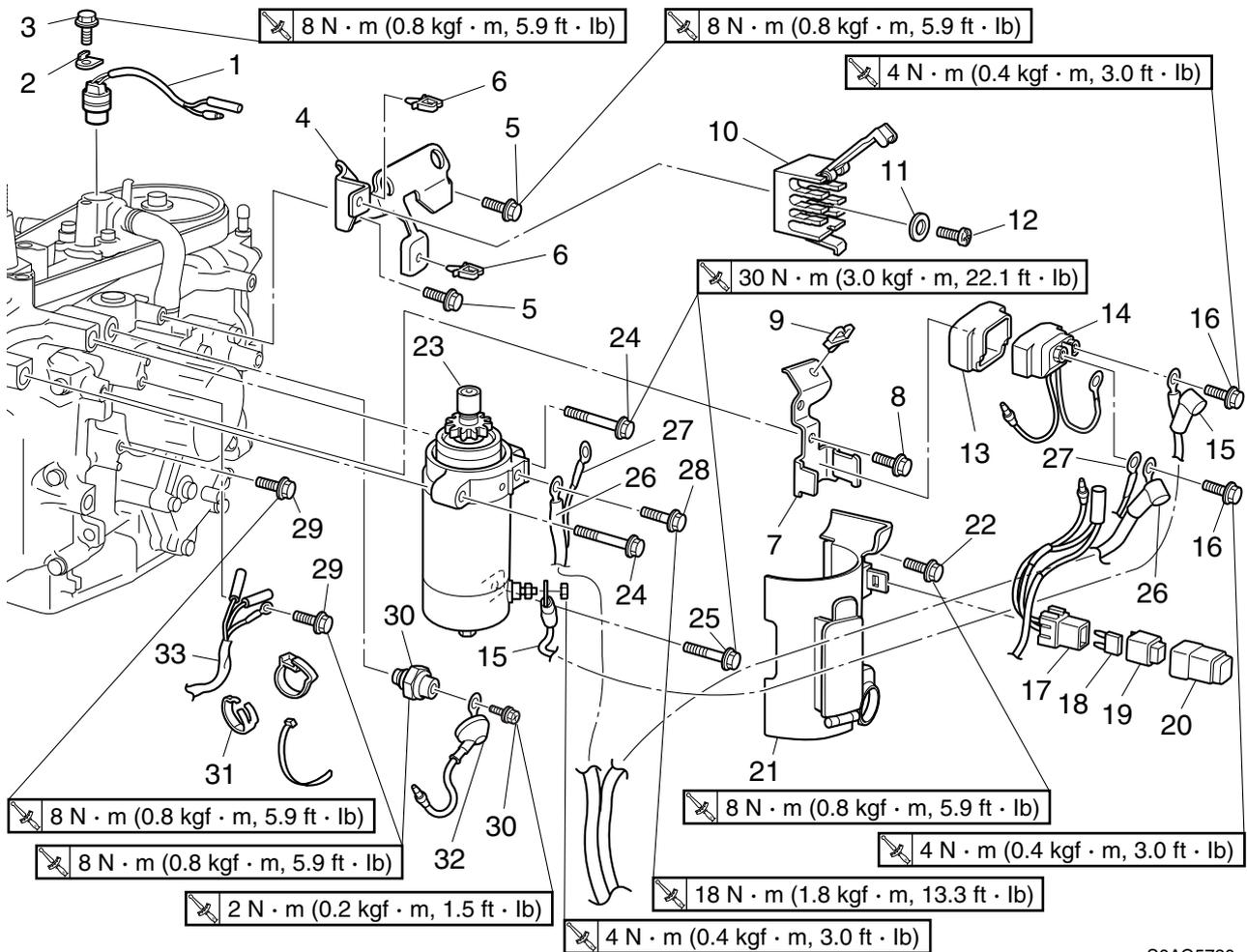
No.	Part name	Q'ty	Remarks
18	Wiring harness	1	
19	Holder	1	
20	Holder	1	
21	Plastic tie	2	

Bracket (electric starter model)



S6AG5720

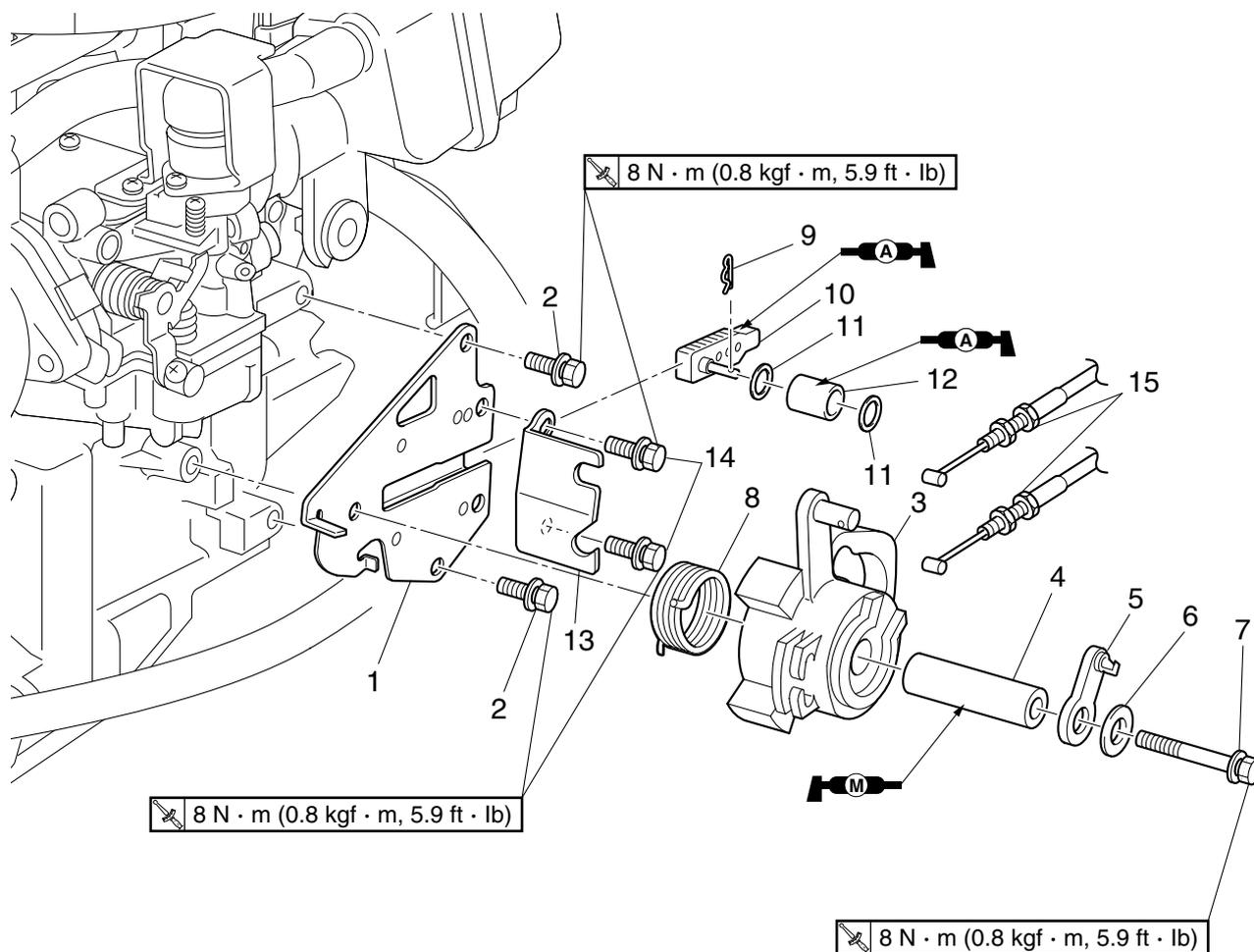
No.	Part name	Q'ty	Remarks
1	Thermoswitch	1	
2	Plate	1	
3	Bolt	1	M6 × 10 mm
4	Bracket	1	
5	Bolt	2	M6 × 14 mm
6	Holder	2	
7	Bracket	1	
8	Bolt	1	M6 × 14 mm
9	Holder	1	
10	Holder	1	
11	Washer	1	
12	Screw	1	ø6 × 10 mm
13	Holder	1	
14	Starter relay	1	
15	Starter motor lead	1	
16	Bolt	2	M6 × 10 mm
17	Fuse lead	1	



S6AG5720

No.	Part name	Q'ty	Remarks
18	Fuse	1	20 A
19	Cap	1	
20	Cover	1	
21	Starter motor cover	1	
22	Bolt	1	M6 × 14 mm
23	Starter motor	1	
24	Bolt	2	M8 × 45 mm
25	Bolt	1	M8 × 35 mm
26	Battery cable	1	
27	Power tilt relay lead	1	Power tilt model
28	Bolt	1	M8 × 16 mm
29	Bolt	2	M6 × 15 mm
30	Oil pressure switch	1	
31	Holder	1	
32	Oil pressure switch lead	1	
33	Wiring harness	1	

Throttle cam



5

S6AG5750

No.	Part name	Q'ty	Remarks
1	Bracket	1	
2	Bolt	2	M6 × 14 mm
3	Throttle cam	1	
4	Shaft	1	
5	Free accel lever	1	
6	Washer	1	
7	Bolt	1	M6 × 45 mm
8	Spring	1	
9	Clip	1	Tiller handle model
10	Stopper	1	Tiller handle model
11	Washer	2	Tiller handle model
12	Collar	1	Tiller handle model
13	Bracket	1	Tiller handle model
14	Bolt	2	M6 × 14 mm/Tiller handle model
15	Throttle cable	2	Tiller handle model



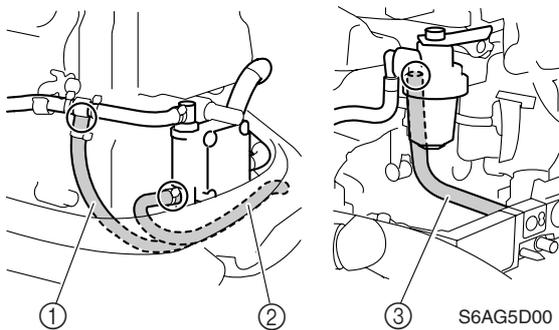
**Removing the power unit**

1. Disconnect the start-in-gear protection cable, and then remove the sprocket cover and manual starter. (Manual starter model)  
Remove the sprocket cover and flywheel magnet cover. (Electric starter model)

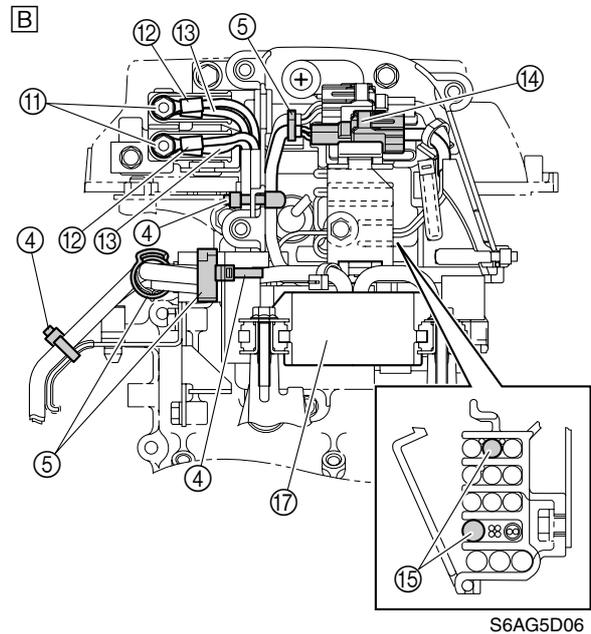
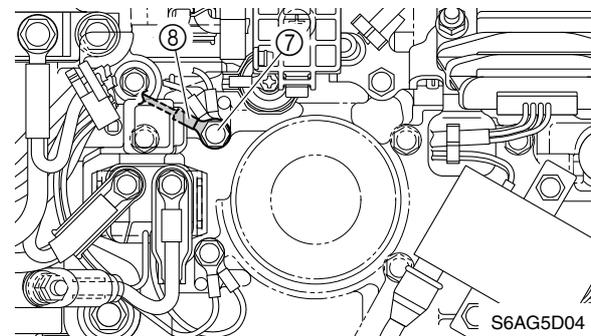
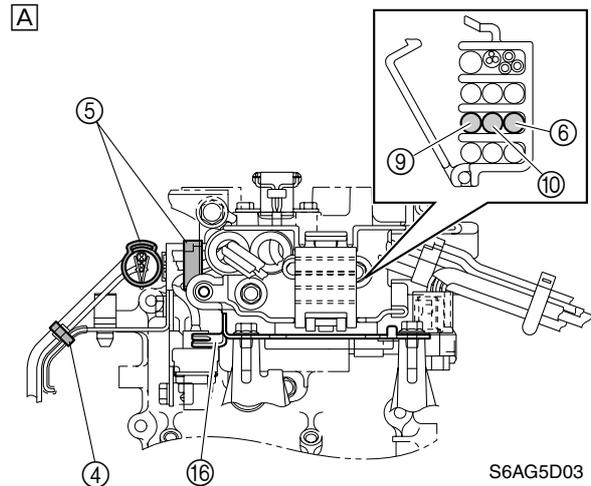
**NOTE:**

Before removing the flywheel magnet cover, remove the junction box bracket bolts. (Power tilt model)

2. Remove the retaining plate. Disconnect the battery cables. (Electric starter model)  
Disconnect the battery cables and 10-pin main harness coupler. (Remote control model)
3. Disconnect the flushing hose ①, cooling water hose ②, and fuel hose ③.



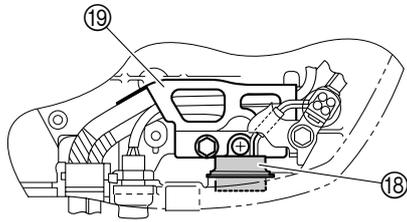
4. Remove the junction box cover, and then remove the plastic ties ④ and clamps ⑤.
5. Disconnect the engine stop lanyard switch lead (W) ⑥. Remove the bolt ⑦ and engine stop lanyard switch lead (B) terminal ⑧. Disconnect the engine start switch leads (R) ⑨ and (Br) ⑩. (Manual tilt model/Tiller handle model)  
Remove the terminal nuts ⑪, and then disconnect the power tilt motor leads ⑫ and power tilt relay leads ⑬. Disconnect the power tilt switch coupler ⑭ and power tilt switch leads (R) ⑮. (Power tilt model)



- A Manual tilt model/Tiller handle model
- B Power tilt model

6. Remove the junction box bracket ⑯. (Manual tilt model)  
Remove the power tilt relay ⑰. (Power tilt model)

7. Remove the warning indicator assembly ⑱ and bracket ⑲.

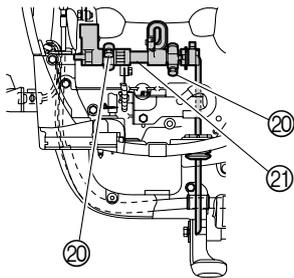


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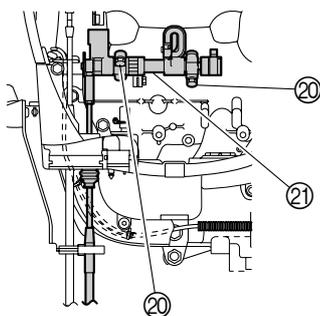
8. Disconnect the throttle cables from the throttle cam. (Tiller handle model)  
Disconnect the cable joint from the throttle cam. (Remote control model)

9. Remove the bolts ⑳, and then remove the shift rod cam ㉑.

A



B

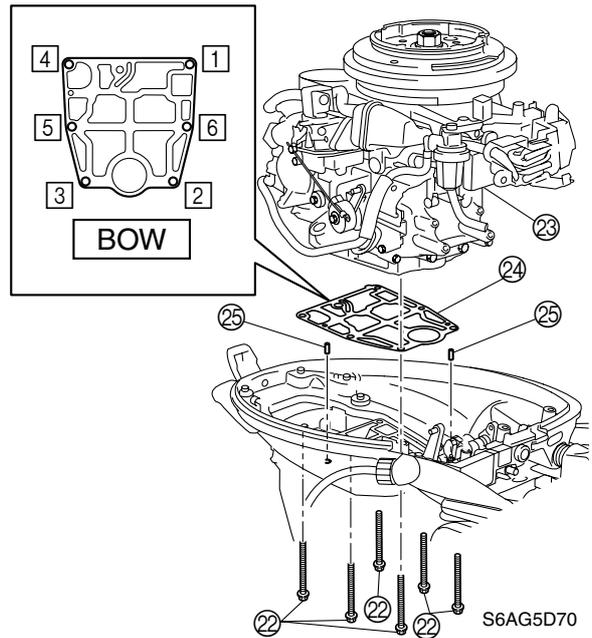


S6AG5D10

- A Tiller handle model  
B Remote control model

10. Remove the dipstick and apron, and then remove the mounting bolts ㉒.

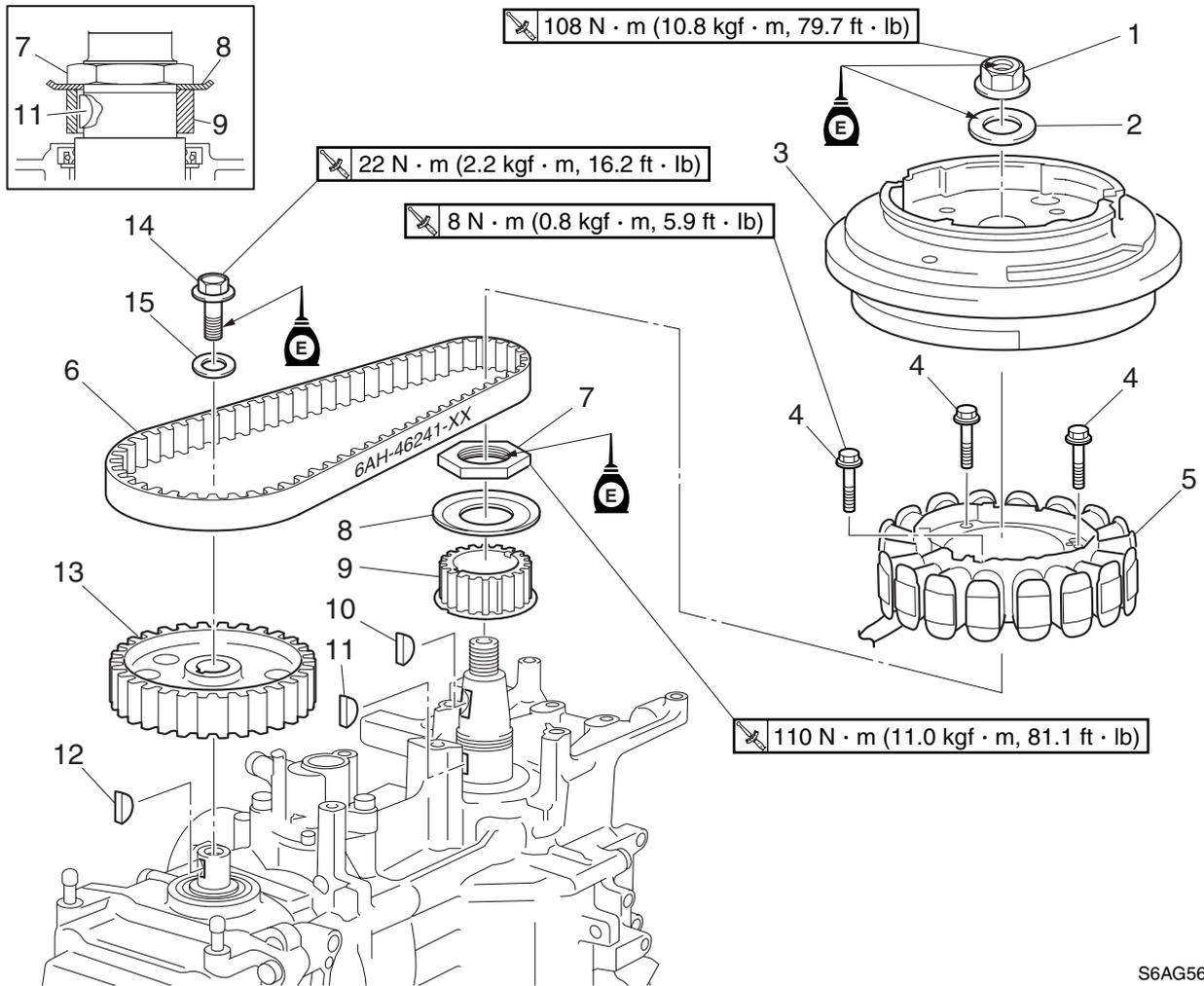
11. Remove the power unit ㉓, gasket ㉔, and dowels ㉕.



S6AG5D70



### Timing belt and sprocket



S6AG5680J

No.	Part name	Q'ty	Remarks
1	Nut	1	Width across flats: 24 mm
2	Washer	1	
3	Flywheel magnet	1	
4	Bolt	3	M6 × 30 mm
5	Stator coil assembly	1	
6	Timing belt	1	
7	Nut	1	Width across flats: 41 mm
8	Retaining plate	1	
9	Drive sprocket	1	
10	Woodruff key	1	
11	Woodruff key	1	
12	Woodruff key	1	
13	Driven sprocket	1	
14	Bolt	1	M8 × 25 mm
15	Washer	1	

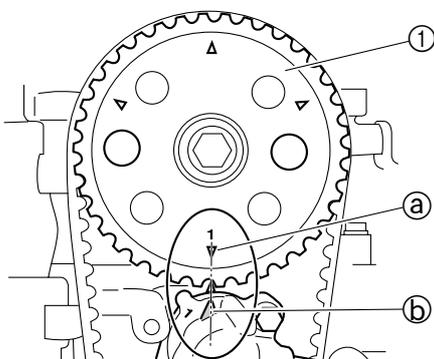
## Removing the timing belt and sprocket

1. Remove the flywheel magnet and stator coil assembly.

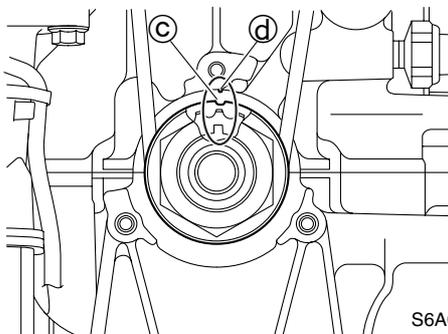
**NOTE:**

See "Replacing the timing belt" (5-3).

2. Align the "1 ▲" mark ① on the driven sprocket with the "▲" mark ② on the cylinder head.



S6AG5H80

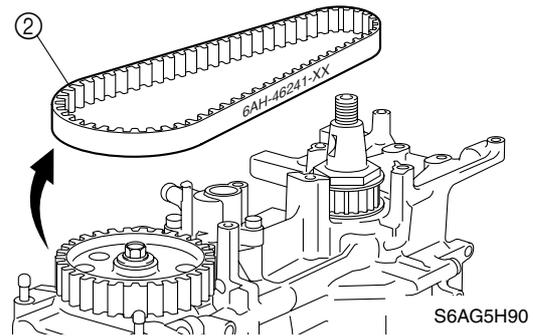


S6AG5B25

**NOTE:**

Check that the mark © on the drive sprocket and the mark ▲ on the cylinder block are aligned.

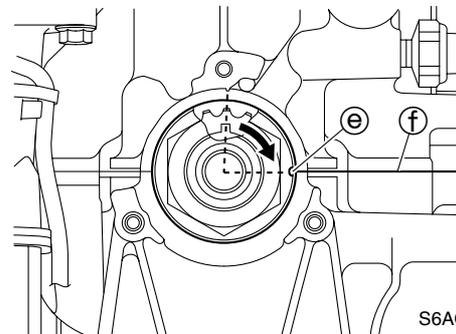
3. Remove the timing belt ② from the driven sprocket, and then remove it from the drive sprocket.



**CAUTION:**

Unless directed to do so in the following instructions, do not turn the drive sprocket or driven sprocket when the timing belt is not installed. Otherwise the pistons and valves will collide with each other and be damaged.

4. Align the mark © on the drive sprocket with the mating surface ⑥ of the crankcase and cylinder block by turning the crankshaft clockwise approximately 90° gradually.



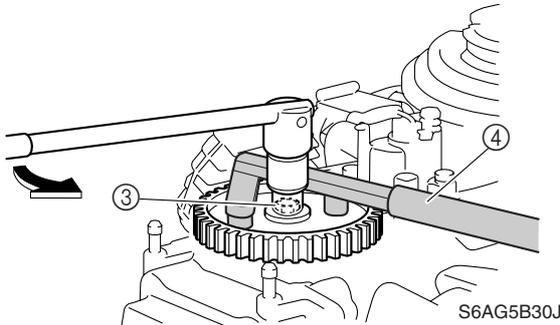
S6AG5A50

**CAUTION:**

Do not turn the crankshaft more than 90°. Otherwise the piston and valves will collide with each other and be damaged.



5. Hold the driven sprocket using the special service tool ④, and then remove the driven sprocket bolt ③.

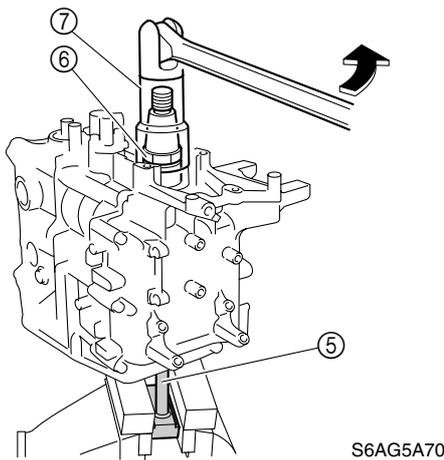


**NOTE:**  
 Make sure that the driven sprocket does not turn when loosening the driven sprocket bolt.



Flywheel holder ④: 90890-06522

6. Remove the driven sprocket and Woodruff key.
7. Install the power unit onto the special service tool ⑤ as shown, and then remove the drive sprocket nut ⑥.



**NOTE:**

- Use a deep 41 mm socket ⑦ to loosen the drive sprocket nut ⑥.
- Make sure that the power unit does not turn when loosening the drive sprocket nut ⑥.



Shaft holder ⑤: 90890-06069

8. Remove the retaining plate, drive sprocket, and Woodruff key.

**Checking the timing belt and sprocket**

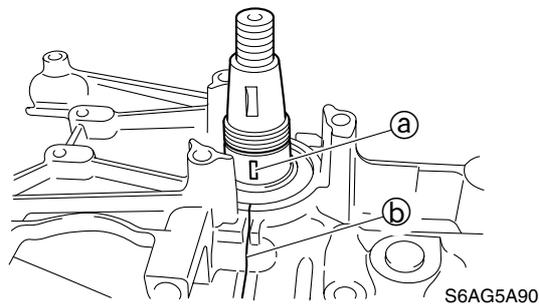
1. Check the interior and exterior of the timing belt. Replace if cracked, damaged, or worn.
2. Check the drive sprocket and driven sprocket. Replace if cracked, damaged, or worn.

**Installing the sprocket and timing belt**

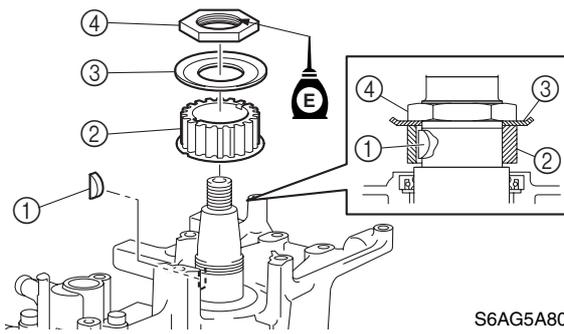
**CAUTION:**

Unless directed to do so in the following instructions, do not turn the drive sprocket or driven sprocket when the timing belt is not installed. Otherwise the pistons and valves will collide with each other and be damaged.

1. Check that the keyway ① in the crankshaft and the mating surface ② of the crankcase and cylinder block are aligned.

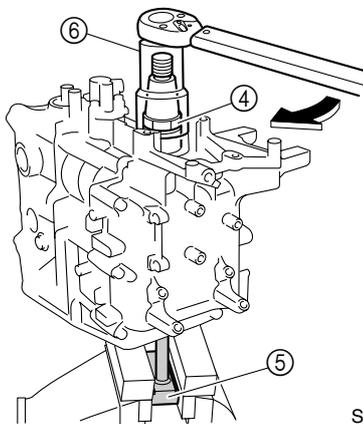


2. Install the Woodruff key ①, drive sprocket ②, and retaining plate ③, and then install the drive sprocket nut ④ temporarily.



S6AG5A80

3. Install the power unit onto the special service tool ⑤, and then tighten the drive sprocket nut ④ to the specified torque.



S6AG5B00

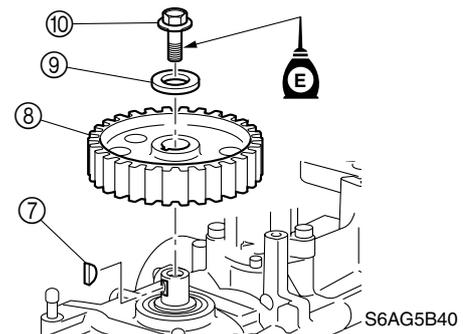
**NOTE:** \_\_\_\_\_

- Use a deep 41 mm socket ⑥ to tighten the drive sprocket nut.
- Make sure that the power unit does not turn when tightening the drive sprocket nut.

 Shaft holder ⑤: 90890-06069

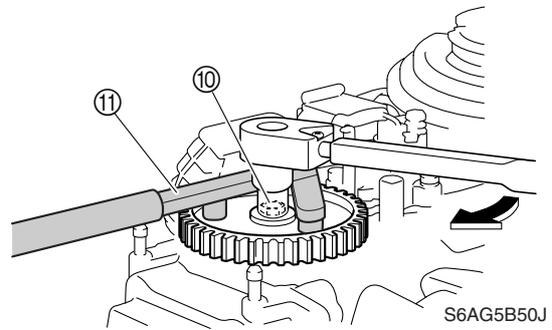
 Drive sprocket nut ④:  
110 N·m (11.0 kgf·m, 81.1 ft·lb)

4. Install the Woodruff key ⑦, driven sprocket ⑧, and washer ⑨, and then install the driven sprocket bolt ⑩ temporarily.



S6AG5B40

5. Hold the driven sprocket using the special service tool ⑪, and then tighten the driven sprocket bolt ⑩ to the specified torque.



S6AG5B50J

**NOTE:** \_\_\_\_\_

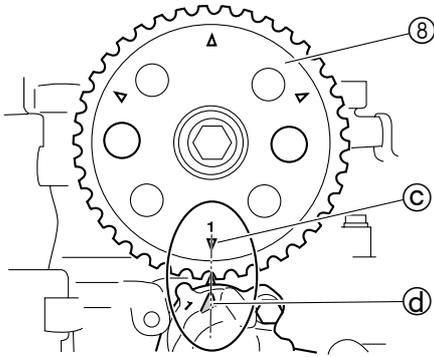
Make sure that the driven sprocket does not turn when tightening the driven sprocket bolt.

 Flywheel holder ⑪: 90890-06522

 Driven sprocket bolt ⑩:  
22 N·m (2.2 kgf·m, 16.2 ft·lb)

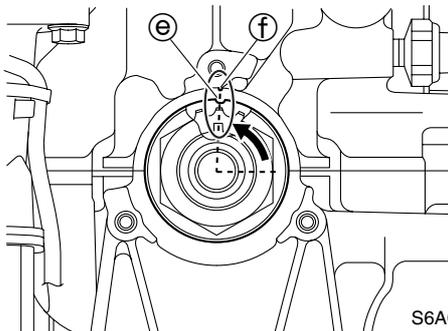


- Align the “1 ▲” mark ③ on the driven sprocket ⑧ with the “▲” mark ④ on the cylinder head.



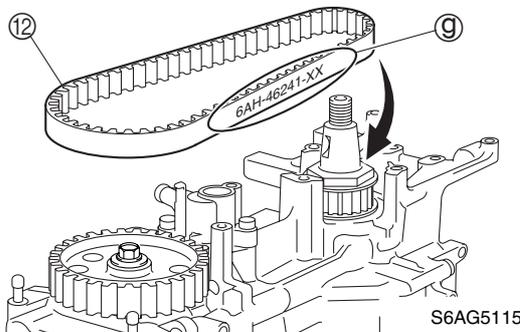
S6AG5H81

- Align the mark ⑤ on the drive sprocket with the mark ⑥ on the cylinder block by turning the crankshaft counterclockwise approximately 90° gradually.



S6AG5B20

- Install the timing belt ⑫ onto the drive sprocket, and then install it onto the driven sprocket with its part number in the upright position ⑨.

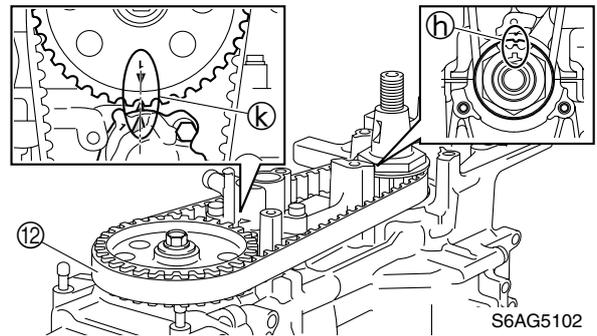


S6AG5115

**CAUTION:**

- Do not twist, turn inside out, or bend the timing belt beyond the maximum limit of 25 mm (1.0 in), otherwise it can be damaged.
- Do not get oil or grease on the timing belt.

- Turn the drive sprocket clockwise 2 turns, and then check that the alignment marks ⑪ and ⑫ are aligned.



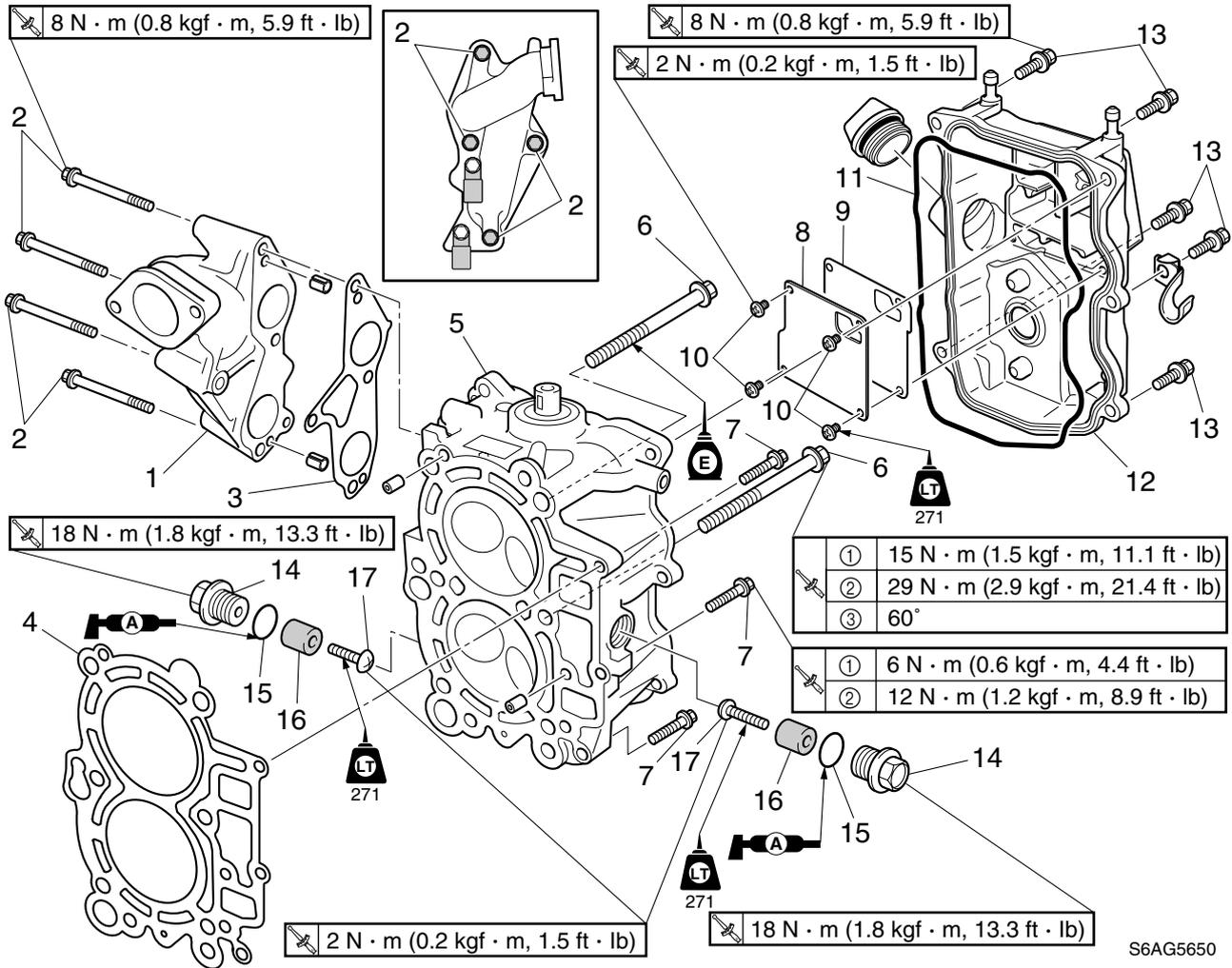
S6AG5102

- Install the stator coil assembly and fly-wheel magnet.

**NOTE:**

See “Replacing the timing belt” (5-3).

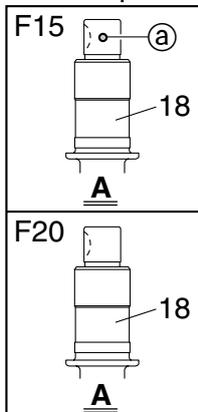
Cylinder head



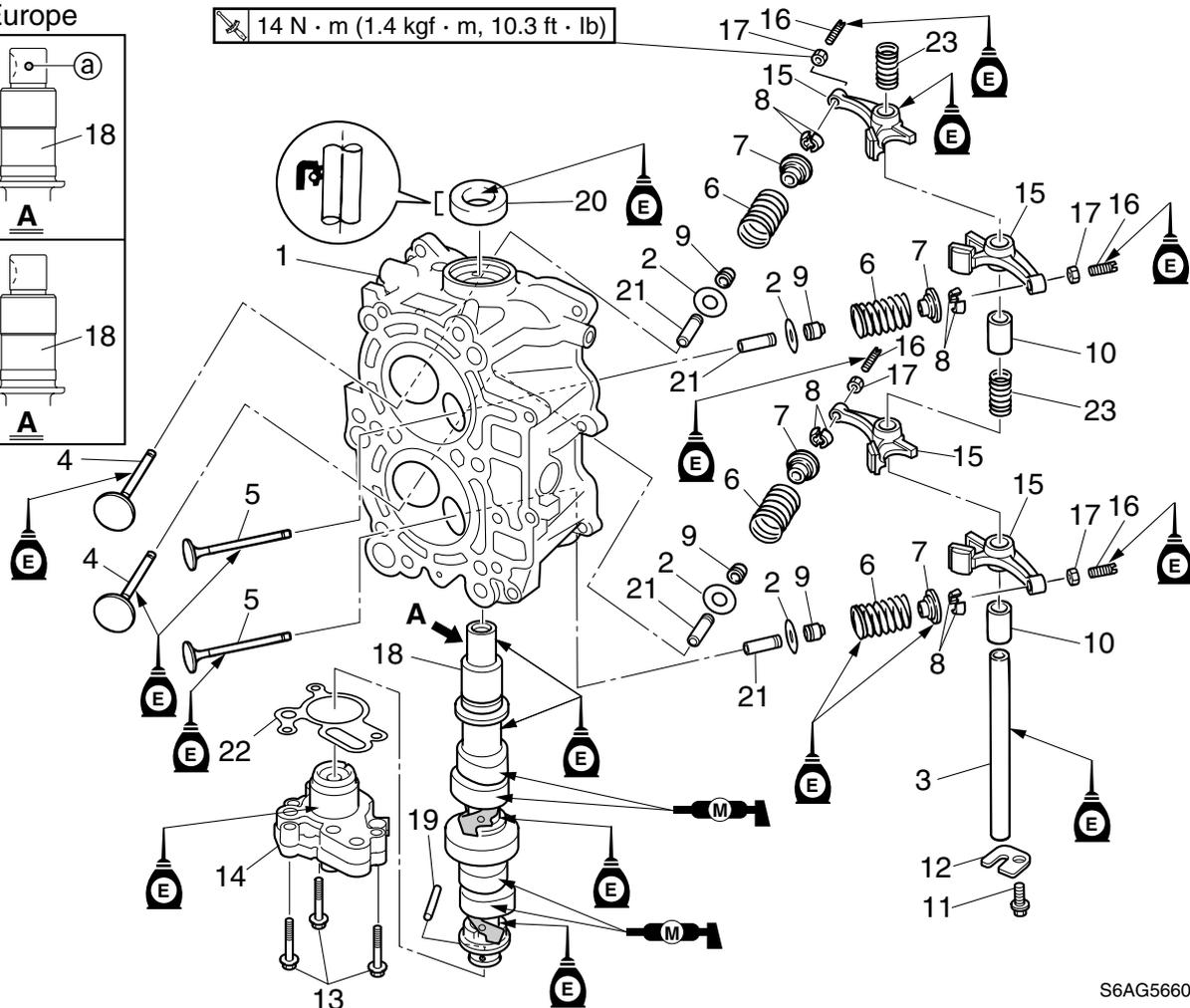
No.	Part name	Q'ty	Remarks
1	Intake manifold	1	
2	Bolt	4	M6 × 55 mm
3	Gasket	1	<b>Not reusable</b>
4	Gasket	1	<b>Not reusable</b>
5	Cylinder head assembly	1	
6	Bolt	6	M9 × 84 mm
7	Bolt	3	M6 × 25 mm
8	Plate	1	
9	Gasket	1	<b>Not reusable</b>
10	Screw	4	ø4 × 9 mm
11	Gasket	1	<b>Not reusable</b>
12	Cylinder head cover	1	
13	Bolt	5	M6 × 20 mm
14	Plug	2	
15	O-ring	2	<b>Not reusable</b>
16	Anode	2	
17	Screw	2	ø5 × 24 mm



For Europe

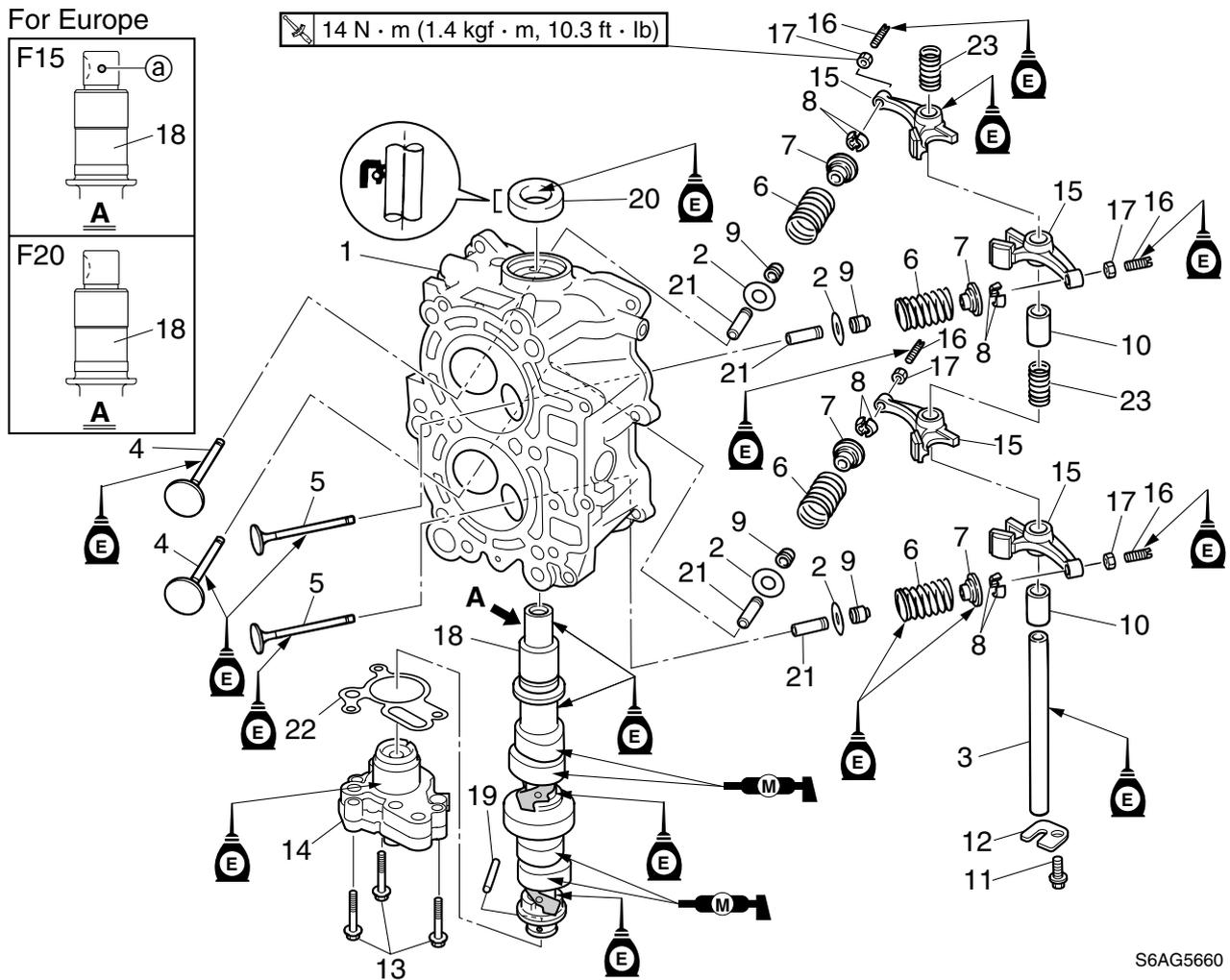


14 N · m (1.4 kgf · m, 10.3 ft · lb)



S6AG5660

No.	Part name	Q'ty	Remarks
1	Cylinder head	1	
2	Valve spring seat	4	
3	Shaft	1	
4	Intake valve	2	
5	Exhaust valve	2	
6	Valve spring	4	
7	Valve spring retainer	4	
8	Valve cotter	8	
9	Valve seal	4	<b>Not reusable</b>
10	Collar	2	
11	Bolt	1	M6 × 12 mm
12	Plate	1	
13	Bolt	3	M6 × 35 mm
14	Oil pump assembly	1	
15	Rocker arm	4	
16	Adjusting screw	4	
17	Locknut	4	



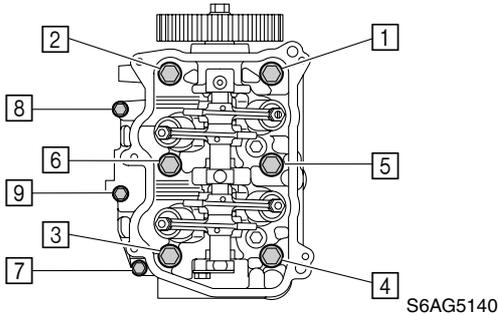
S6AG5660

No.	Part name	Q'ty	Remarks
18	Camshaft	1	F15/F20 (For Europe)
19	Pin	1	
20	Oil seal	1	<b>Not reusable</b>
21	Valve guide	4	<b>Not reusable</b>
22	Gasket	1	<b>Not reusable</b>
23	Spring	2	



### Removing the cylinder head

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

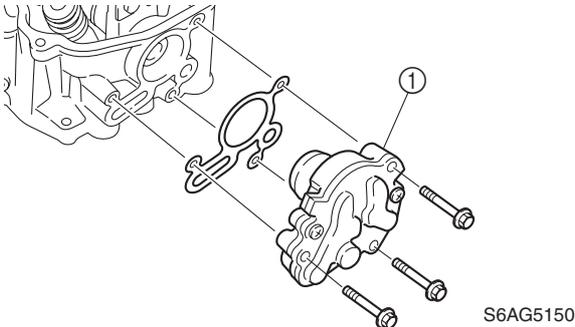


**CAUTION:**

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

### Disassembling the cylinder head

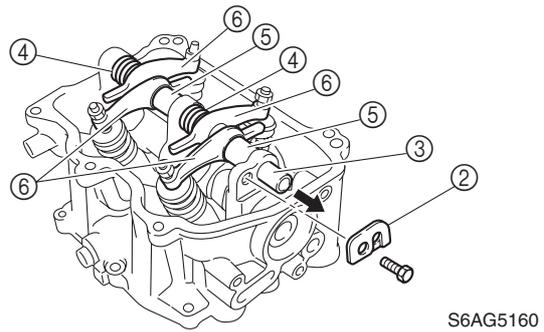
1. Remove the oil pump assembly ①.



**NOTE:**

To disassemble, check, and assemble the oil pump, see "Checking the oil pump" (5-47).

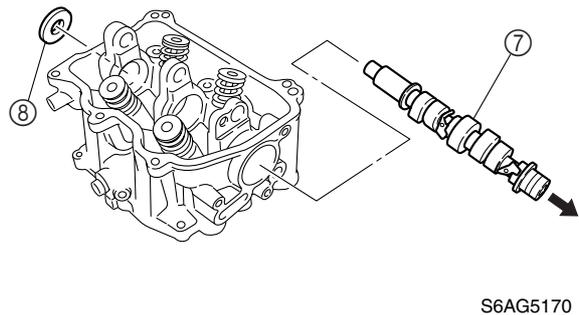
2. Remove the plate ② from the cylinder head, pull out the shaft ③, and then remove the springs ④, collars ⑤, and rocker arms ⑥.



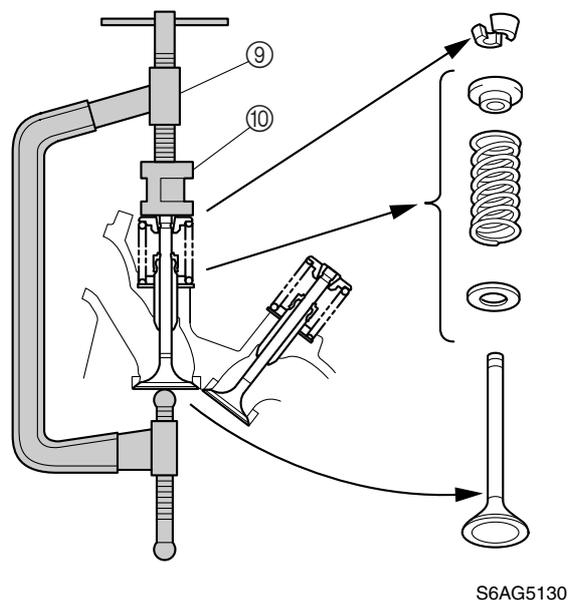
**NOTE:**

- Loosen the locknut and adjust screw to slack off the tension, before remove the rocker arm shaft.
- Be sure to keep the parts in the order as they were removed.

3. Remove the camshaft ⑦, and then remove the oil seal ⑧.



4. Remove the intake and exhaust valves.



**NOTE:**

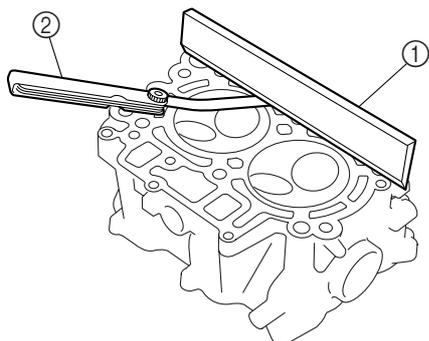
Be sure to keep the valves, springs, and other parts in the order as they were removed.



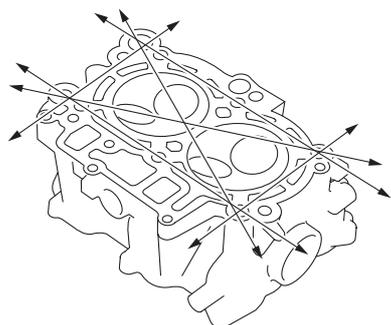
Valve spring compressor ⑨:  
90890-04019  
Valve spring compressor  
attachment ⑩: 90890-06320

**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 the directions shown. Replace the cylinder head assembly if above specification.



S6AG5260



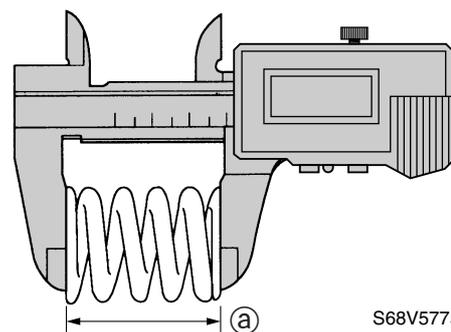
S6AG5270



Cylinder head warpage limit:  
0.10 mm (0.0039 in)

**Checking the valve spring**

1. Measure the valve spring free length ③. Replace if below specification.

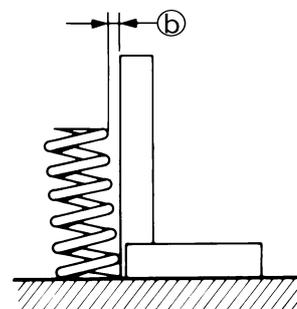


S68V5775



Valve spring free length ③:  
32.63 mm (1.2846 in)

2. Measure the valve spring tilt ④. Replace if above specification.



S69J5730

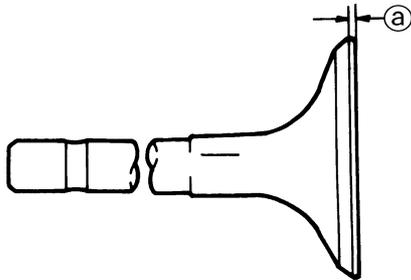


Valve spring tilt limit ④:  
1.4 mm (0.055 in)



**Checking the valve**

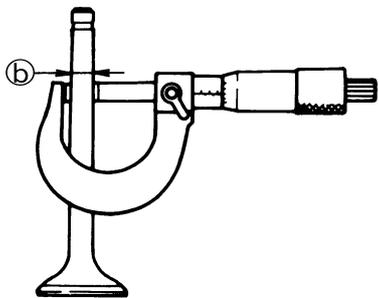
1. Check the valve face. Replace the valve if pitted or worn.
2. Measure the valve margin thickness (a). Replace the valve if out of specification.



S69J5740

	<b>Valve margin thickness (a):</b>
	Intake:
	0.8–1.2 mm (0.0315–0.0472 in)
	Exhaust:
	1.0–1.4 mm (0.0394–0.0551 in)

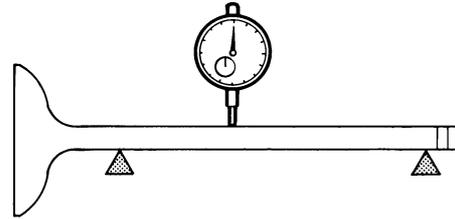
3. Measure the valve stem diameter (b). Replace the valve if out of specification.



S69J5750

	<b>Valve stem diameter (b):</b>
	Intake:
	5.475–5.490 mm (0.2156–0.2161 in)
	Exhaust:
	5.460–5.475 mm (0.2150–0.2156 in)

4. Measure the valve stem runout. Replace the valve if above specification.



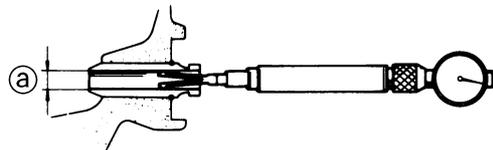
S69J5760

	<b>Valve stem runout limit:</b>
	0.01 mm (0.0004 in)

**Checking the valve guide**

**NOTE:** Before checking a valve guide, make sure that the valve stem diameter is within specification.

1. Measure the valve guide inside diameter (a).



S6D55490

	<b>Valve guide inside diameter (a):</b>
	Intake and exhaust:
	5.500–5.512 mm (0.2165–0.2170 in)

2. Calculate the valve-stem-to-valve-guide clearance as follows. Replace the valve guide if out of specification.

 Valve-stem-to-valve-guide clearance = valve guide inside diameter – valve stem diameter:

Intake:  
0.010–0.037 mm  
(0.0004–0.0015 in)

Exhaust:  
0.025–0.052 mm  
(0.0010–0.0020 in)

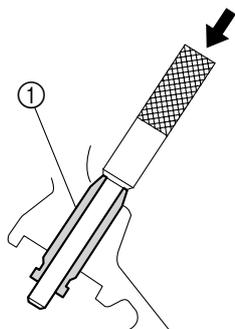
 Valve guide remover/installer ③:  
90890-06801

 Valve guide height ④:  
Intake and exhaust:  
10.8 ± 0.2 mm (0.4 ± 0.01 in)

4. Insert the special service tool into the valve guide ②, and then ream the valve guide.

### Replacing the valve guide

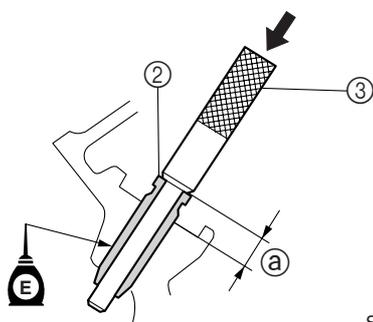
1. Remove the valve seal.
2. Remove the valve guide ① by striking the special service tool from the combustion chamber side.



S6AG5181

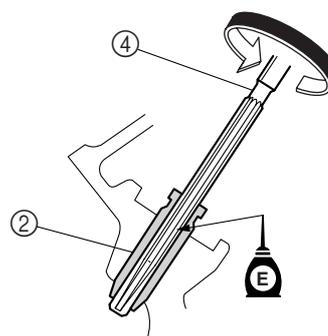
 Valve guide remover/installer:  
90890-06801

3. Install a new valve guide ② using the special service tool ③ from the camshaft side to the specified height ④.



S6AG5180

**NOTE:** \_\_\_\_\_  
Apply engine oil to the surface of the new valve guide before installation.



S6AG5190

- NOTE:** \_\_\_\_\_
- Apply engine oil to the inner surface of the valve guide before reaming it.
  - Turn the valve guide reamer clockwise to ream the valve guide.
  - Do not turn the reamer counterclockwise when removing it.
  - Be sure to clean the valve guide after reaming it.

 Valve guide reamer ④: 90890-06804

5. Measure the valve guide inside diameter.

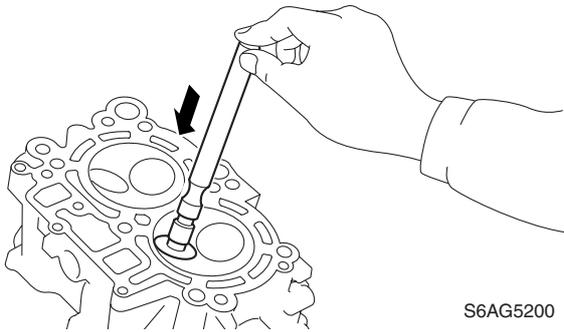
 Valve guide inside diameter:  
Intake and exhaust:  
5.500–5.512 mm  
(0.2165–0.2170 in)

### Checking the valve seat

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

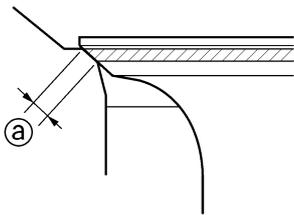


- Press the valve slowly against the valve seat with a valve lapper as shown.

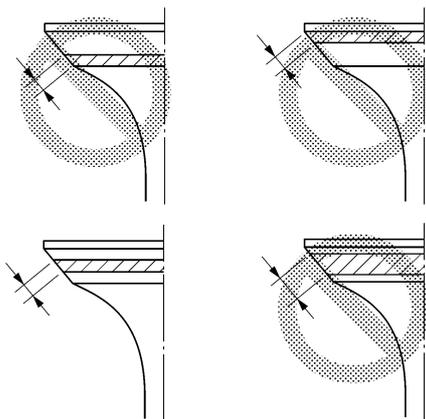


S6AG5200

- Measure the valve seat contact width **Ⓐ** where the blueing dye is adhered to the valve face. Reface the valve seat if the valve is not seated properly or if the valve seat contact width is out of specification. Check the valve guide if the valve seat contact is uneven.



S69J5830

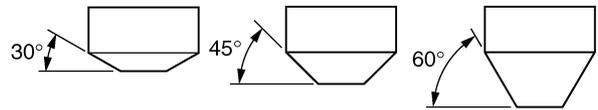


S69J5840

	<b>Valve seat contact width <b>Ⓐ</b>:</b>
	Intake and exhaust:
	1.2–1.6 mm (0.047–0.063 in)

**Refacing the valve seat**

- Reface the valve seat with the valve seat cutters.



S69J5850

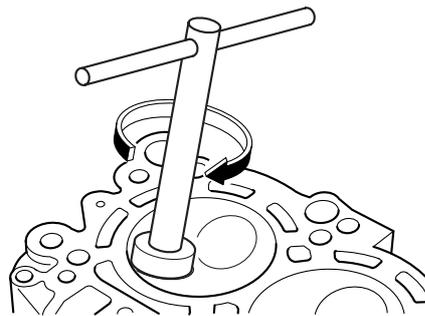


Valve seat cutter holder:  
90890-06316

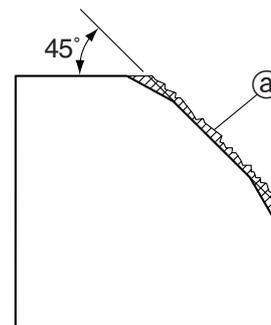
Valve seat cutter:

- 30° (intake): 90890-06818
- 30° (exhaust): 90890-06819
- 45° (intake): 90890-06555
- 45° (exhaust): 90890-06312
- 60° (intake): 90890-06323
- 60° (exhaust): 90890-06315

- Cut the surface of the valve seat with a 45° cutter by turning the cutter clockwise until the valve seat face has become smooth.



S6AG5210



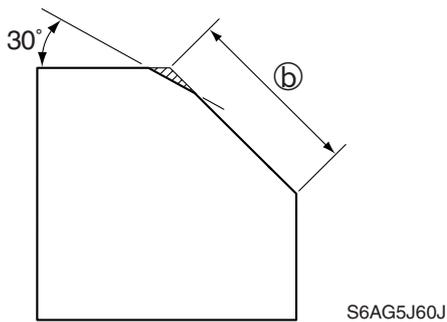
S6AG5J20J

**Ⓐ** Slag or rough surface

**CAUTION:**

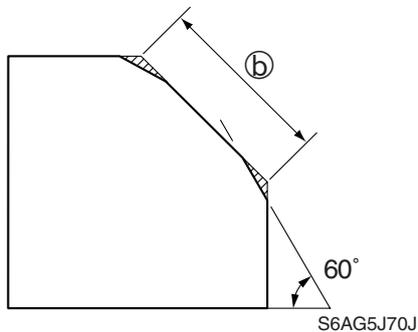
Do not over cut the valve seat. Be sure to turn the cutter evenly downward at a pressure of 40–50 N (4–5 kgf, 8.8–11 lbf) to prevent chatter marks.

- Use a 30° cutter to adjust the contact width of the top edge of the valve seat.



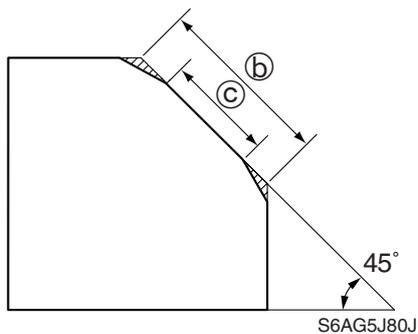
(b) Previous contact width

- Use a 60° cutter to adjust the contact width of the bottom edge of the valve seat.



(b) Previous contact width

- Use a 45° cutter to adjust the contact width of the valve seat to specification.



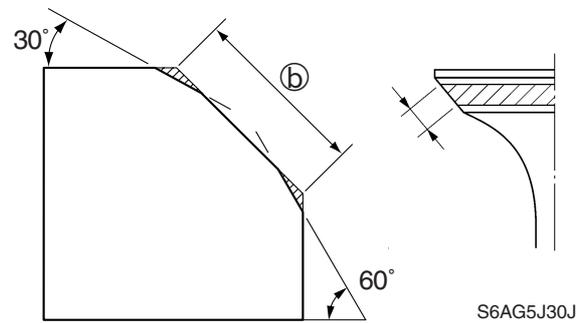
(b) Previous contact width  
(c) Specified contact width

- Check the valve seat contact area of the valve.

**NOTE:**

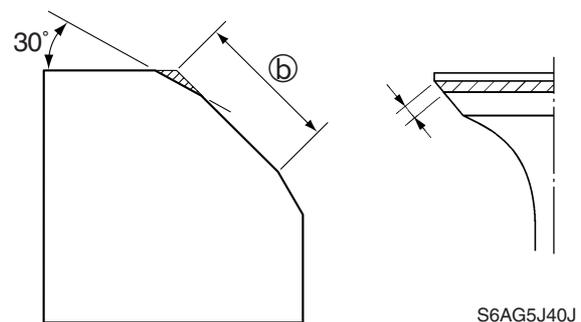
To check the valve seat contact area, see “Checking the valve seat” (5-40).

- If the valve seat contact area is too wide and situated in the center of the valve face, use a 30° cutter to cut the top edge of the valve seat and a 60° cutter to cut the bottom edge to center the area and set its width.



(b) Previous contact width

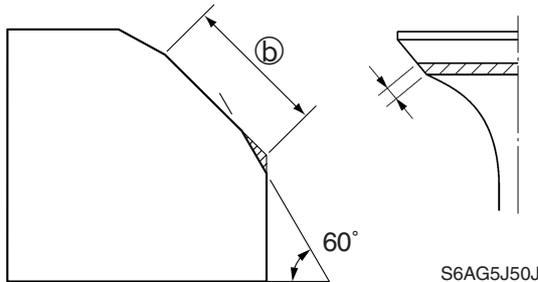
- If the valve seat contact area is too narrow and situated near the top edge of the valve face, use a 30° cutter to cut the top edge of the valve seat, and then use a 45° cutter to center the area and set its width.



(b) Previous contact width

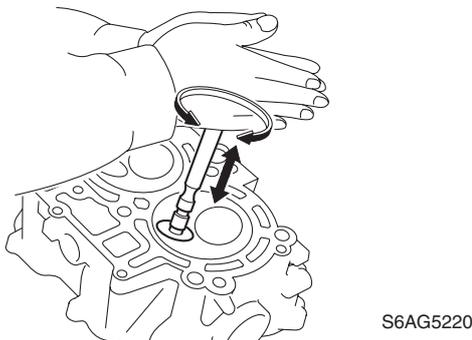


- If the valve seat contact area is too narrow and situated near the bottom edge of the valve face, use a 60° cutter to cut the bottom edge of the valve seat, and then use a 45° cutter to center the area and set its width.



ⓑ Previous contact width

- After refacing the valve seat to the specified contact width, apply a thin, even layer of lapping compound onto the valve seat, and then lap the valve using a valve lapper.



**CAUTION:**

**Do not get the lapping compound on the valve stem and valve guide.**

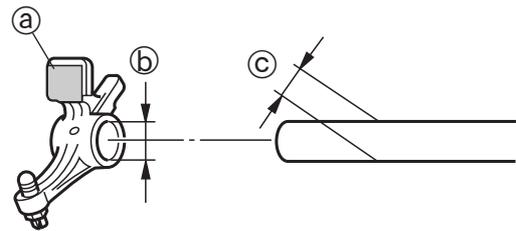
- After every lapping procedure, be sure to clean off any remaining lapping compound from the cylinder head and the valve.
- Check the valve seat contact area of the valve again.

**NOTE:**

To check the valve seat contact area, see “Checking the valve seat” (5-40).

**Checking the rocker arm and rocker arm shaft**

- Check the rocker arms, rocker arm shaft, and rocker arm contact surface ⓐ. Replace if worn.
- Measure the rocker arm inside diameter ⓑ and rocker arm shaft outside diameter ⓒ. Replace if out of specification.

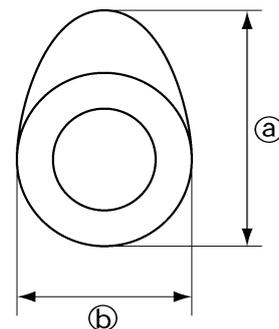


S6AG5230

	Rocker arm inside diameter ⓑ:
	13.000–13.018 mm (0.5118–0.5125 in)
	Rocker arm shaft outside diameter ⓒ:
	12.941–12.951 mm (0.5095–0.5099 in)

**Checking the camshaft**

- Measure the cam lobe. Replace if out of specification.

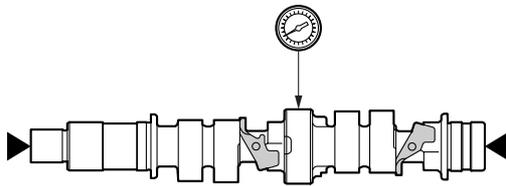


S69J5950

 Cam lobe (a):  
 Intake:  
 28.546–28.646 mm  
 (1.1239–1.1278 in)  
 Exhaust:  
 28.582–28.682 mm  
 (1.1253–1.1292 in)  
 Cam lobe (b):  
 Intake and exhaust:  
 23.95–24.05 mm  
 (0.9429–0.9468 in)

 Camshaft journal diameter (c):  
 21.967–21.980 mm  
 (0.8648–0.8654 in)  
 Camshaft journal diameter (d):  
 33.935–33.955 mm  
 (1.3360–1.3368 in)  
 Cylinder head journal inside diameter (e):  
 22.000–22.021 mm  
 (0.8661–0.8670 in)  
 Cylinder head journal inside diameter (f):  
 34.000–34.025 mm  
 (1.3386–1.3396 in)

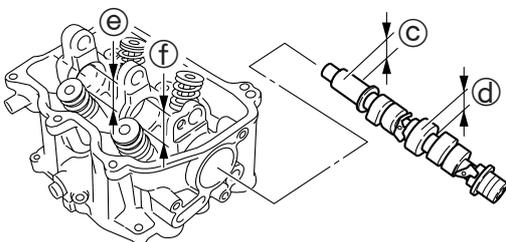
2. Measure the camshaft runout. Replace if above specification.



S6AG5240

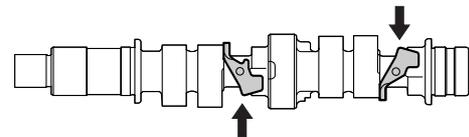
 Camshaft runout limit:  
 0.03 mm (0.0012 in)

3. Measure the camshaft journal diameters (c) and (d) and the cylinder head journal inside diameters (e) and (f). Replace the camshaft, cylinder head, or both if out of specification.



S6AG5250

4. Check the automatic decompression actuator. Replace the camshaft if damaged or worn.

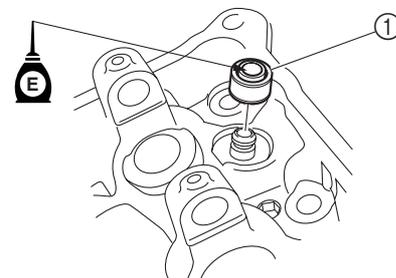


S6AG5245

# 5

## Assembling the cylinder head

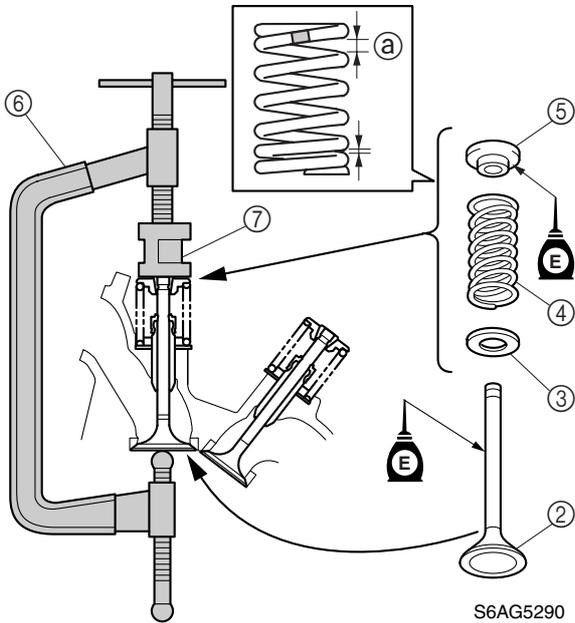
1. Install a new valve seal (1) onto the valve guide.



S6AG5280



2. Install the valve ②, valve spring seat ③, valve spring ④, and valve spring retainer ⑤ in the sequence shown, and then attach the special service tools.



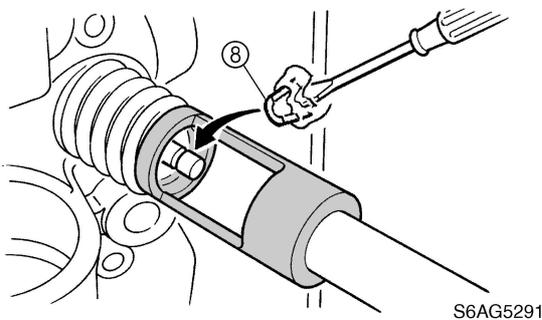
**NOTE:**

Face the wide pitch spring end ①, identified by the paint mark, toward the valve spring retainer ⑤.

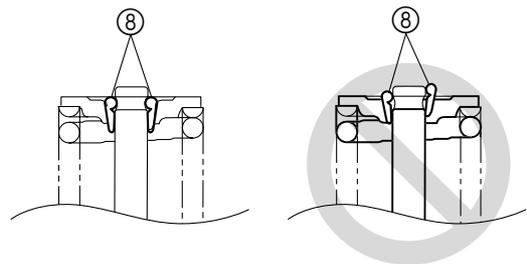
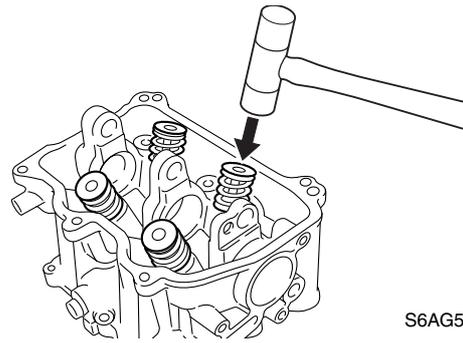


Valve spring compressor ⑥:  
90890-04019  
Valve spring compressor  
attachment ⑦: 90890-06320

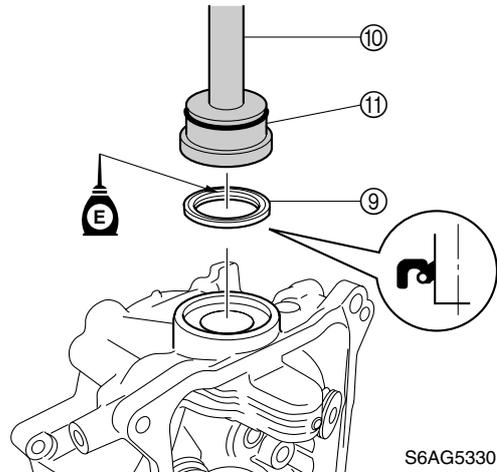
3. Compress the valve spring, and then install the valve cotters ⑧.



4. Lightly tap the valve spring retainer with a plastic hammer to set the valve cotters ⑧ securely.

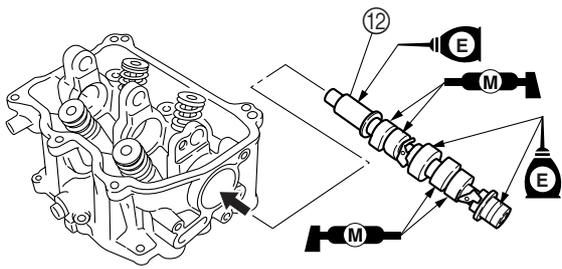


5. Install a new oil seal ⑨.



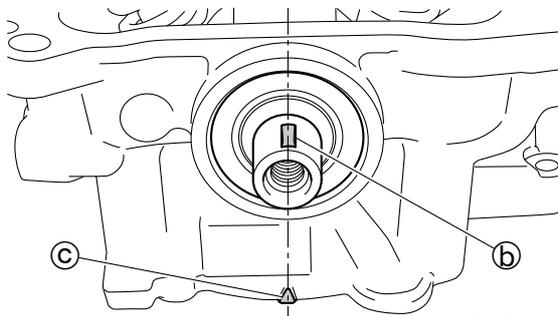
Driver rod L3 ⑩: 90890-06652  
Needle bearing attachment ⑪:  
90890-06653

6. Install the camshaft ⑫ in the direction shown.



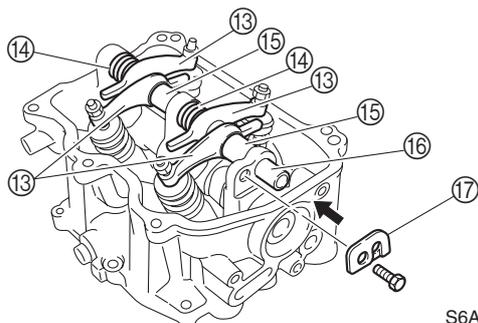
S6AG5340

7. Align the keyway (b) in the camshaft with the mark (c) on the cylinder head as shown.



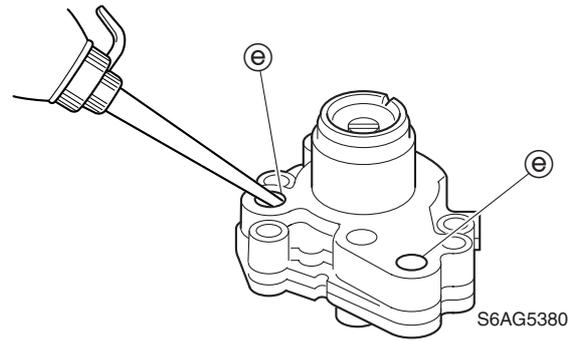
S6AG5350

8. Install the rocker arms (13), springs (14), and collars (15) into the cylinder head, and then install the shaft (16) and plate (17).

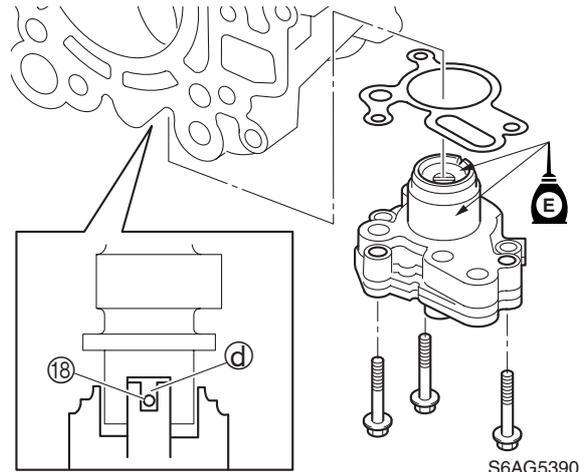


S6AG5370

9. Install the oil pump by aligning the slot (d) in the oil pump drive shaft with the camshaft pin (18).



S6AG5380



S6AG5390

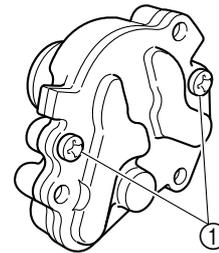
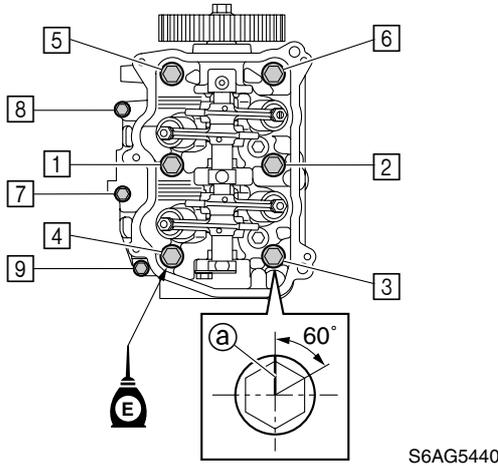
**NOTE:**

- To disassemble, check, and assemble the oil pump, see "Checking the oil pump" (5-47).
- Before installing the oil pump, be sure to fill it with a small amount of engine oil through the oil passages (e).



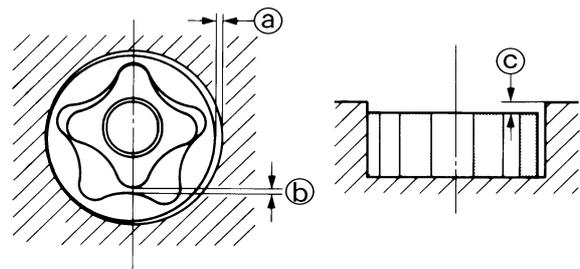
### Installing the cylinder head

1. Install a new gasket and the cylinder head, and then tighten the bolts to the specified torques in the sequence shown.



S6AG5430

2. Check the inner surface of the oil pump case. Replace the oil pump assembly if scratched.
3. Measure the oil pump rotor clearances as shown. Replace the oil pump assembly if out of specification.



S6D55580

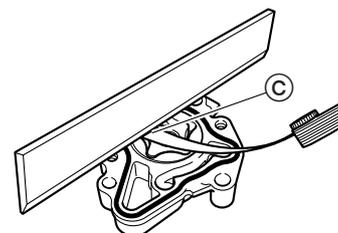
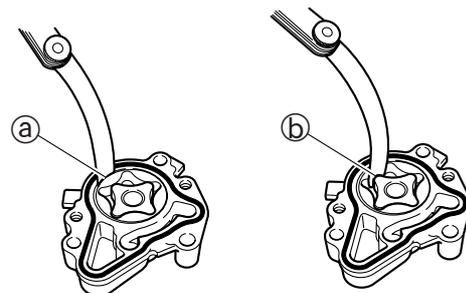
**CAUTION:**

**Do not reuse the cylinder head gasket, always replace it with a new one.**

**NOTE:**

- Apply engine oil to the cylinder head bolts before installation.
- Tighten the bolts to the specified torques in 3 stages.
- Make a mark (a) on cylinder head bolts (M9) and the cylinder head, and then tighten the bolts 60° from the mark.

	Cylinder head bolt 1-6 (M9):
	1st: 15 N·m (1.5 kgf·m, 11.1 ft·lb)
	2nd: 29 N·m (2.9 kgf·m, 21.4 ft·lb)
	3rd: 60°
	Cylinder head bolt 7-9 (M6):
	1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb)
2nd: 12 N·m (1.2 kgf·m, 8.9 ft·lb)	



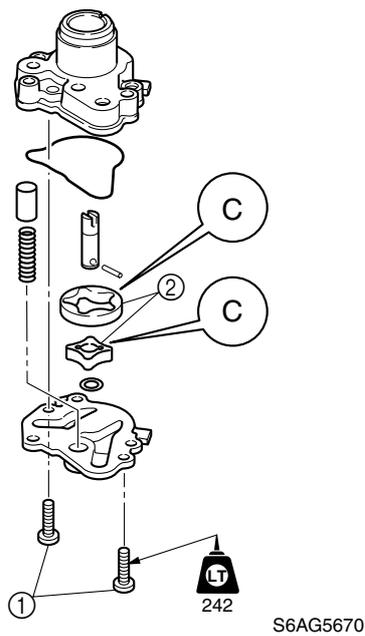
S6AG5420

### Checking the oil pump

1. Remove the oil pump screws (1) and disassemble the oil pump.

	Clearance (a): 0.09–0.15 mm (0.0035–0.0059 in)
	Clearance (b): Within 0.12 mm (0.0047 in)
	Clearance (c): 0.03–0.08 mm (0.0012–0.0031 in)

- Assemble the oil pump, and then tighten the oil pump screws (1) to the specified torque.

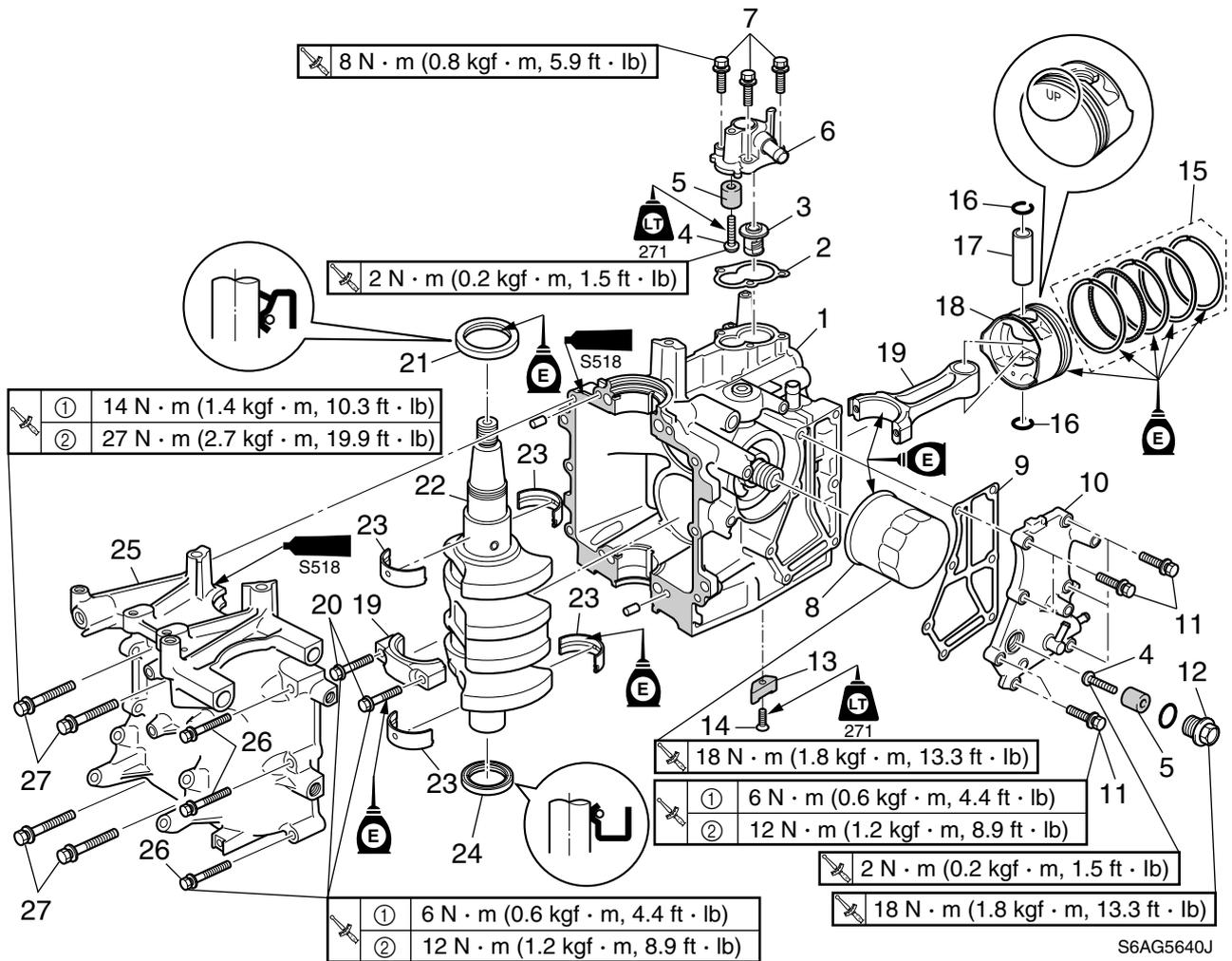


**NOTE:** \_\_\_\_\_  
When assembling the oil pump, face the “C” mark on each rotor (2) up.

	Oil pump screw (1): 5 N·m (0.5 kgf·m, 3.7 ft·lb)
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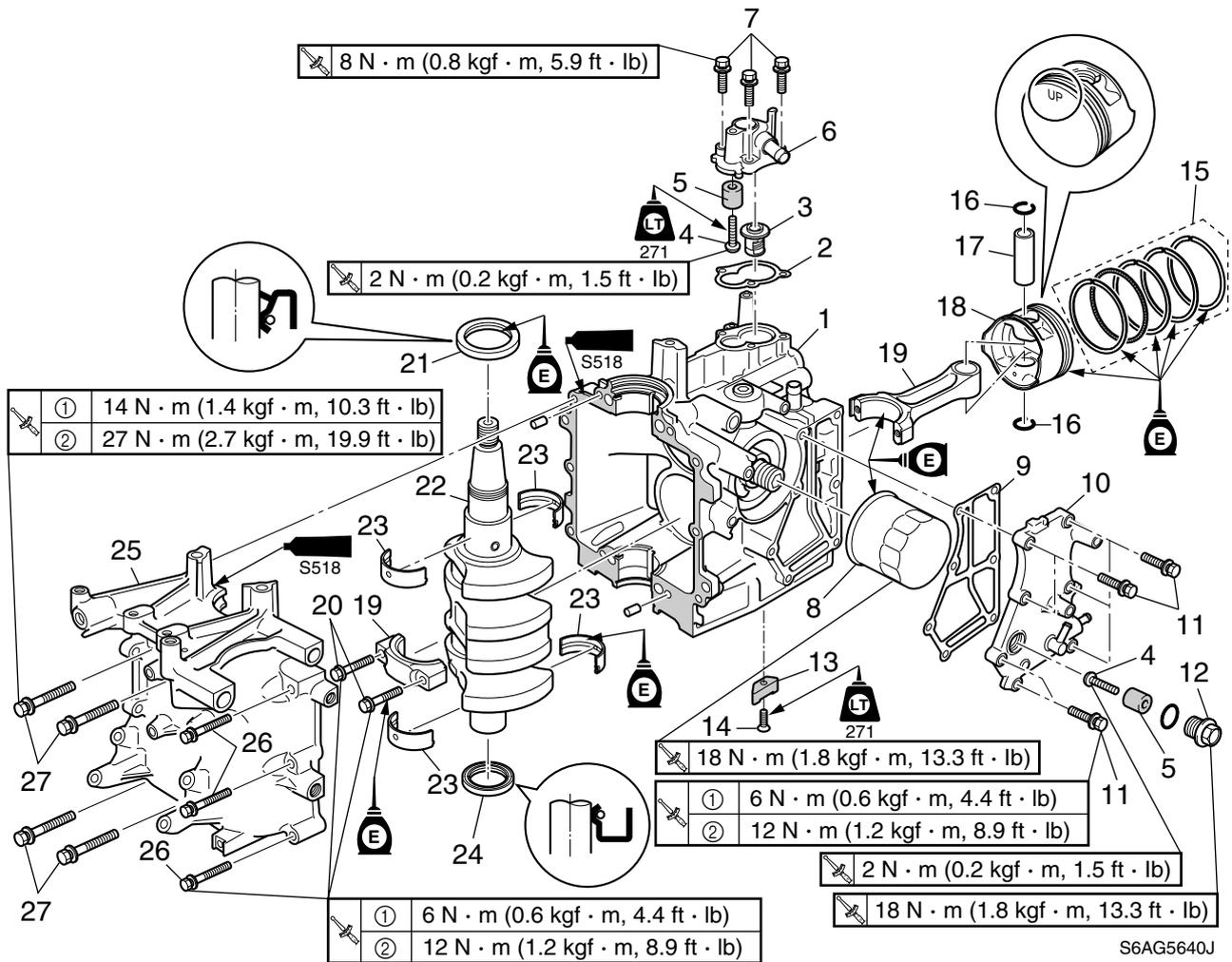


Cylinder block



S6AG5640J

No.	Part name	Q'ty	Remarks
1	Cylinder block	1	
2	Gasket	1	<b>Not reusable</b>
3	Thermostat	1	
4	Screw	2	ø5 × 25 mm
5	Anode	2	
6	Thermostat cover	1	
7	Bolt	3	M6 × 25 mm
8	Oil filter	1	
9	Gasket	1	<b>Not reusable</b>
10	Exhaust cover	1	
11	Bolt	7	M6 × 25 mm
12	Plug	1	
13	Anode	1	
14	Screw	1	ø4 × 16 mm
15	Piston ring set	2	
16	Clip	4	<b>Not reusable</b>
17	Piston pin	2	



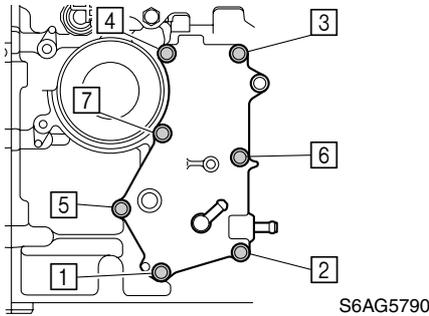
5

No.	Part name	Q'ty	Remarks
18	Piston	2	
19	Connecting rod	2	
20	Bolt	4	M6 × 36 mm
21	Oil seal	1	<b>Not reusable</b>
22	Crankshaft	1	
23	Main bearing	4	
24	Oil seal	1	<b>Not reusable</b>
25	Crankcase	1	
26	Bolt	6	M6 × 40 mm
27	Bolt	4	M8 × 65 mm

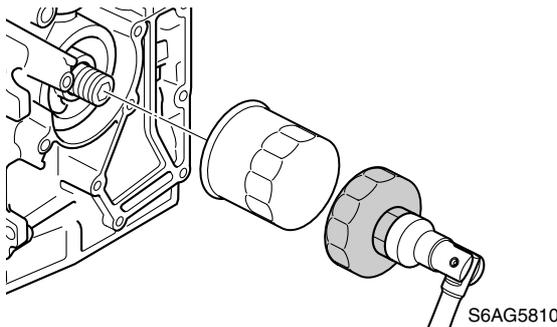


**Disassembling the cylinder block**

1. Remove the exhaust cover bolts in the sequence shown, and then remove the exhaust cover.

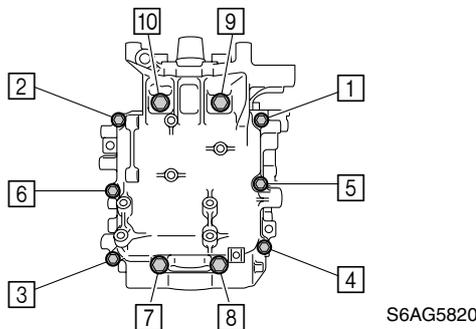


2. Remove the thermostat cover.
3. Remove the oil filter using a 64 mm (2.5 in) oil filter wrench.

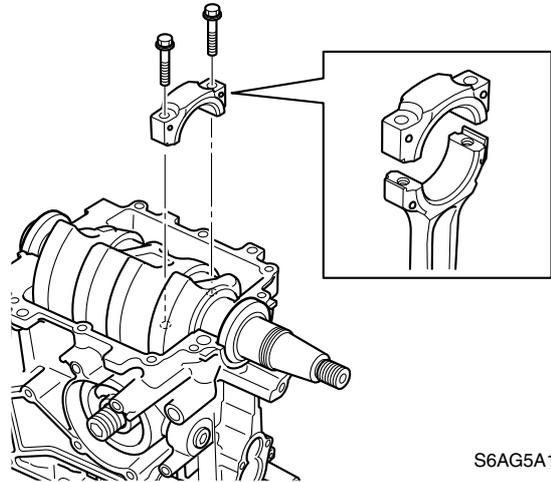


Oil filter wrench: 90890-01426

4. Remove the crankcase bolts in the sequence shown, and then remove the crankcase.



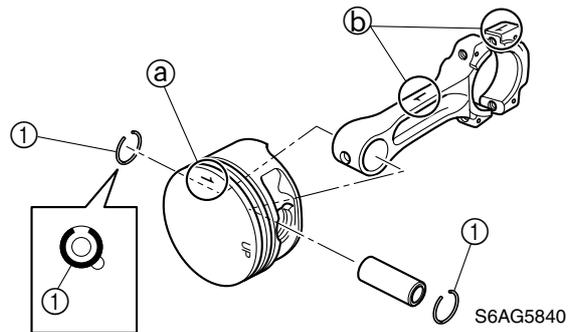
5. Remove the connecting rod cap bolts and connecting rod caps, and then remove the connecting rod and piston assemblies.



6. Remove the crankshaft, main bearings and oil seals.

**NOTE:** \_\_\_\_\_  
 Be sure to keep the main bearings in the order as they were removed.

7. Remove the piston pin clips ① and piston pin, and then remove the piston.



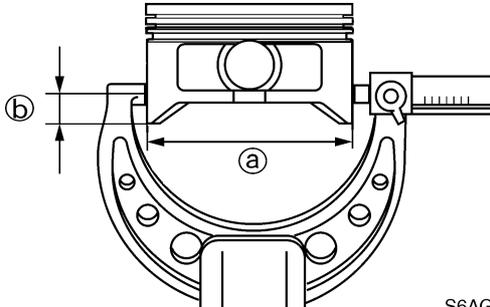
**NOTE:** \_\_\_\_\_

- Mark each piston with an identification number ① of the corresponding cylinder.
- To avoid interchanging the connecting rods and connecting rod caps, mark each with an identification mark ② and be sure to keep them in the order as they were removed.

8. Remove the piston rings.

### Checking the piston diameter

1. Measure the piston diameter at the specified measuring point. Replace if out of specification.



S6AG5850

	Piston diameter (a):
	62.950–62.965 mm (2.4783–2.4789 in)
	Measuring point (b):
	3.5 mm (0.14 in) up from the bottom of the piston skirt
	Oversize piston diameter:
	Oversize 1st:
63.200–63.215 mm (2.4882–2.4888 in)	
Oversize 2nd:	
63.450–63.465 mm (2.4980–2.4986 in)	

	Cylinder bore ( $D_1$ – $D_6$ ):
	63.000–63.015 mm (2.4803–2.4809 in)

### Checking the piston clearance

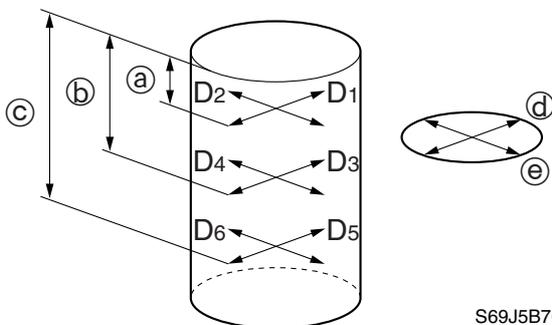
1. Check the piston clearances if replacing the piston, the piston ring set, the cylinder block, or all parts.

**NOTE:** \_\_\_\_\_  
The figures are for reference only. Depending on how the parts are assembled, the actual measurements may not be within the specified ranges.

	Piston clearance (reference data):
	0.035–0.065 mm (0.0014–0.0026 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 in direction (e) ( $D_2$ ,  $D_4$ ,  $D_6$ ), which is at a right angle to the crankshaft.



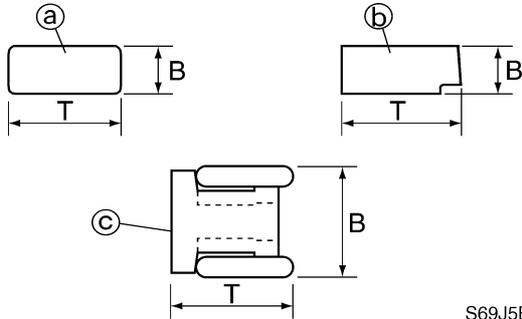
S69J5B70

- (a) 20 mm (0.8 in)
- (b) 40 mm (1.6 in)
- (c) 60 mm (2.4 in)



**Checking the piston ring**

1. Measure the piston ring dimensions B and T. Replace the piston ring set if out of specification.



S69J5B80



**Piston ring dimensions:**

**Top ring (a):**

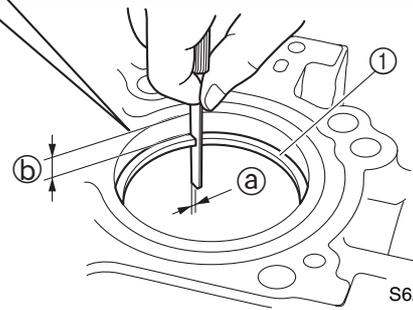
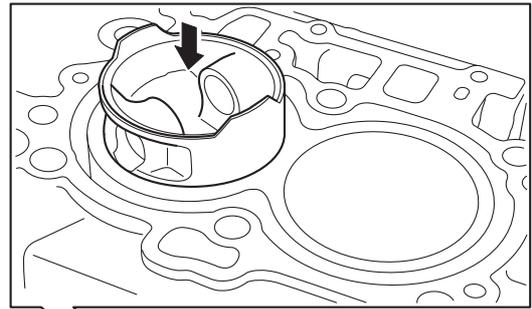
- B: 1.17–1.19 mm  
(0.0461–0.0469 in)
- T: 2.30–2.50 mm  
(0.0906–0.0984 in)

**2nd ring (b):**

- B: 1.17–1.19 mm  
(0.0461–0.0469 in)
- T: 2.4–2.6 mm  
(0.0945–0.1024 in)

**Oil ring (c):**

- B: 2.34–2.46 mm  
(0.0921–0.0969 in)
- T: 2.75 mm (0.1083 in)



S6AG5860

**NOTE:**

The figures are for reference only. Depending on how the parts are assembled, the actual measurements may not be within the specified ranges.



**Piston ring end gap (a) (reference data):**

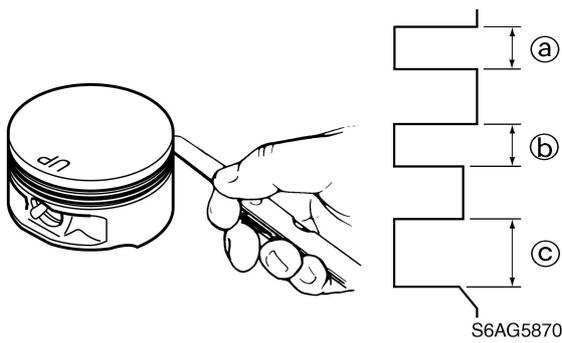
- Top ring:  
0.15–0.30 mm  
(0.0059–0.0118 in)
  - 2nd ring:  
0.25–0.4 mm  
(0.0098–0.0157 in)
  - Oil ring:  
0.2–0.7 mm (0.0079–0.0276 in)
- Measuring point (b) (reference data):**  
20 mm (0.8 in)

**Checking the piston ring end gap**

1. Level the piston ring ① in the cylinder with a piston crown.
2. Measure the piston ring end gap (a) at the specified measuring point (b).

**Checking the piston ring groove**

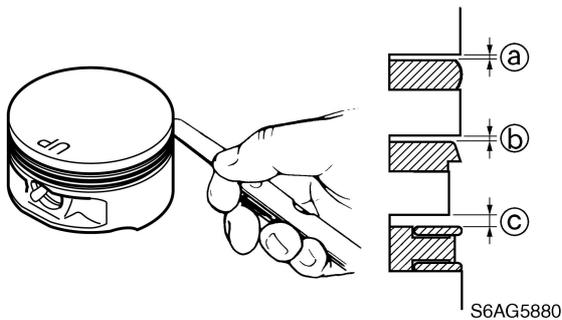
1. Measure the piston ring grooves. Replace the piston if out of specification.



	<b>Piston ring groove:</b>
	Top ring (a):
	1.21–1.23 mm (0.0476–0.0484 in)
	2nd ring (b):
	1.21–1.23 mm (0.0476–0.0484 in)
	Oil ring (c):
	2.51–2.53 mm (0.0988–0.0996 in)

### Checking the piston ring side clearance

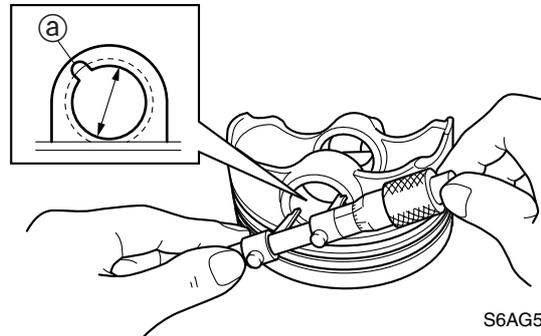
1. Measure the piston ring side clearance. Replace the piston and piston rings as a set if out of specification.



	<b>Piston ring side clearance:</b>
	Top ring (a):
	0.02–0.06 mm (0.0008–0.0024 in)
	2nd ring (b):
	0.02–0.06 mm (0.0008–0.0024 in)
	Oil ring (c):
	0.05–0.19 mm (0.0020–0.0075 in)

### Checking the piston pin boss bore

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

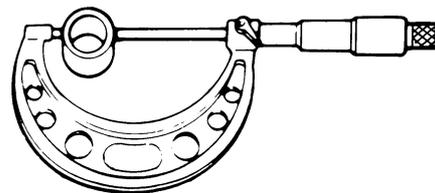


**NOTE:** When measuring the piston pin boss bore, do not measure it at the ring groove (a).

	<b>Piston pin boss bore:</b>
	16.004–16.015 mm (0.6301–0.6305 in)

### Checking the piston pin diameter

1. Measure the piston pin diameter. Replace if out of specification.



S69J5C30

	<b>Piston pin diameter:</b>
	15.995–16.000 mm (0.6297–0.6299 in)

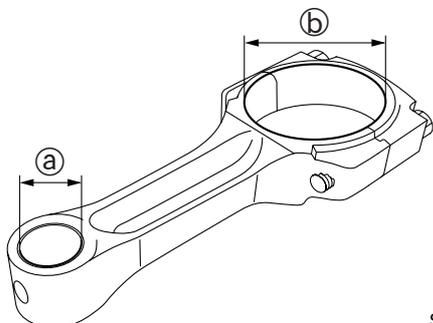
### Checking the connecting rod small and big end inside diameter

1. Tighten the connecting rod cap bolts to the specified torques in 2 stages.

	<b>Connecting rod cap bolt:</b>
	1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb)
	2nd: 12 N·m (1.2 kgf·m, 8.9 ft·lb)



2. Measure the connecting rod small end inside diameter (a) and big end inside diameter (b). Replace the connecting rod if out of specification.



S6AG5H70



Connecting rod small end inside diameter (a):

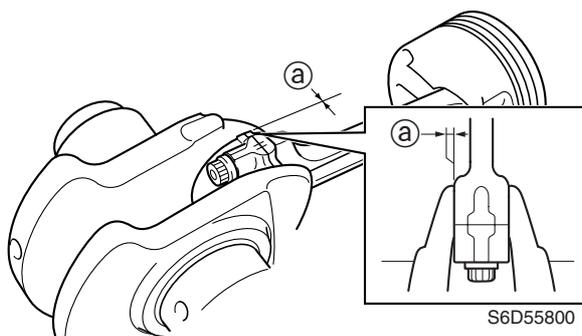
16.015–16.029 mm  
(0.6305–0.6311 in)

Connecting rod big end inside diameter (b):

34.030–34.042 mm  
(1.3398–1.3402 in)

**Checking the connecting rod big end side clearance**

1. Measure the connecting rod big end side clearance (a).



S6D55800

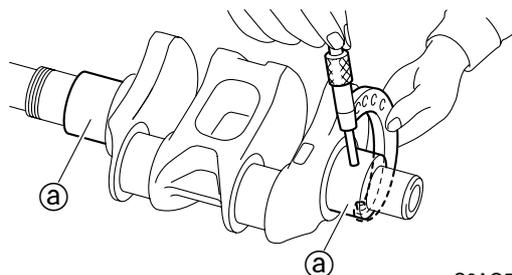


Connecting rod big end side clearance (a) (reference data):

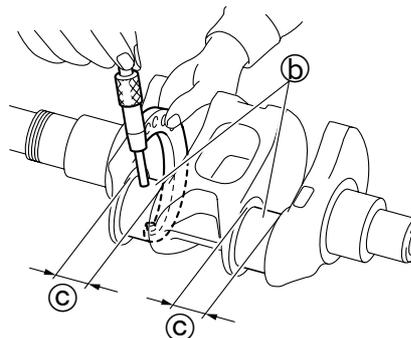
0.05–0.22 mm (0.0020–0.0087 in)

**Checking the crankshaft**

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



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S6AG5920



Crankshaft journal diameter (a):

36.997–37.009 mm  
(1.4566–1.4570 in)

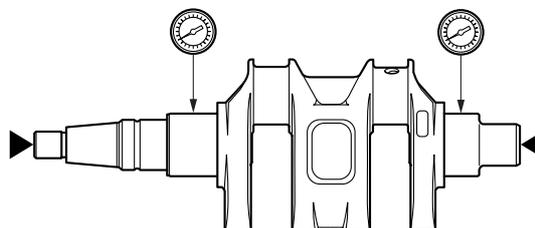
Crankpin diameter (b):

33.997–34.009 mm  
(1.3385–1.3389 in)

Crankpin width (c):

21.000–21.070 mm  
(0.8268–0.8295 in)

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



S6AG5930



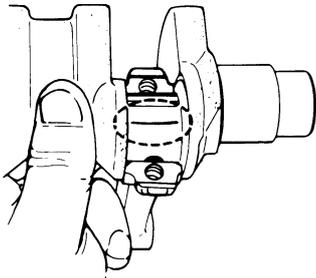
Crankshaft runout limit:

0.05 mm (0.0020 in)

**Checking the crankpin oil clearance**

1. Clean the contact surfaces of the connecting rod and crankpin.

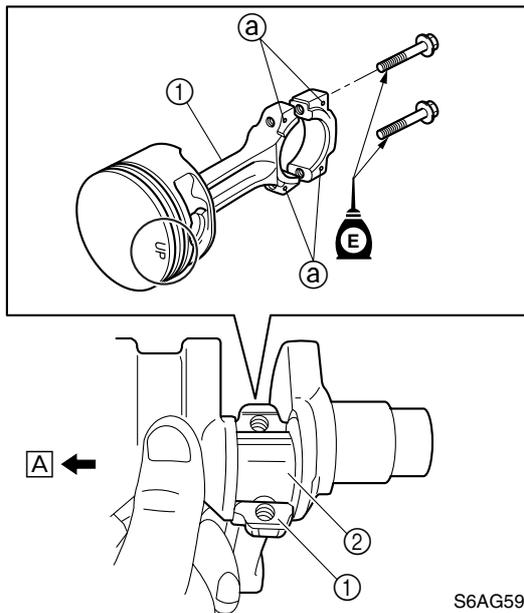
- Put a piece of Plastigauge (PG-1) onto the crankpin, parallel to the crankshaft.



S69J5D00

**NOTE:**  
Be sure not to put the Plastigauge (PG-1) over the oil hole in the crankpin of the crankshaft.

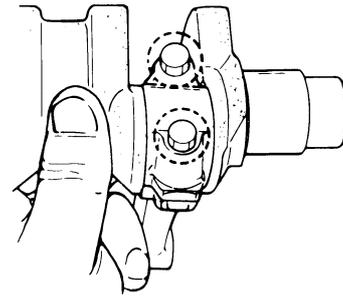
- Install the connecting rod ① to the crankpin ②.



S6AG5940

**NOTE:**  
Make sure that the projections ② of the connecting rod face towards the flywheel magnet side A of the crankshaft.

- Tighten the connecting rod cap bolts to the specified torques in 2 stages.

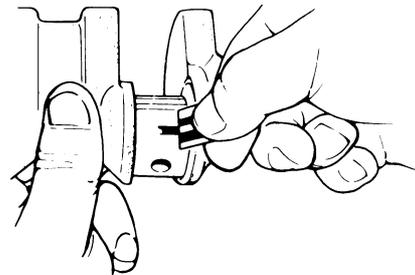


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**NOTE:**  
Do not turn the connecting rod until the crankpin oil clearance measurement has been completed.

	Connecting rod cap bolt:
	1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb) 2nd: 12 N·m (1.2 kgf·m, 8.9 ft·lb)

- Remove the connecting rod cap and measure the width of the compressed Plastigauge (PG-1) on each crankpin. Check the connecting rods and crankshaft if out of specification and, if necessary, replace them as a set.



S69J5D30

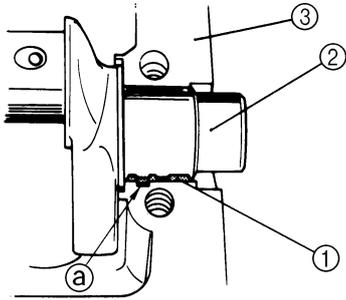
	Crankpin oil clearance (reference data):
	0.021–0.045 mm (0.0008–0.0018 in)

### Checking the crankshaft journal oil clearance

- Clean the main bearings, crankshaft journals, and bearing portions of the crankcase and cylinder block.
- Place the cylinder block upside down on a bench.



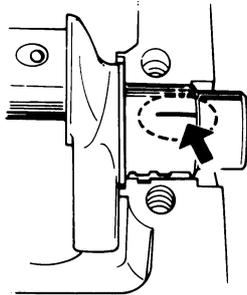
3. Install half of the main bearings ① and the crankshaft ② into the cylinder block ③.



S6D55860

- NOTE:**
- Install the main bearings in their original positions.
  - Insert the projection ① of each bearing into the slots in the cylinder block.

4. Put a piece of Plastigauge (PG-1) on each crankshaft journal parallel to the crankshaft.



S6D55870

- NOTE:**
- Be sure not to put the Plastigauge (PG-1) over the oil hole in each main journal of the crankshaft.

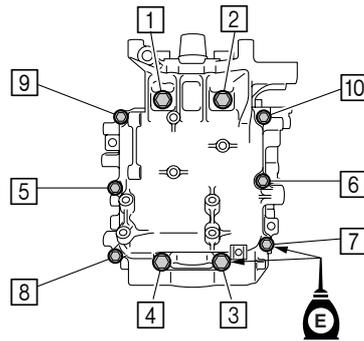
5. Install the remaining half of the main bearings into the crankcase.

- NOTE:**
- Install the main bearings in their original positions.
  - Insert the projection of each bearing into the slots in the crankcase.

6. Install the crankcase onto the cylinder block.

- NOTE:**
- Apply engine oil to the threads of the crankcase bolts.

7. Tighten the crankcase bolts to the specified torques in 2 stages and in the sequence shown.



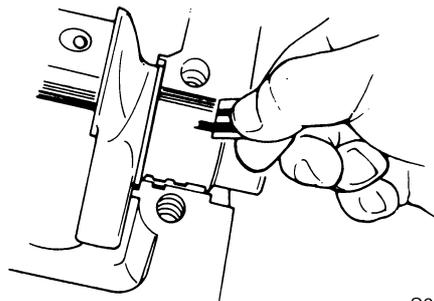
S6AG5830

- NOTE:**
- Do not turn the crankshaft until the crankshaft journal oil clearance measurement has been completed.



- Crankcase bolt ①-④ (M8):  
 1st: 14 N·m (1.4 kgf·m, 10.3 ft·lb)  
 2nd: 27 N·m (2.7 kgf·m, 19.9 ft·lb)  
 Crankcase bolt ⑤-⑩ (M6):  
 1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb)  
 2nd: 12 N·m (1.2 kgf·m, 8.9 ft·lb)

8. Gently remove the crankcase, and then measure the width of the compressed Plastigauge (PG-1) on each crankshaft journal. Replace the main bearings if out of specification.



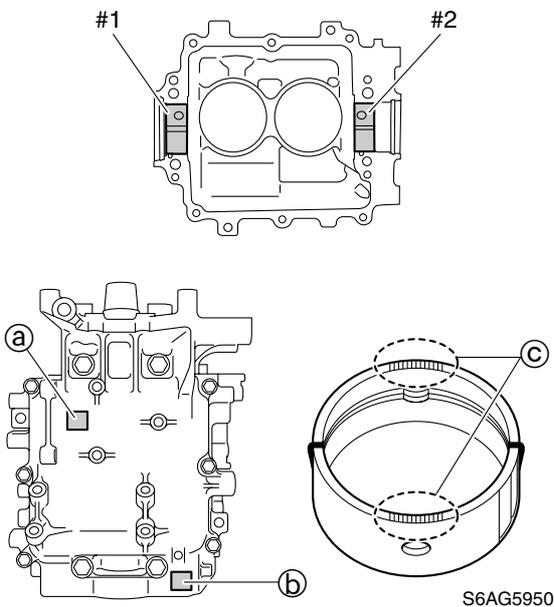
S6D55880

**NOTE:** \_\_\_\_\_  
 When loosening the crankcase bolts, loosen them in the opposite order used for tightening.

	Crankshaft journal oil clearance (reference data): 0.011–0.039 mm (0.0004–0.0015 in)
---	---

**Selecting the crankshaft main bearing**

1. Check the stamped marks (a) and (b) on the crankcase and cylinder block.



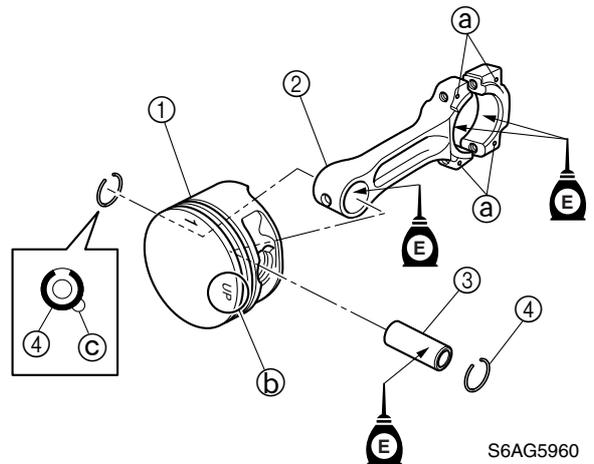
**NOTE:** \_\_\_\_\_  
 The stamped mark (a) for the main bearing of crankshaft journal #1 is on the crankcase cover and the stamped mark (b) for the main bearing of crankshaft journal #2 is on the cylinder block.

2. Select the suitable bearing color (c) for the main bearing from the table.

Stamped marks (a) and (b)	Bearing color (c)
A	Blue
B	Black
C	Brown

**Assembling the cylinder block**

1. Assemble the piston (1), connecting rod (2), piston pin (3), and piston pin clips (4).



**CAUTION:** \_\_\_\_\_  
 Do not reuse the piston pin clips (4), always replace them with new ones.

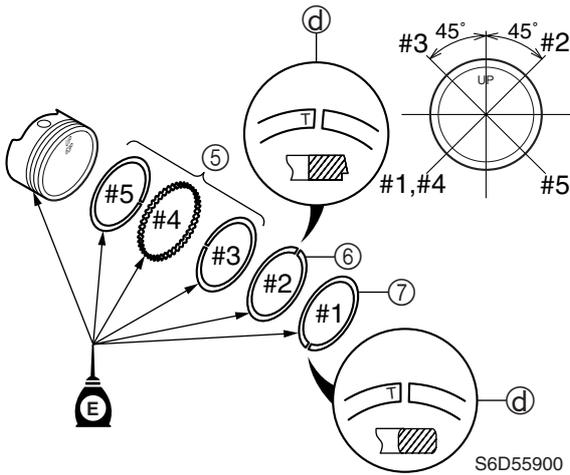
**NOTE:** \_\_\_\_\_  
 • Face the projections (a) on the connecting rod in the same direction as the “UP” mark (b) on the piston.  
 • Do not allow the piston pin clip end to align with the piston pin slot (c).



2. Install the oil ring (5), 2nd ring (6), and top ring (7) onto each piston.

**NOTE:** \_\_\_\_\_  
 Make sure that the “T” marks (d) of the 2nd ring and the top ring are facing upward.

3. Offset the piston ring end gaps as shown.

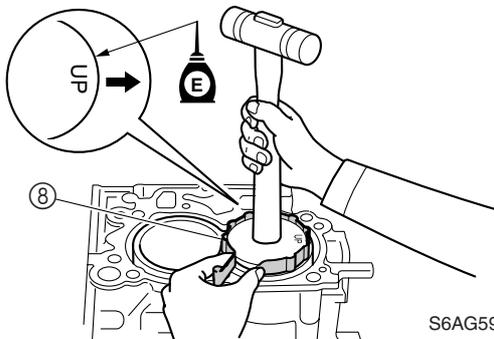


S6D55900

**CAUTION:** \_\_\_\_\_  
**Do not scratch the pistons or break the piston rings.**

**NOTE:** \_\_\_\_\_  
 After installing the piston rings, check that they move smoothly.

4. Install the piston with the “UP” mark on the piston crown facing towards the fly-wheel magnet.



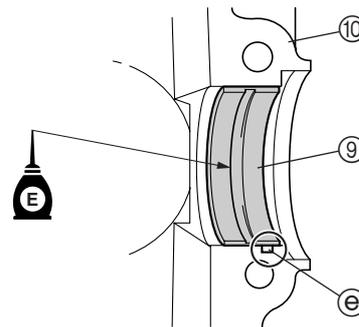
S6AG5980

**NOTE:** \_\_\_\_\_  
 Apply engine oil to the side of the pistons and piston rings before installation.



Piston slider (8): 90890-06529

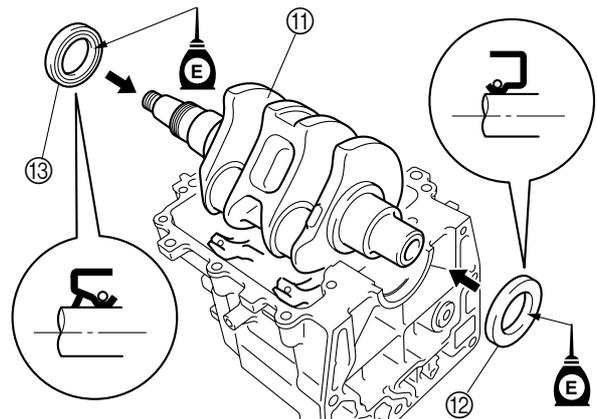
5. Install half of the main bearings (9) into the cylinder block (10).



S6AG5990

**NOTE:** \_\_\_\_\_  
 • Install the main bearings in their original positions.  
 • Insert the projection (e) of each bearing into the slots in the cylinder block.

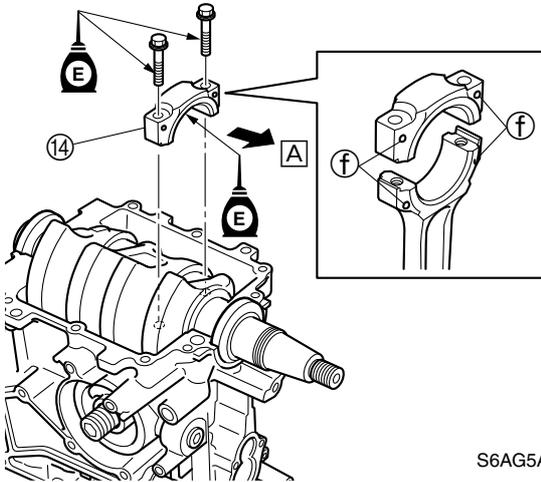
6. Install the crankshaft (11) and oil seals (12 and 13) into the cylinder block as shown.



S6AG5A00

**NOTE:** \_\_\_\_\_  
 Apply engine oil to the inside of the oil seals before installation.

7. Install the connecting rod caps ⑭ to the connecting rods, and then tighten the connecting rod cap bolts to the specified torques in 2 stages.



S6AG5A10

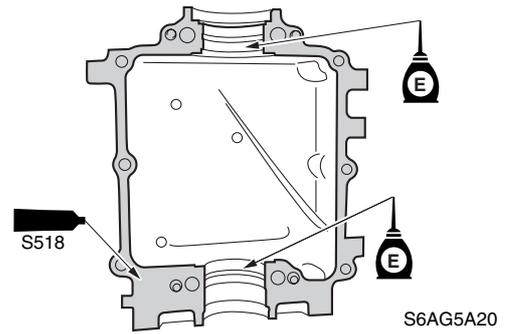
- NOTE:**
- Make sure that the projections ⑆ on the connecting rod cap face towards the fly-wheel magnet end **A** of the crankshaft.
  - Apply engine oil to the connecting rod cap bolts before installation.
  - After tightening the connecting rod cap bolts, check that the crankshaft rotates smoothly.

	Connecting rod cap bolt:
	1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb) 2nd: 12 N·m (1.2 kgf·m, 8.9 ft·lb)

8. Install the remaining half of the main bearings into the crankcase.

- NOTE:**
- Install the main bearings in their original positions.
  - Insert the projection of each bearing into the slots in the crankcase.

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



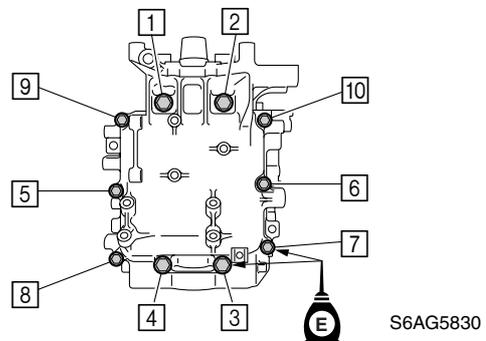
S6AG5A20

- NOTE:**  
Do not get any sealant on the main bearings.

10. Install the crankcase onto the cylinder block.

- NOTE:**  
Apply engine oil to the threads of the crankcase bolts.

11. Tighten the crankcase bolts to the specified torques in 2 stages and in the sequence shown.

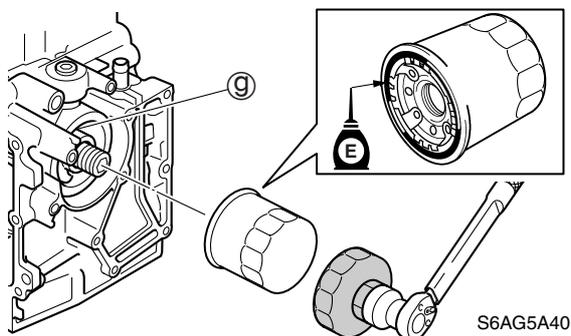


S6AG5830

	Crankcase bolt <b>1</b> – <b>4</b> (M8):
	1st: 14 N·m (1.4 kgf·m, 10.3 ft·lb) 2nd: 27 N·m (2.7 kgf·m, 19.9 ft·lb)
	Crankcase bolt <b>5</b> – <b>10</b> (M6):
	1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb) 2nd: 12 N·m (1.2 kgf·m, 8.9 ft·lb)



12. Install the oil filter, and then tighten it to the specified torque using a 64 mm (2.5 in) oil filter wrench.



**NOTE:**

- Before installing the oil filter, be sure to supply engine oil to the oil passage ⑨.
- Apply a thin coat of engine oil to the O-ring of the new oil filter before installation.

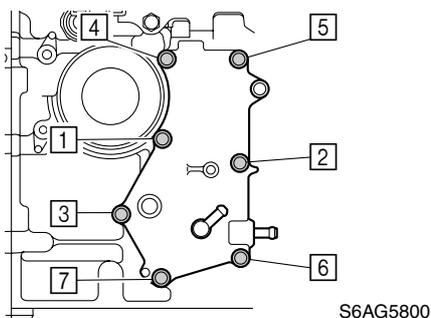
	Oil filter wrench: 90890-01426
--	--------------------------------

	Oil filter: 18 N·m (1.8 kgf·m, 13.3 ft·lb)
--	---

13. Install a new gasket, the thermostat, and the thermostat cover.

	Thermostat cover bolt: 8 N·m (0.8 kgf·m, 5.9 ft·lb)
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14. Install a new gasket and the exhaust cover, and then tighten the bolts to the specified torques in 2 stages and in the sequence shown.



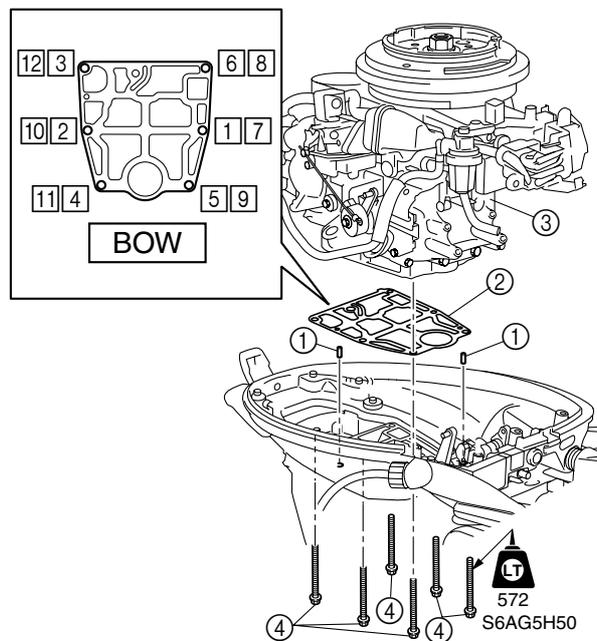
	Exhaust cover bolt: 1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb) 2nd: 12 N·m (1.2 kgf·m, 8.9 ft·lb)
--	--

**Installing the power unit**

1. Clean the power unit mating surface, and then install the dowels ①, a new gasket ②, and the power unit ③.

**CAUTION:** Do not reuse the gasket, always replace it with a new one.

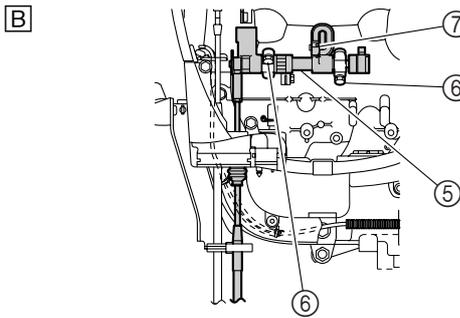
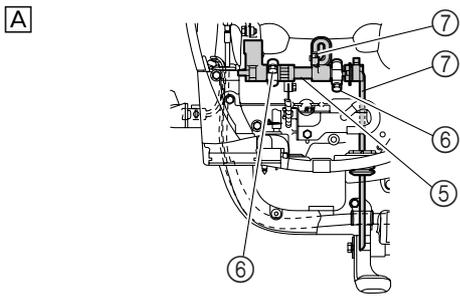
2. Install the mounting bolts ④, and then tighten them to the specified torque.



**NOTE:** Before installing the power unit, be sure to remove the fuel pump to prevent damaging it.

	Power unit mounting bolt: 1st: 27 N·m (2.7 kgf·m, 19.9 ft·lb) 2nd: 27 N·m (2.7 kgf·m, 19.9 ft·lb)
--	---

3. Install the apron and dipstick.
4. Install the shift rod cam ⑤, and then tighten the bolts ⑥.

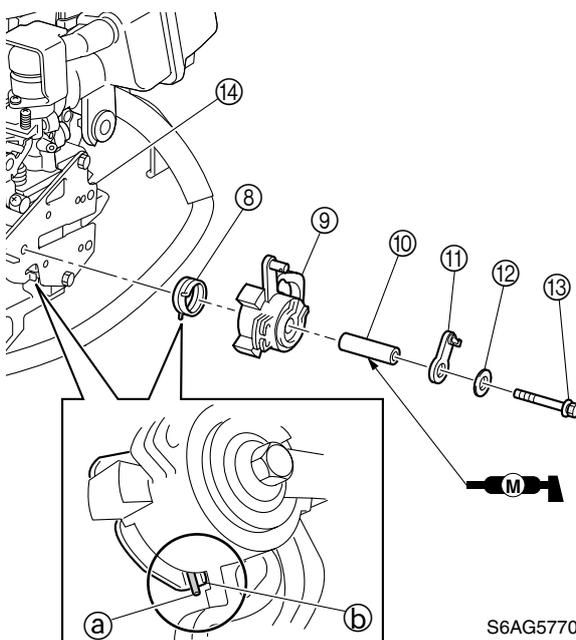


S6AG5H60

- A Tiller handle model
- B Remote control model

**NOTE:**  
Before installing the shift rod cam ⑤, make sure that the shift link rods ⑦ (tiller handle model) or shift rod ⑦ (remote control model) is installed correctly.

5. Install the spring ⑧, throttle cam ⑨, shaft ⑩, free accel lever ⑪, washer ⑫, and bolt ⑬, and then tighten the bolt to the specified torque.

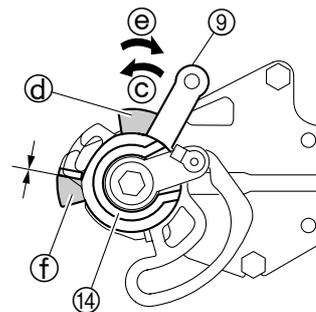


S6AG5770

**NOTE:**  
When installing the throttle cam ⑨ to the bracket ⑭, be sure to hook the end ① of the spring onto the projection ② of the bracket as shown.

 Throttle cam bolt ⑬:  
8 N·m (0.8 kgf·m, 5.9 ft·lb)

6. Turn the throttle cam ⑨ counterclockwise ③ until the fully open stopper ④ on the cam contacts the throttle cam bracket, and then release ⑤ it and check that the fully closed stopper ⑥ on the cam contacts the bracket due to the spring force.



S6AG5780

**NOTE:**  
If the fully closed stopper ⑥ does not contact the bracket, check that the spring ⑧ is installed correctly. If the end ① of the spring is not hooked onto the projection ② on the bracket, repeat steps 5–6.

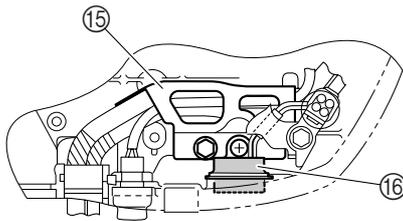


- Install the throttle cables onto the throttle cam ⑨, and then adjust the throttle cables. (Tiller handle model)  
Install the cable joint onto the throttle cam ⑨, and then adjust the throttle cable. (Remote control model)

**NOTE:**

- To adjust the throttle cable(s), see “Adjusting the throttle cable (tiller handle model)” (3-7) or “Adjusting the throttle cable (remote control model)” (3-8).
- Install the steering bracket cover after adjusting the throttle cables. (Tiller handle model)

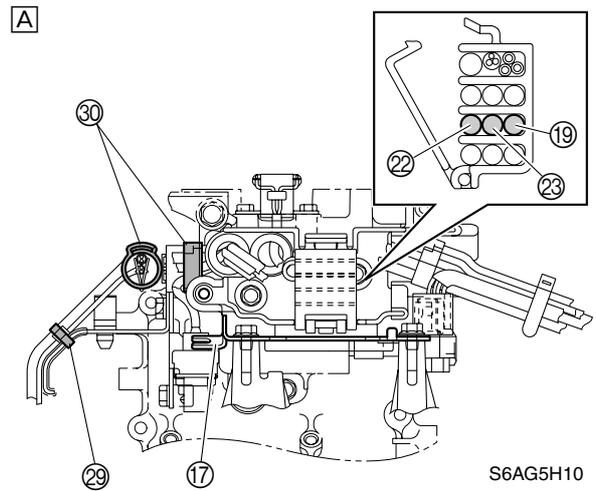
- Install the bracket 15 and warning indicator assembly 16.



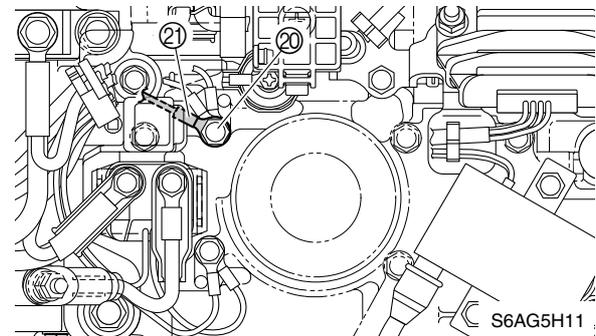
S6AG5H00

- Install the junction box bracket 17. (Manual tilt model)  
Install the power tilt relay 18. (Power tilt model)

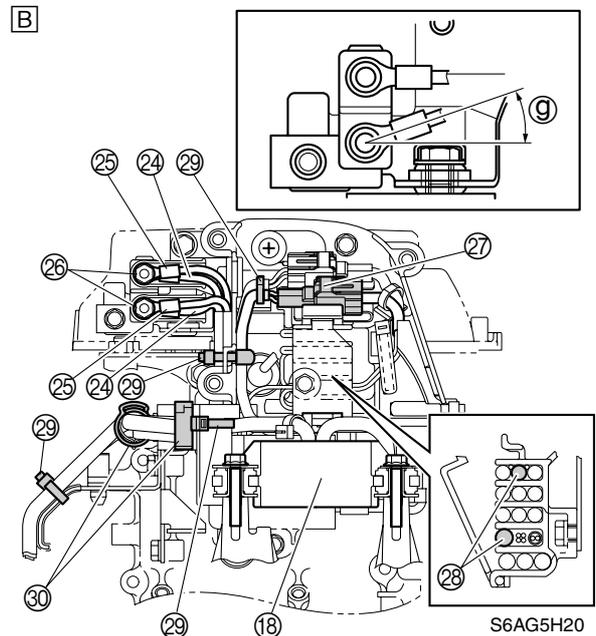
- Connect the engine stop lanyard switch lead (W) 19. Install the engine stop lanyard switch lead (B) terminal 21 using the bolt 20. Connect the engine start button leads (R) 22 and (Br) 23. (Manual tilt model/Tiller handle model)  
Connect the power tilt motor leads 24 and power tilt relay leads 25, and then install the terminal nuts 26. Connect the power tilt switch coupler 27 and power tilt switch lead (R) 28. (Power tilt model)



S6AG5H10



S6AG5H11



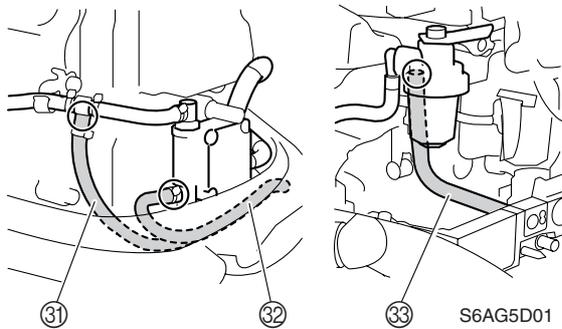
S6AG5H20

- A Manual tilt model/Tiller handle model
- B Power tilt model

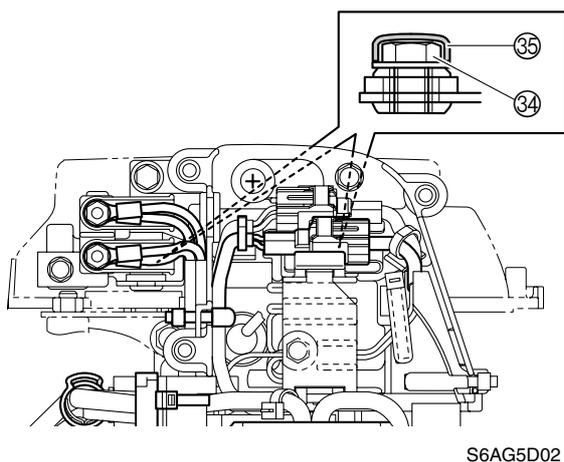
**NOTE:**

Install the power tilt motor leads 24 and power tilt relay leads 25 to the terminals, making sure to install the leads at an angle ⑨ of approximately 15–20°.

11. Fasten the leads with the plastic ties ⑳ and holders ㉑, and then install the junction box cover.
12. Connect the flushing hose ㉓, cooling water hose ㉒, and fuel hose ㉔.



13. Connect the battery cables. (Electric starter model)  
Connect the battery cables and 10-pin main harness coupler. (Remote control model)  
Install the retaining plate.
14. Install the manual starter and sprocket cover, and then connect the start-in-gear protection cable. (Manual starter model)  
Install the flywheel magnet cover and sprocket cover. (Electric starter model)



**NOTE:** \_\_\_\_\_

- To connect the start-in-gear protection cable, see “Checking the start-in-gear protection (manual starter model)” (3-11).
- Be sure to install the caps ㉕ on the bolts ㉖ for the flywheel magnet cover and junction box.

15. Pour the specified amount of the recommended engine oil into the oil filler hole.

**NOTE:** \_\_\_\_\_

For the specified amount and recommended engine oil, see “Changing the engine oil” (3-3).

**POWR**



Power unit

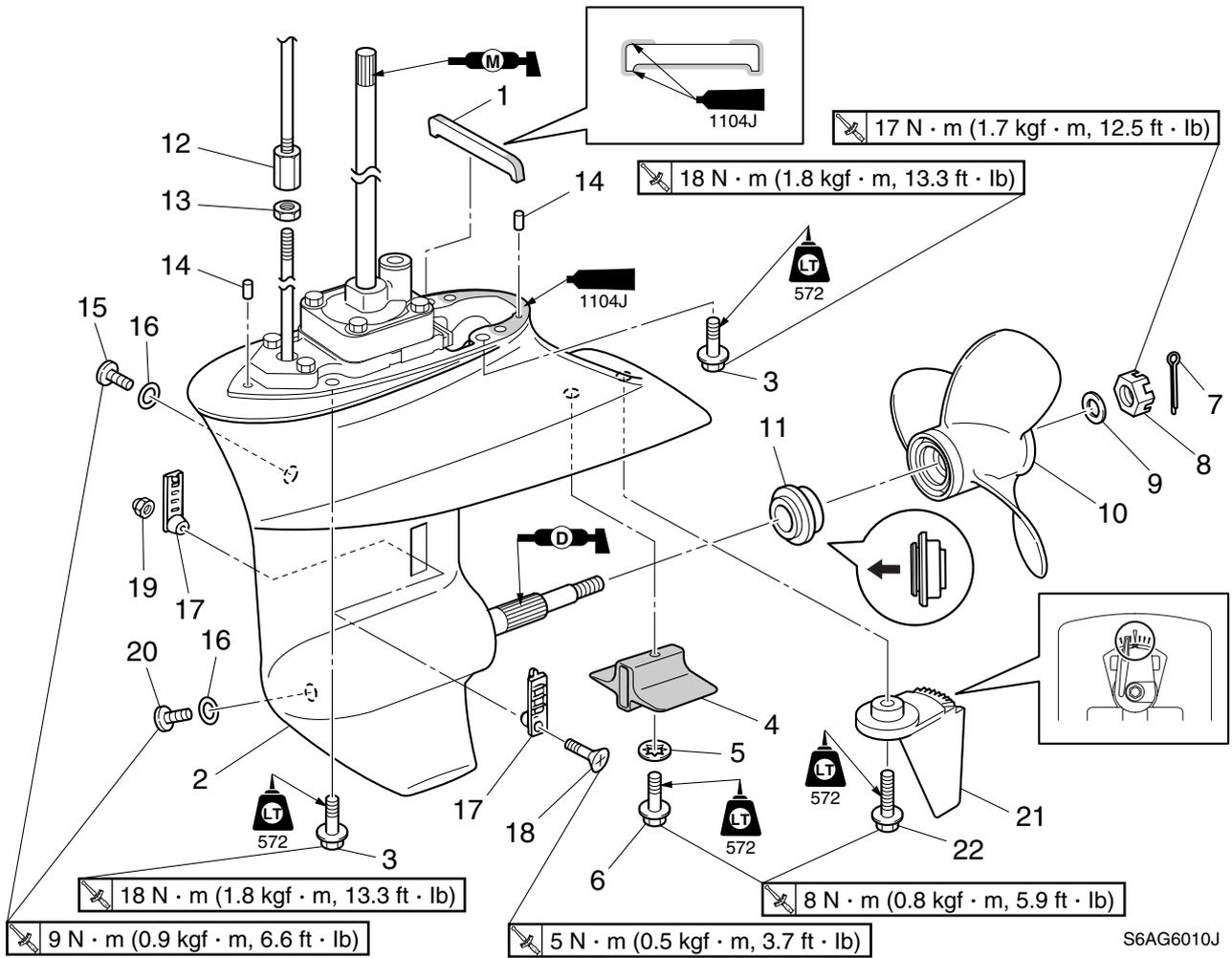
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**— MEMO —**

## Lower unit

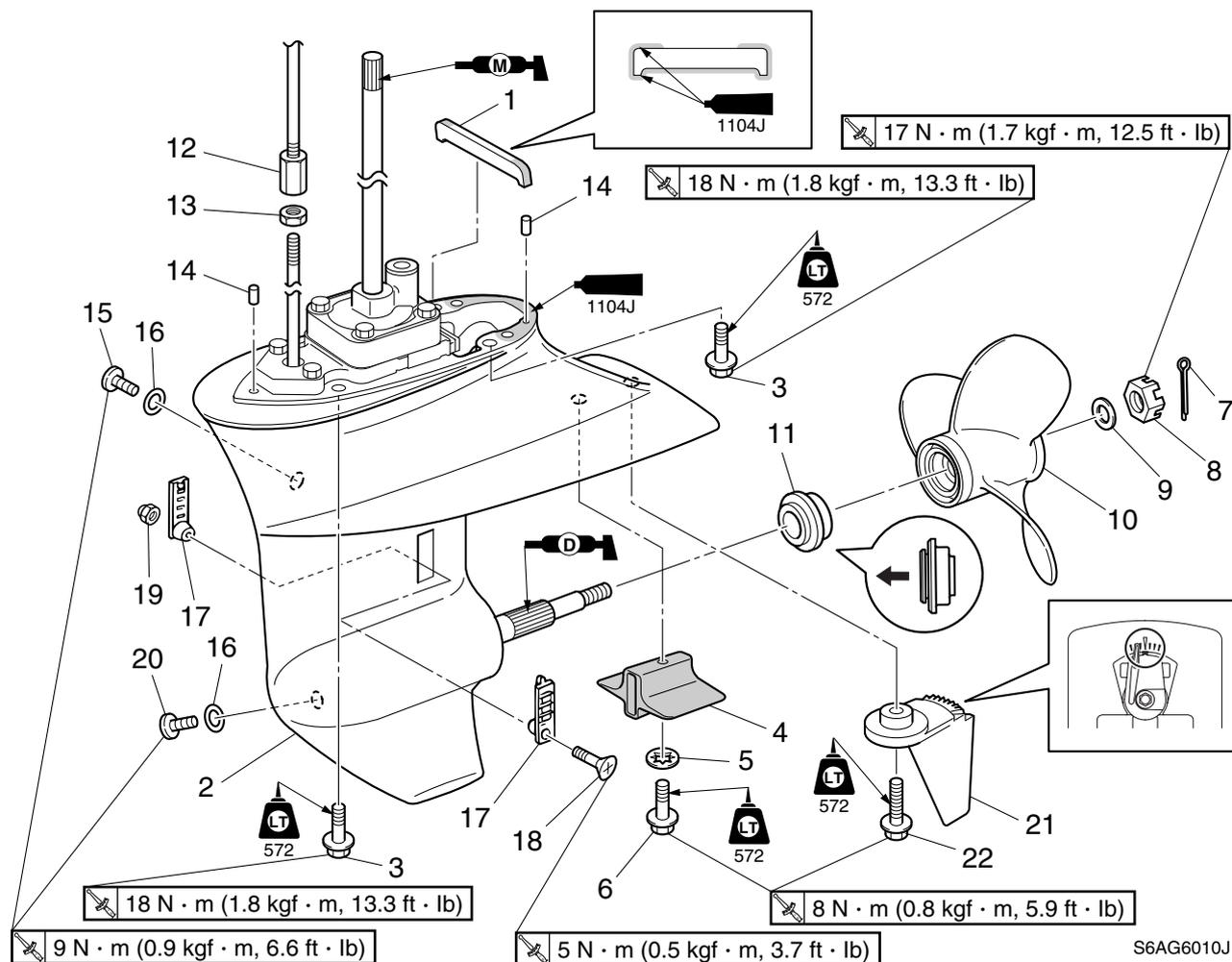
<b>Lower unit</b> .....	<b>6-1</b>
Removing the lower unit .....	6-4
Removing the water pump.....	6-5
Checking the water pump.....	6-5
<b>Propeller shaft housing</b> .....	<b>6-6</b>
Removing the propeller shaft housing assembly .....	6-7
Disassembling the propeller shaft assembly .....	6-7
Disassembling the propeller shaft housing assembly.....	6-7
Checking the propeller shaft housing .....	6-8
Checking the propeller shaft.....	6-8
Assembling the propeller shaft assembly .....	6-8
Assembling the propeller shaft housing.....	6-9
<b>Drive shaft and lower case</b> .....	<b>6-11</b>
Removing the drive shaft, drive shaft housing, and shift rod.....	6-12
Disassembling the drive shaft housing .....	6-12
Disassembling the forward gear .....	6-12
Disassembling the lower case .....	6-13
Checking the pinion and forward gear .....	6-13
Checking the bearing.....	6-13
Checking the drive shaft .....	6-13
Checking the shift rod.....	6-13
Checking the lower case .....	6-13
Assembling the lower case.....	6-14
Assembling the forward gear.....	6-14
Assembling the drive shaft housing.....	6-15
Installing the shift rod, drive shaft housing, and drive shaft.....	6-15
Installing the propeller shaft housing .....	6-16
Installing the water pump.....	6-16
Installing the lower unit.....	6-17
<b>Shimming</b> .....	<b>6-20</b>
Shimming.....	6-21
Selecting the pinion shim.....	6-21
Selecting the forward gear shim .....	6-21
Selecting the reverse gear shim .....	6-22
<b>Backlash</b> .....	<b>6-23</b>
Measuring the forward and reverse gear backlash .....	6-23

**Lower unit**



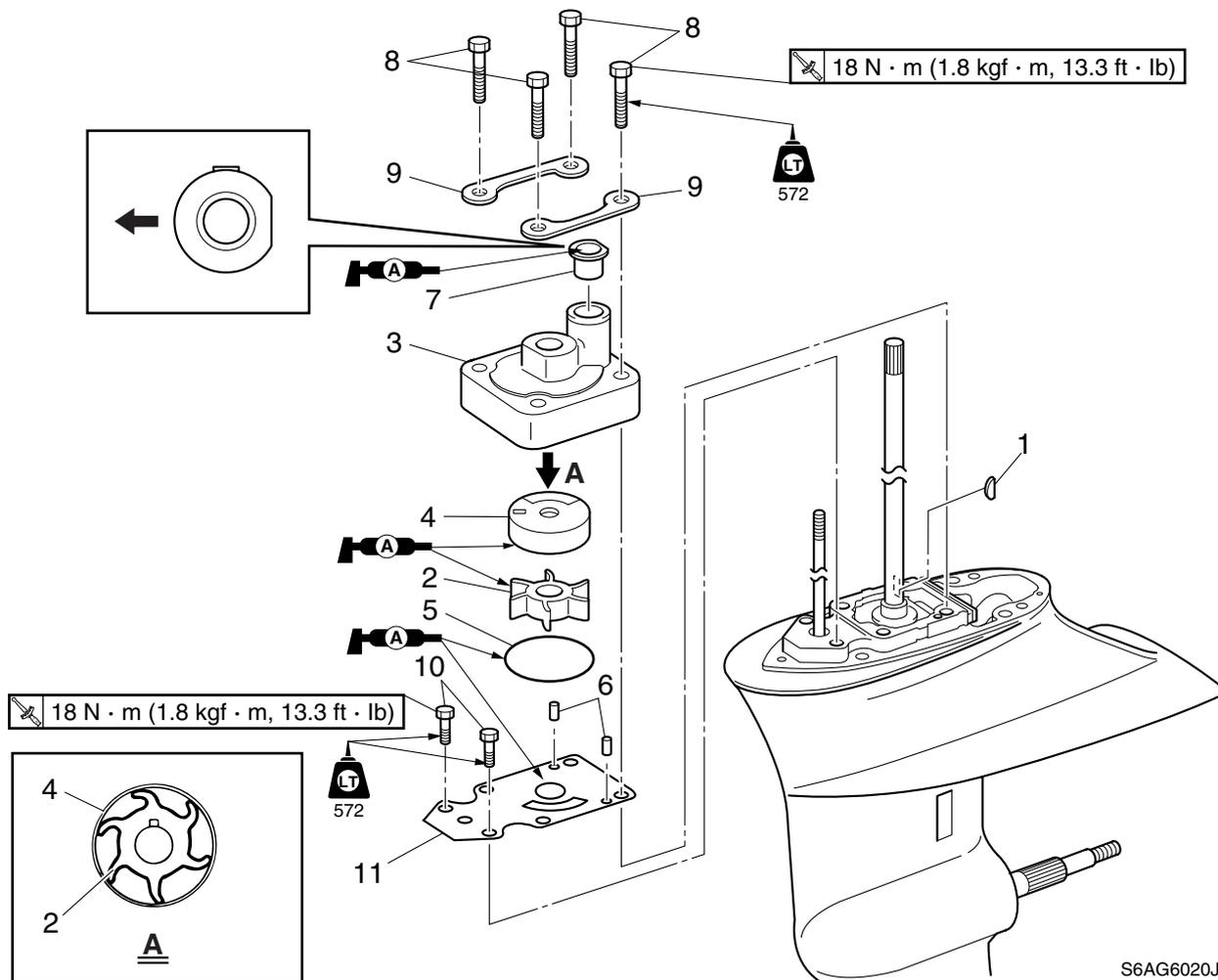
S6AG6010J

No.	Part name	Q'ty	Remarks
1	Rubber seal	1	
2	Lower case	1	
3	Bolt	4	M8 × 30 mm
4	Anode	1	
5	Special washer	1	<b>Not reusable</b>
6	Bolt	1	M6 × 35 mm
7	Cotter pin	1	<b>Not reusable</b>
8	Propeller nut	1	
9	Washer	1	
10	Propeller	1	
11	Spacer	1	
12	Adjusting nut	1	
13	Locknut	1	
14	Dowel	2	
15	Check screw	1	
16	Gasket	2	<b>Not reusable</b>
17	Cooling water inlet cover	2	



No.	Part name	Q'ty	Remarks
18	Screw	1	
19	Nut	1	
20	Drain screw	1	
21	Trim tab	1	
22	Bolt	1	M6 × 16 mm

# 6

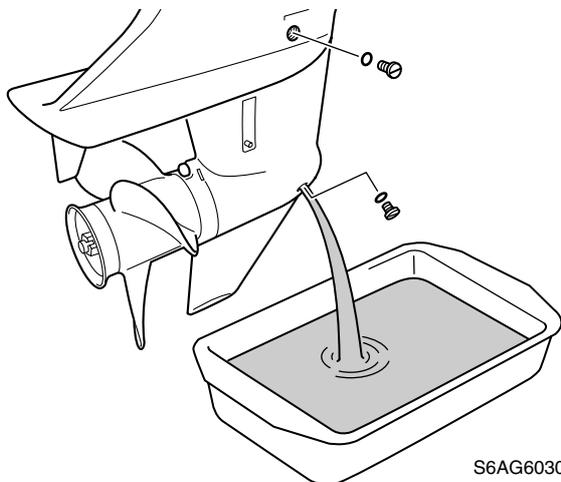


S6AG6020J

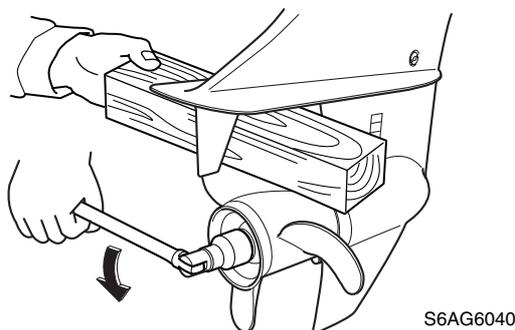
No.	Part name	Q'ty	Remarks
1	Woodruff key	1	
2	Impeller	1	
3	Water pump housing	1	
4	Insert cartridge	1	
5	O-ring	1	<b>Not reusable</b>
6	Dowel	2	
7	Rubber seal	1	
8	Bolt	4	M8 × 45 mm
9	Plate	2	
10	Bolt	2	M8 × 25 mm
11	Outer plate cartridge	1	

## Removing the lower unit

1. Drain the gear oil.



2. Set the gear shift to the neutral position, 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.



### **⚠ WARNING**

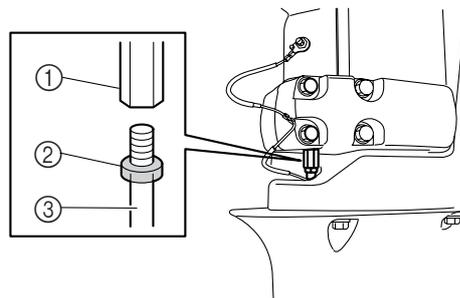
- Do not hold the propeller with your hands when loosening or tightening it.
- Be sure to disconnect the battery cables from the battery and remove the clip from the engine stop lanyard switch. (Electric starter model)

3. Loosen the locknut ② while holding the adjusting nut ①, and then turn the adjusting nut to disconnect the shift rod ③.

### **NOTE:**

Set the gear shift to the neutral position before disconnecting the shift rod.

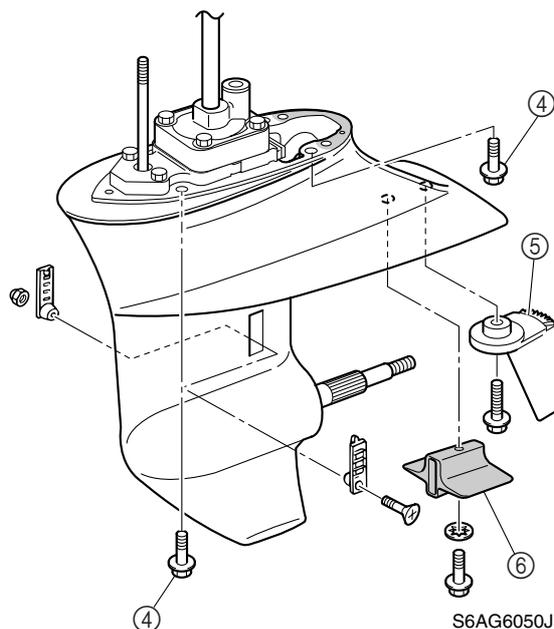
4. Remove the locknut ②.



### **NOTE:**

Be sure to remove the locknut from the shift rod before removing the lower unit.

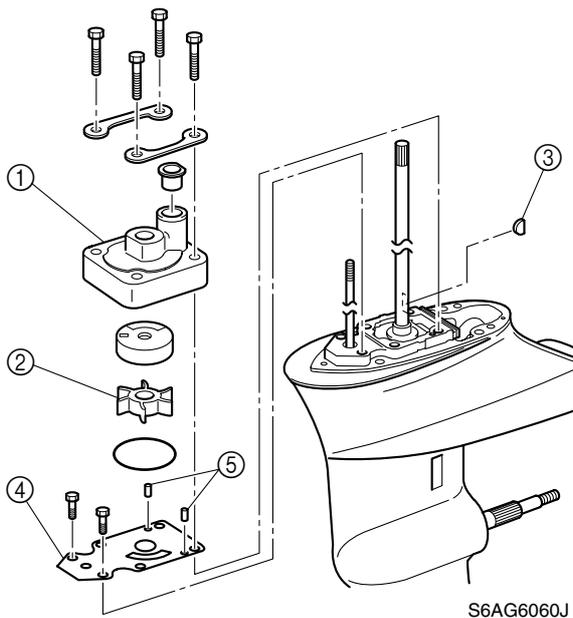
5. Remove the lower unit by removing the lower case mounting bolts ④.
6. Remove the trim tab ⑤, anode ⑥, and cooling water inlet covers.





## Removing the water pump

1. Remove the water pump housing ① and impeller ②.
2. Remove the Woodruff key ③ from the drive shaft, and then remove the outer plate cartridge ④.
3. Remove the dowels ⑤ from the lower case.



## Checking the water pump

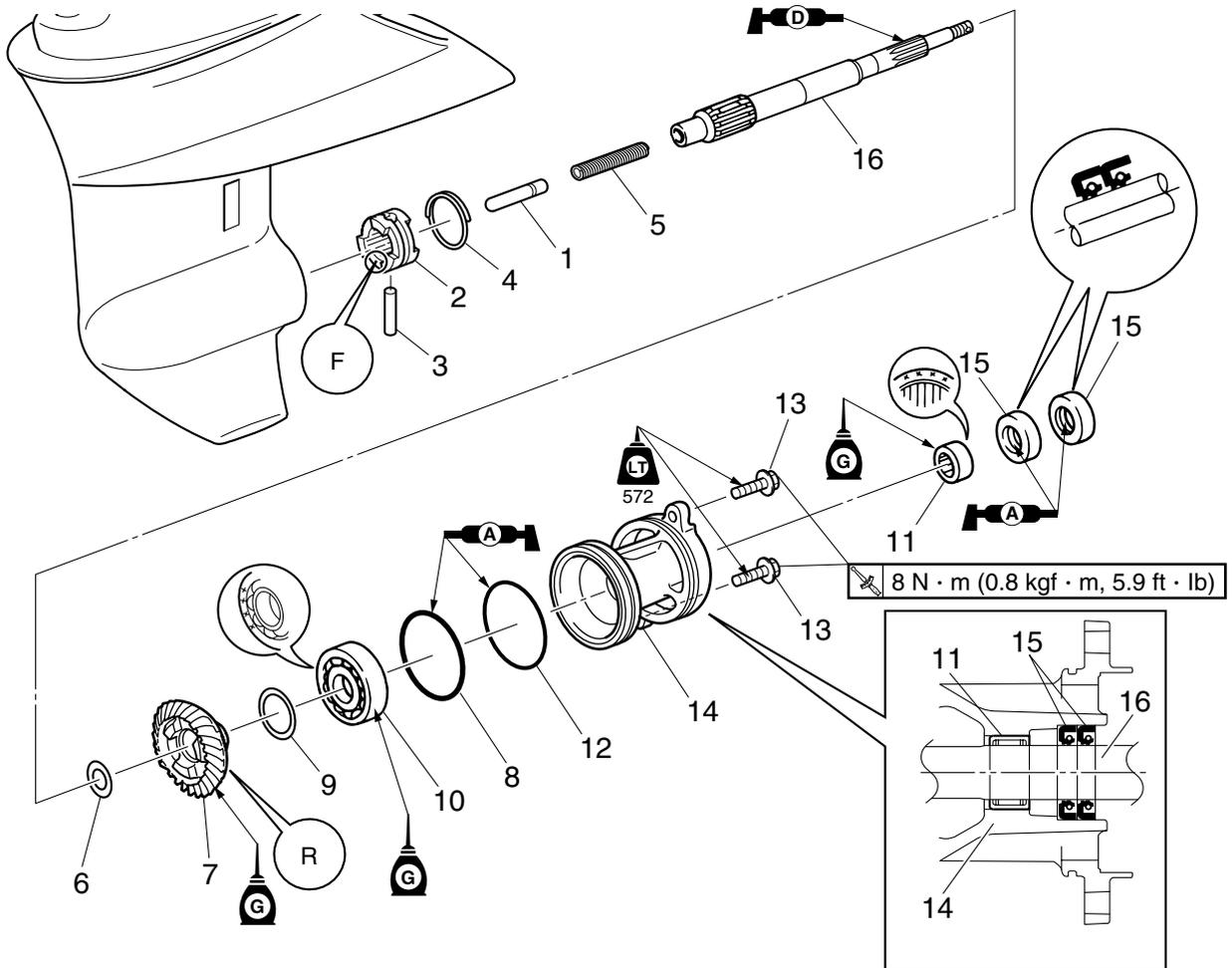
1. Check the water pump housing. Replace if deformed.

### **NOTE:**

If the engine overheated, the inside of the water pump housing may be deformed, therefore be sure to remove the insert cartridge when checking the housing.

2. Check the impeller, insert cartridge, and outer plate cartridge. Replace if cracked or worn.
3. Check the Woodruff key and the keyway in the drive shaft. Replace if worn or deformed.

Propeller shaft housing



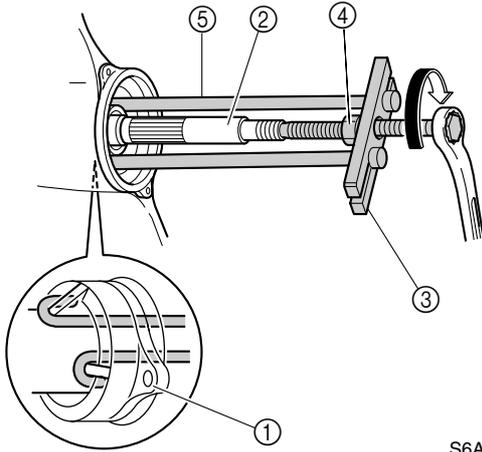
S6AG6070

No.	Part name	Q'ty	Remarks
1	Shift plunger	1	
2	Dog clutch	1	
3	Cross pin	1	
4	Cross pin ring	1	
5	Spring	1	
6	Washer	1	
7	Reverse gear	1	
8	O-ring	1	<b>Not reusable</b>
9	Reverse gear shim	—	
10	Ball bearing	1	<b>Not reusable</b>
11	Needle bearing	1	<b>Not reusable</b>
12	O-ring	1	<b>Not reusable</b>
13	Bolt	2	M6 × 20 mm
14	Propeller shaft housing	1	
15	Oil seal	2	<b>Not reusable</b>
16	Propeller shaft	1	



**Removing the propeller shaft housing assembly**

1. Remove the bolts from the propeller shaft housing.
2. Remove the propeller shaft housing ①, and then remove the propeller shaft ②.



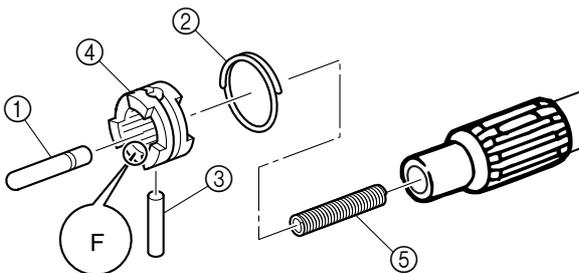
S6AG6080



Stopper guide plate ③: 90890-06501  
 Center bolt ④: 90890-06504  
 Bearing housing puller claw S ⑤:  
 90890-06564

**Disassembling the propeller shaft assembly**

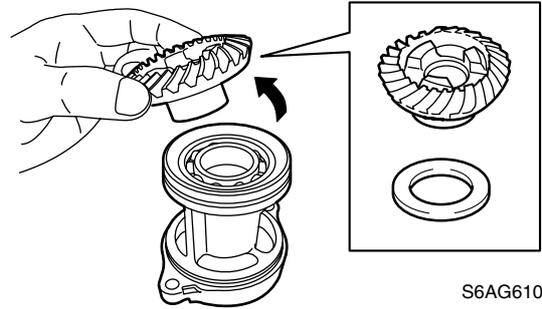
1. Remove the shift plunger ① from the propeller shaft.
2. Remove the cross pin ring ②, and then remove the cross pin ③ and dog clutch ④.
3. Pull out the spring ⑤ from the propeller shaft.



S6AG6090

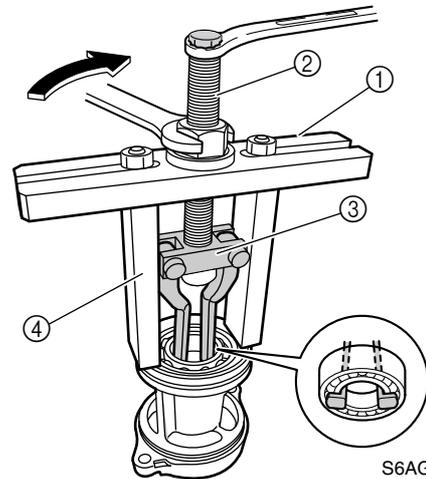
**Disassembling the propeller shaft housing assembly**

1. Remove the reverse gear and shim(s).



S6AG6100

2. Remove the ball bearing.



S6AG6110

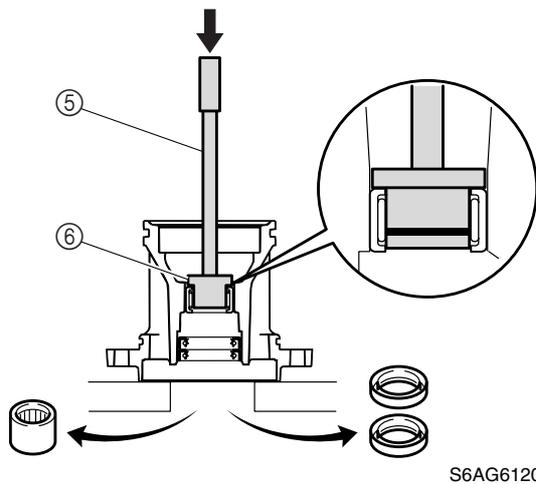
**CAUTION:**

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



Stopper guide plate ①: 90890-06501  
 Center bolt ②: 90890-06504  
 Bearing puller assembly ③:  
 90890-06535  
 Stopper guide stand ④:  
 90890-06538

3. Remove the oil seals and the needle bearing.



S6AG6120

**CAUTION:**

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



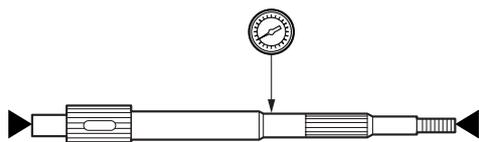
Driver rod L3 (5): 90890-06652  
Needle bearing attachment (6):  
90890-06616

**Checking the propeller shaft housing**

1. Clean the propeller shaft housing, and then check it. Replace if cracked or damaged.
2. Check the teeth and dogs of the reverse gear. Replace the reverse gear if cracked or worn.

**Checking the propeller shaft**

1. Check the propeller shaft. Replace if damaged or worn.
2. Measure the propeller shaft runout. Replace if above specification.



S6AG6130



Propeller shaft runout limit:  
0.05 mm (0.0020 in)

3. Check the dog clutch, shift plunger, and cross pin. Replace if cracked or worn.

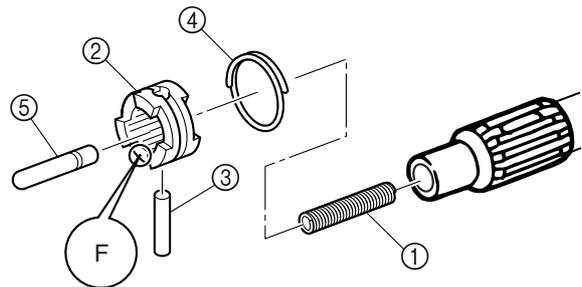
**Assembling the propeller shaft assembly**

1. Insert the spring (1) into the propeller shaft.
2. Install the dog clutch (2), cross pin (3), and cross pin ring (4).

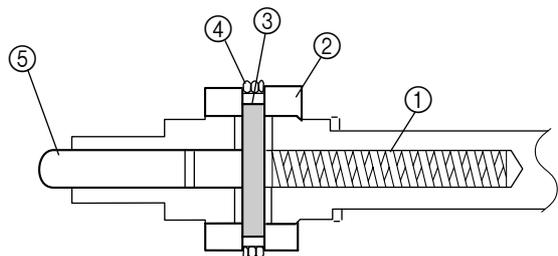
**NOTE:**

Install the dog clutch with the "F" mark facing toward the forward gear.

3. Install the shift plunger (5).



S6AG6150

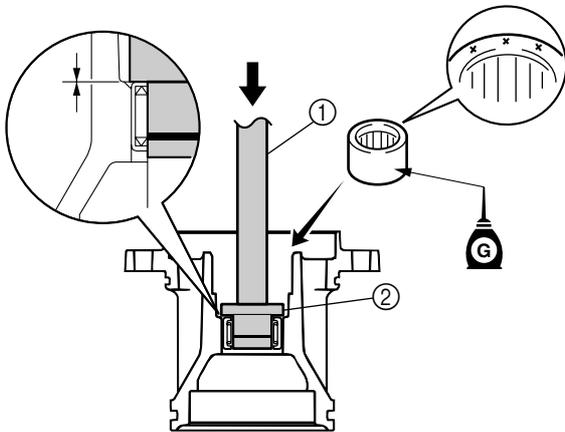


S6AG6140



### Assembling the propeller shaft housing

1. Install a new needle bearing into the propeller shaft housing.

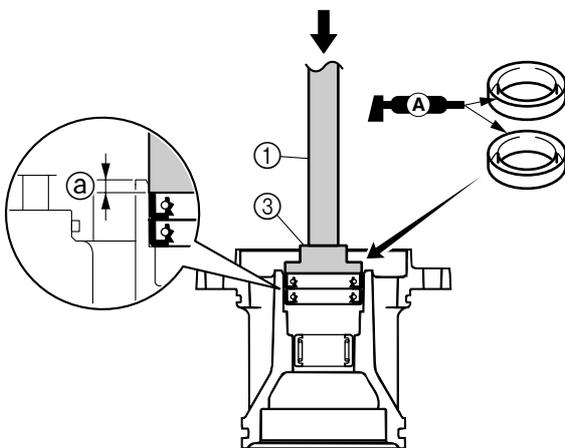


S6AG6160

**NOTE:** Install the needle bearing with the manufacture identification mark facing toward the oil seal (propeller side).

	Driver rod L3 ①: 90890-06652 Needle bearing attachment ②: 90890-06616
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2. Apply grease to new oil seals, and then install them into the propeller shaft housing to the specified depth (a).



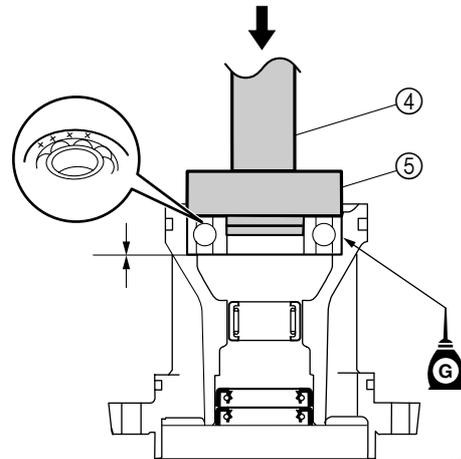
S6AG6170

**NOTE:** Install an oil seal halfway into the propeller shaft housing, and then install the other oil seal.

	Driver rod L3 ①: 90890-06652 Needle bearing attachment ③: 90890-06613
---	---

	Installation depth (a): 3.0–3.5 mm (0.12–0.14 in)
---	--

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

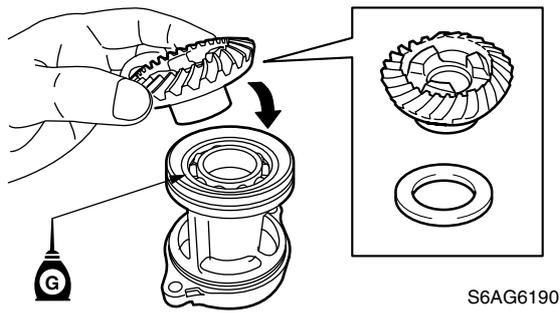


S6AG6180

**NOTE:** Install the ball bearing with the manufacture identification mark facing toward the reverse gear.

	Driver rod LS ④: 90890-06606 Ball bearing attachment ⑤: 90890-06632
---	---

4. Install the reverse gear and original shim(s) into the propeller shaft housing.



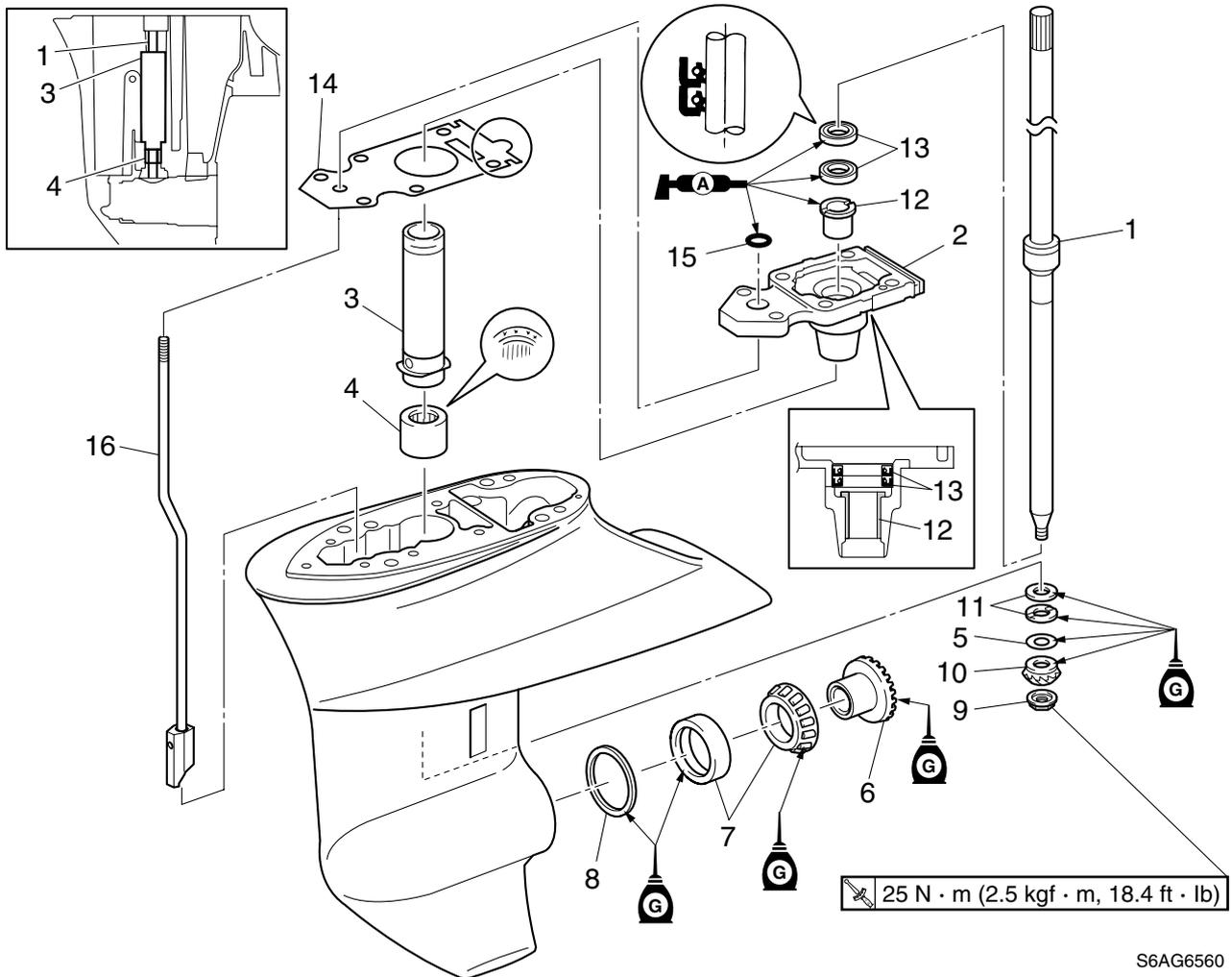
S6AG6190

**NOTE:**

- Be sure to select the reverse gear shim(s) if replacing the propeller shaft housing, ball bearing, or lower case. To select the shims, see “Shimming” (6-20).
- After installing the reverse gear and shim(s), check that the reverse gear rotates smoothly.



Drive shaft and lower case

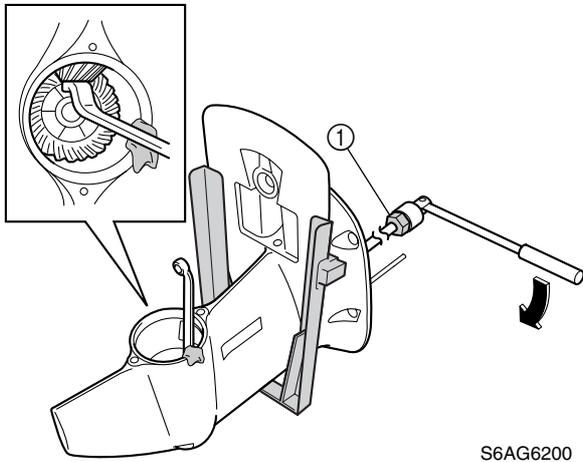


S6AG6560

No.	Part name	Q'ty	Remarks
1	Drive shaft	1	L-transom model/S-transom model
2	Drive shaft housing	1	
3	Drive shaft sleeve	1	
4	Needle bearing	1	<b>Not reusable</b>
5	Pinion shim	—	
6	Forward gear	1	
7	Taper roller bearing	1	<b>Not reusable</b>
8	Forward gear shim	—	
9	Pinion nut	1	
10	Pinion	1	
11	Thrust bearing	1	
12	Bushing	1	
13	Oil seal	2	<b>Not reusable</b>
14	Gasket	1	<b>Not reusable</b>
15	O-ring	1	<b>Not reusable</b>
16	Shift rod	1	L-transom model/S-transom model

### Removing the drive shaft, drive shaft housing, and shift rod

1. Remove the pinion nut.

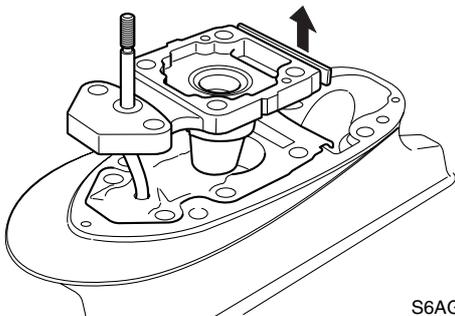


S6AG6200



Drive shaft holder 1 ①: 90890-06515

2. Remove the pinion, pinion shim(s), and thrust bearing.
3. Remove the drive shaft, and then remove the drive shaft housing assembly, gasket, and shift rod.



S6AG6220

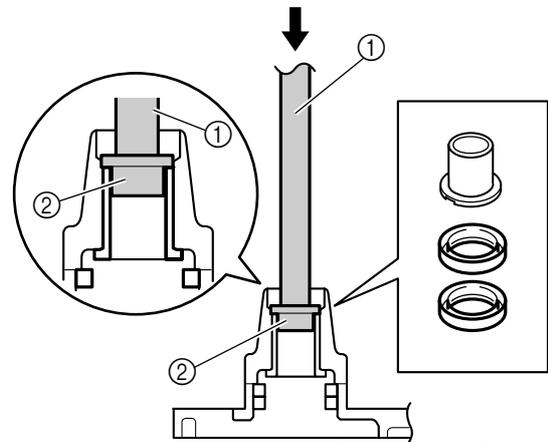
**CAUTION:** \_\_\_\_\_

Be sure to remove the drive shaft before removing the drive shaft housing from the lower case.

4. Remove the drive shaft sleeve.
5. Pull out the forward gear.

### Disassembling the drive shaft housing

1. Remove the oil seals and bushing.



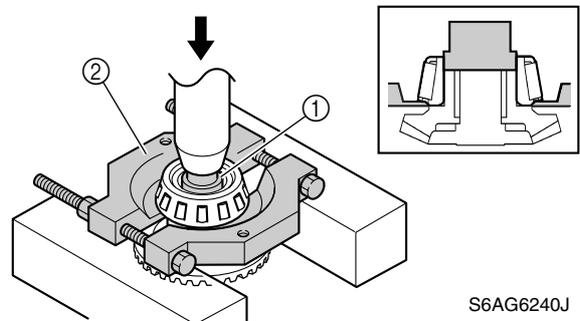
S6AG6230



Driver rod L3 ①: 90890-06652  
Bushing attachment ②:  
90890-06649

### Disassembling the forward gear

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



S6AG6240J

**CAUTION:** \_\_\_\_\_

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

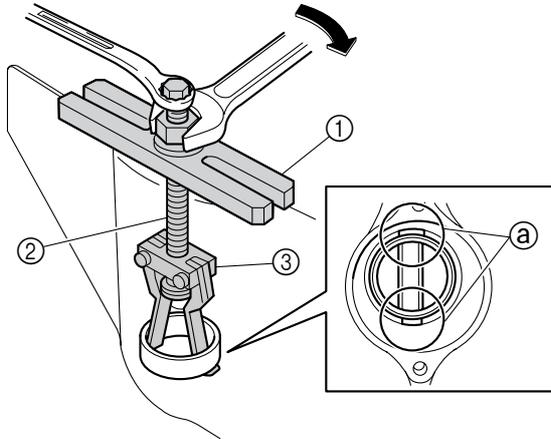


Needle bearing attachment ①:  
90890-06616  
Bearing separator ②: 90890-06534



**Disassembling the lower case**

1. Remove the taper roller bearing outer race and forward gear shim(s).



S6AG6250

**CAUTION:**

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

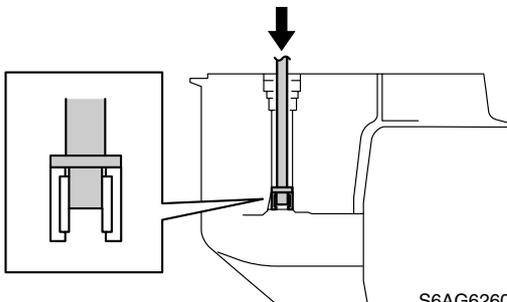
**NOTE:**

Fit the hooks of the puller claw into the slots (a) in the lower case.



Stopper guide plate (1): 90890-06501  
 Center bolt (2): 90890-06504  
 Bearing puller assembly (3): 90890-06535

2. Remove the needle bearing from the lower case.



S6AG6260

**CAUTION:**

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

**NOTE:**

Be sure to remove the forward gear before removing the needle bearing.



Driver rod L3: 90890-06652  
 Needle bearing attachment: 90890-06617

**Checking the pinion and forward gear**

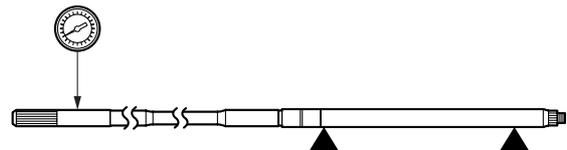
1. Check the teeth of the pinion, and the teeth and dogs of the forward gear. Replace the pinion or forward gear if cracked or worn.

**Checking the bearing**

1. Check the bearings. 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. Replace if above specification.



S6AG6270



Drive shaft runout limit: 0.5 mm (0.0197 in)

**Checking the shift rod**

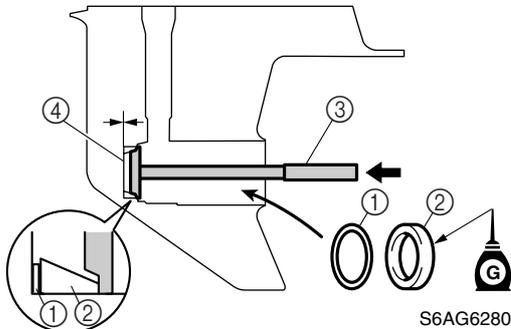
1. Check the shift rod. Replace if bent or worn.

**Checking the lower case**

1. Check the skag, torpedo, and anti-cavitation plate. Replace the lower case if cracked or damaged.

### Assembling the lower case

1. Install the original forward gear shim(s) ① and new taper roller bearing outer race ②.

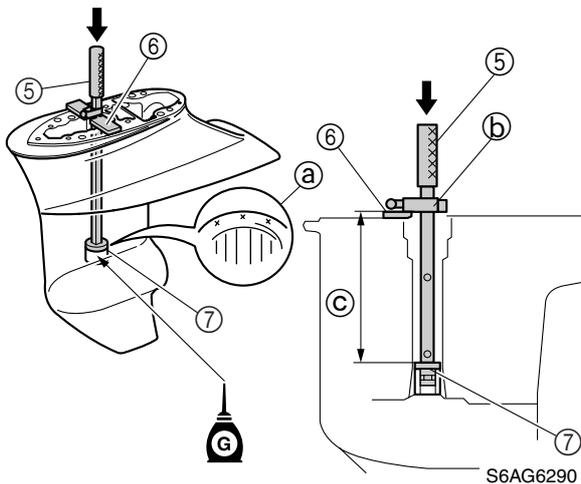


**NOTE:**

Be sure to select the forward gear shim(s) if replacing the lower case or taper roller bearing. To select the shims, see “Shimming” (6-20).

	Driver rod LL ③: 90890-06605 Bearing outer race attachment ④: 90890-06625
---	---

2. Install a new needle bearing into the lower case to the specified depth ③.



**NOTE:**

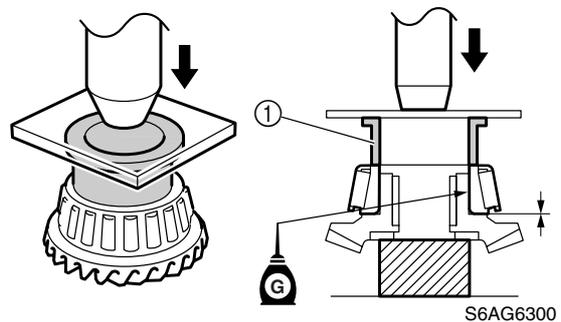
- Install the needle bearing with the manufacture identification mark ① facing upward.
- Install the stopper ② onto the driver rod SL at the installation depth ③ as shown. Install the needle bearing until the stopper ② contacts the bearing depth plate ⑥.

	Driver rod SL ⑤: 90890-06602 Bearing depth plate ⑥: 90890-06603 Needle bearing attachment ⑦: 90890-06617
---	---

	Installation depth ③: 172.7–173.2 mm (6.80–6.82 in)
---	--

### Assembling the forward gear

1. Install a new taper roller bearing onto the forward gear using a press.

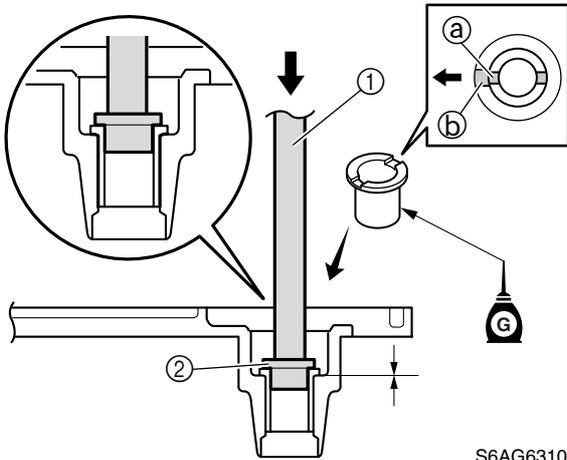


	Bearing inner race attachment ①: 90890-06644
---	---



**Assembling the drive shaft housing**

1. Install the bushing into the drive shaft housing using a press.

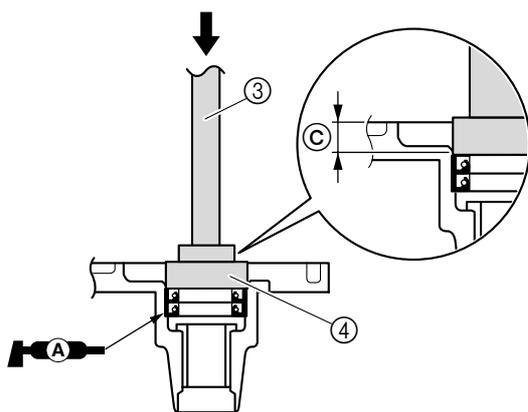


S6AG6310

**NOTE:** \_\_\_\_\_  
Align a groove (a) in the bushing with the hole (b) in the drive shaft housing.

	Driver rod L3 (1): 90890-06652
	Bushing attachment (2): 90890-06649

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



S6AG6320

**NOTE:** \_\_\_\_\_  
Install an oil seal halfway into the drive shaft housing, and then install the other oil seal.

	Driver rod L3 (3): 90890-06652
	Needle bearing attachment (4): 90890-06613

	Installation depth (c): 7.0–8.0 mm (0.28–0.31 in)
---	---

**Installing the shift rod, drive shaft housing, and drive shaft**

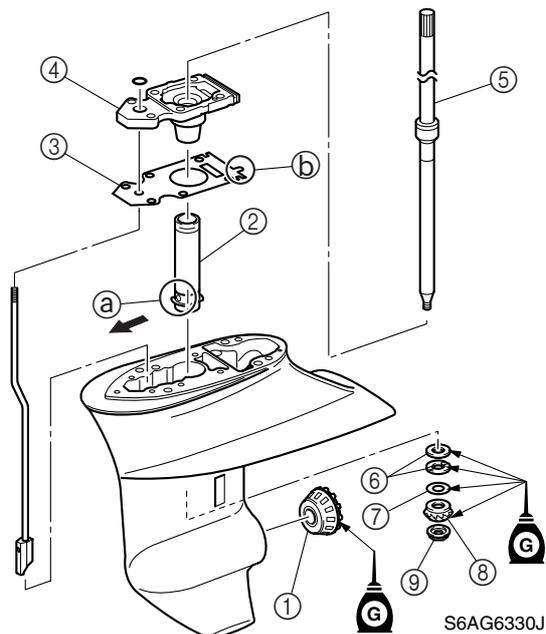
1. Install the forward gear assembly (1) into the lower case.
2. Install the drive shaft sleeve (2) into the lower case.

**NOTE:** \_\_\_\_\_  
Install the drive shaft sleeve (2) with the hole (a) facing forward.

3. Install the shift rod, a new gasket (3), and the drive shaft housing assembly (4).

**NOTE:** \_\_\_\_\_  
Make sure that the projection (b) on the gasket is toward the port side.

4. Install the drive shaft (5), thrust bearing (6), original pinion shim(s) (7), pinion (8), and pinion nut (9) into the lower case.



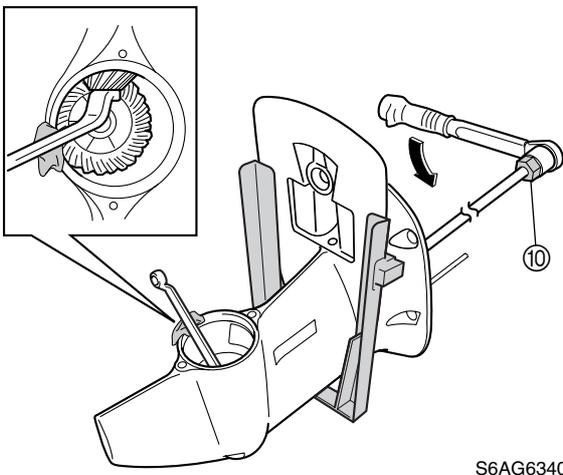
S6AG6330J

## Drive shaft and lower case

### NOTE:

- When installing the pinion, lift up the drive shaft slightly and align the gear and shaft splines.
- Be sure to select the pinion shim(s) if replacing the pinion, thrust bearing, or lower case. To select the shims, see “Shimming” (6-20).

5. Tighten the pinion nut to the specified torque.



S6AG6340



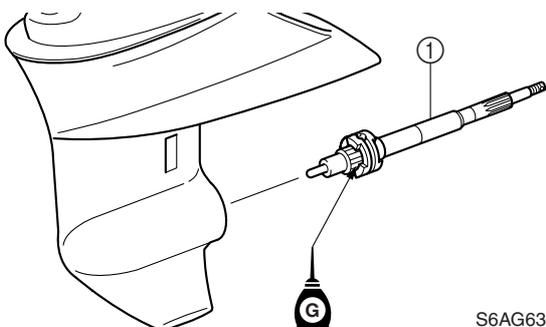
Drive shaft holder 1 (10): 90890-06515



Pinion nut (9):  
25 N·m (2.5 kgf·m, 18.4 ft·lb)

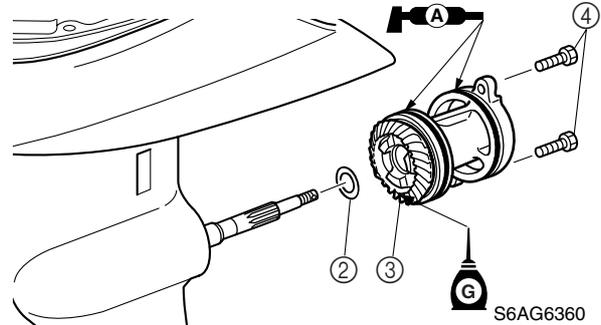
### Installing the propeller shaft housing

1. Install the propeller shaft assembly (1) into the lower case.



S6AG6341

2. Install the washer (2) and propeller shaft housing assembly (3) into the lower case, and then tighten the bolts (4) to the specified torque.

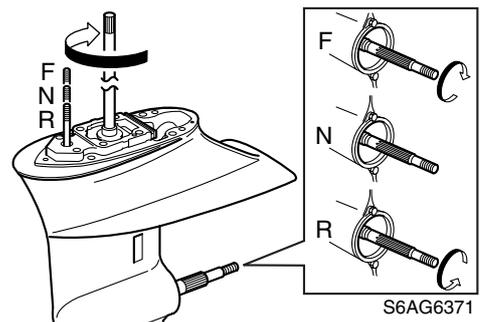


S6AG6360



Propeller shaft housing bolt (4):  
8 N·m (0.8 kgf·m, 5.9 ft·lb)

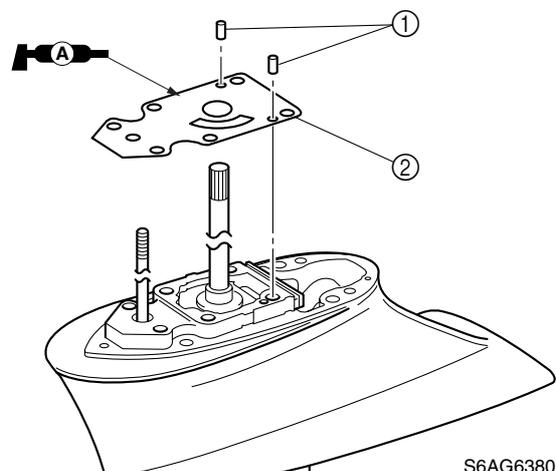
3. Check that the shifting mechanism works properly and smoothly.



S6AG6371

### Installing the water pump

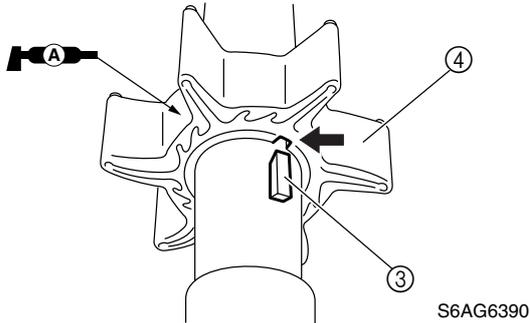
1. Install the dowels (1) and outer plate cartridge (2).



S6AG6380

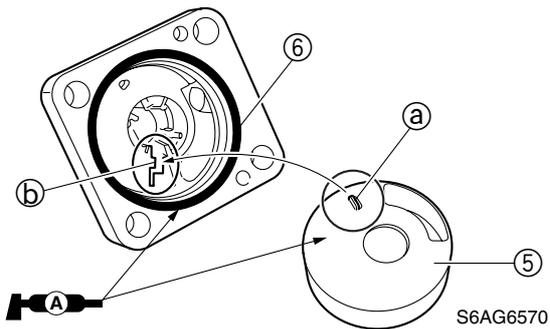


2. Install the Woodruff key ③ and impeller ④ to the drive shaft.



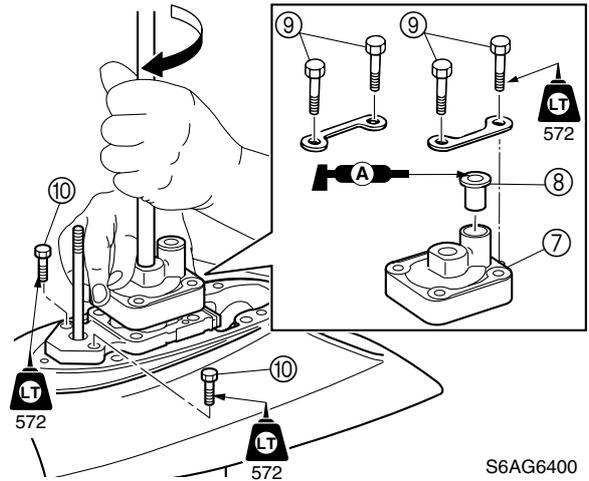
**NOTE:** \_\_\_\_\_  
 When installing the impeller ④ onto the drive shaft, align the groove in the impeller with the Woodruff key ③.

3. Install the insert cartridge ⑤ and a new O-ring ⑥ into the pump housing.



**NOTE:** \_\_\_\_\_  
 Align the insert cartridge projection ① with the hole ② in the pump housing.

4. Install the water pump housing assembly ⑦ into the lower case, and then install the rubber seal ⑧.



**CAUTION:** \_\_\_\_\_  
**Do not turn the drive shaft counterclockwise, otherwise the water pump impeller may be damaged.**

**NOTE:** \_\_\_\_\_

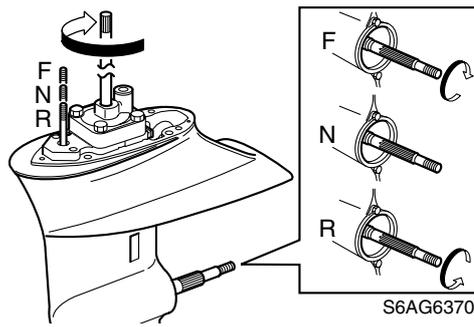
- Apply grease to the inside of the water pump housing.
- While turning the drive shaft clockwise, push down on the water pump housing and install it.
- Align the projection on the rubber seal ⑧ with the hole in the pump housing.

5. Tighten the water pump housing bolts ⑨ and outer plate cartridge bolts ⑩ to the specified torque.

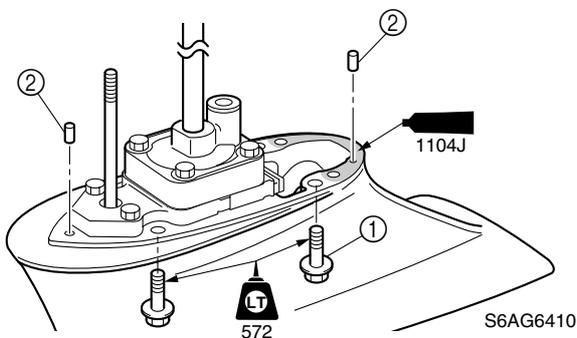
	Water pump housing bolt ⑨: 18 N·m (1.8 kgf·m, 13.3 ft·lb)
	Outer plate cartridge bolt ⑩: 18 N·m (1.8 kgf·m, 13.3 ft·lb)

**Installing the lower unit**

1. Set the shift lever to the neutral position.  
 (Tiller handle model)  
 Set the remote control lever to the neutral position. (Remote control model)
2. Set the shift rod to the neutral position.



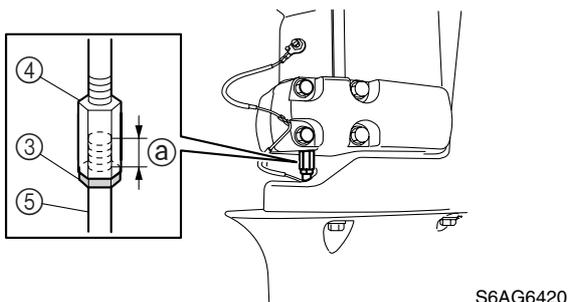
3. Install the lower unit to the upper case, and then tighten the lower case mounting bolts ① to the specified torque.



- NOTE:**
- Before installing the lower unit to the upper case, install the dowels ② into the lower case.
  - Before installing the lower unit, make sure that the locknut is removed from the shift rod.

 Lower case mounting bolt ①:  
18 N·m (1.8 kgf·m, 13.3 ft·lb)

4. Install the locknut ③, and then screw the adjusting nut ④ onto the shift rod ⑤.

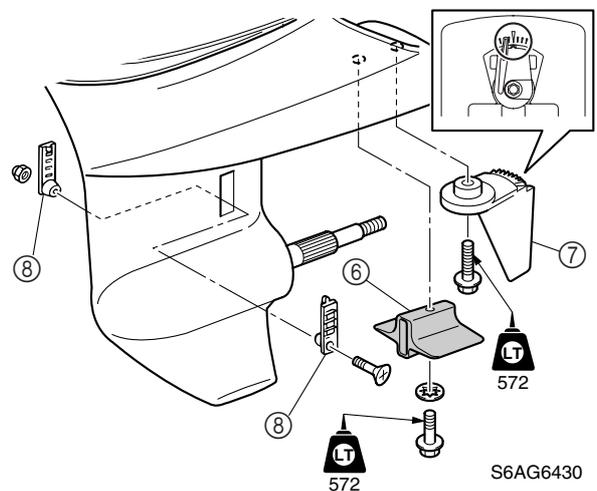


- NOTE:**
- The adjusting nut ④ must be screwed in a minimum of 8.0 mm (0.31 in) ①.

5. Tighten the locknut ③.

- NOTE:**
- After connecting the shift rod, check that the gear shift operates properly.

6. Install the anode ⑥, trim tab ⑦, and inlet covers ⑧, and then tighten the bolts to the specified torque.

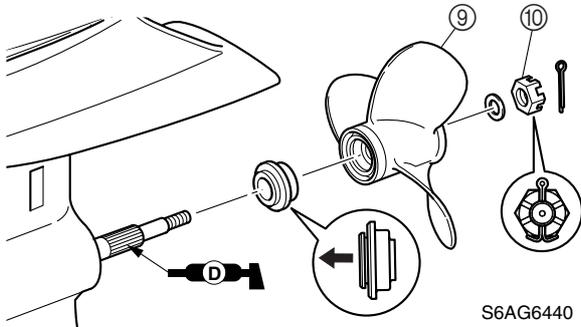


- NOTE:**
- Install the trim tab in its original position.

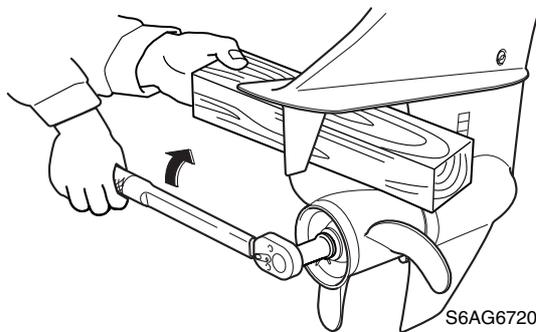
 Anode bolt:  
8 N·m (0.8 kgf·m, 5.9 ft·lb)  
Trim tab bolt:  
8 N·m (0.8 kgf·m, 5.9 ft·lb)



7. Install the propeller ⑨ and propeller nut ⑩. 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.



S6AG6440



S6AG6720



Recommended gear oil:  
 Hypoid gear oil  
 API: GL-4  
 SAE: 90  
 Gear oil quantity:  
 300 cm<sup>3</sup>  
 (10.14 US oz, 10.58 Imp oz)

**⚠ 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 clip from the engine stop lanyard switch. (Electric starter model)

**NOTE:**

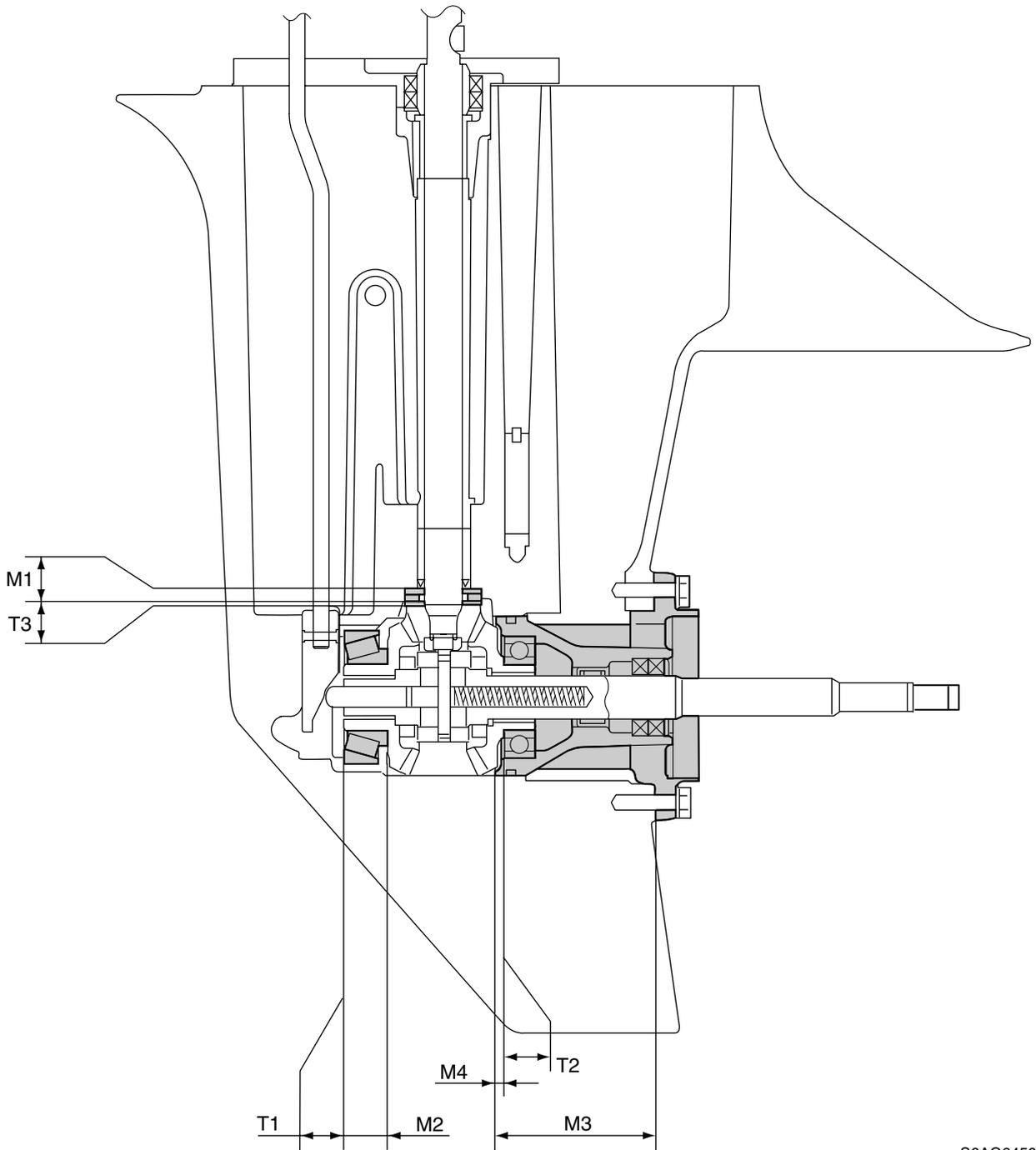
If the grooves in the propeller nut do not align with the cotter pin hole, tighten the nut until they are aligned.



Propeller nut:  
 17 N·m (1.7 kgf·m, 12.5 ft·lb)

8. Fill the gear oil to the correct level.

# Shimming



6

S6AG6450



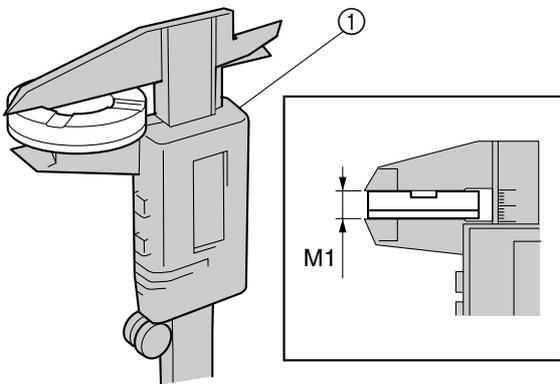
**Shimming**

**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. Measure the thickness (M1) of the thrust bearing.



S6AG6460

**NOTE:**

- Select the shim thickness (T3) by using the specified measurement(s) and the calculation formula.
- Measure the thrust bearing at 4 points to find the thickness average.

 Digital caliper ①: 90890-06704

2. Calculate the pinion shim thickness.

Calculation formula:  
Pinion shim thickness (T3) =  
 $6.05 - M1$

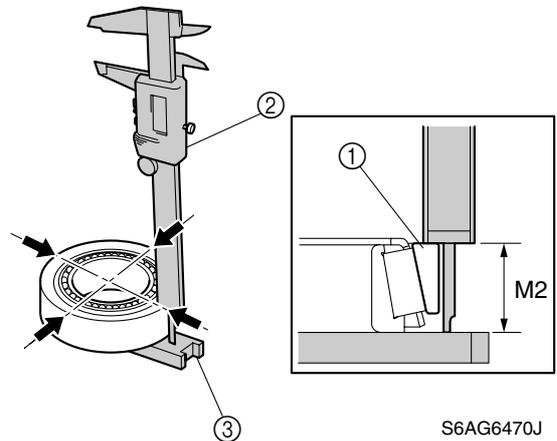
3. Select the pinion shim(s) (T3) as follows.

Calculated number	Shim thickness (mm)
1.14–1.20	1.13
1.21–1.30	1.20

Available shim thicknesses:  
1.13 and 1.20 mm

**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 (M2) as shown.



S6AG6470J

**NOTE:**

- Select the shim thickness (T1) by using the specified measurement(s) and the calculation formula.
- Measure the bearing outer race at 4 points to find the height average.

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

2. Calculate the forward gear shim thickness.

Calculation formula:  
Forward gear shim thickness (T1) =  
 $16.60 - M2$

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

Calculated number at 1/100th place	Rounded number
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

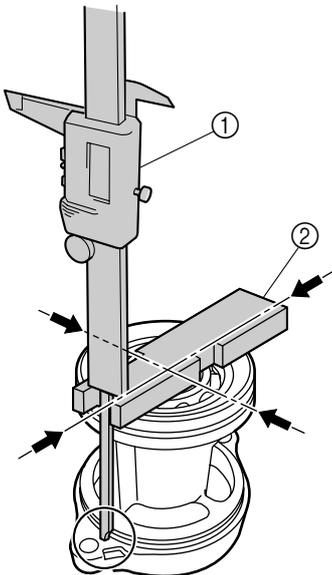
Example:

If "T1" is 0.23 mm, then the forward gear shim is 0.22 mm.

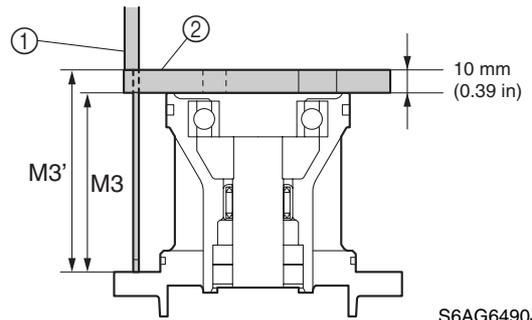
If "T1" is 0.30 mm, then the forward gear shim is 0.28 mm.

### Selecting the reverse gear shim

1. Remove the reverse gear and reverse gear shim(s) from the propeller shaft housing.
2. Measure the propeller shaft housing height (M3) as shown.



S6AG6480



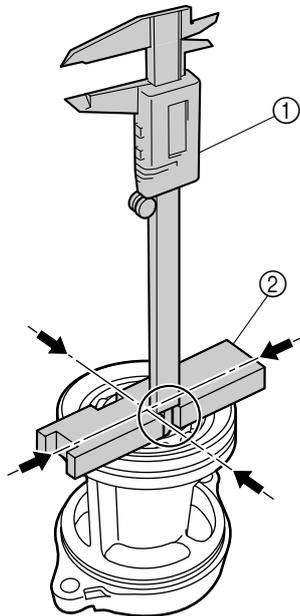
$$M3 = M3' - 10 \text{ mm}$$

**NOTE:** Measure the propeller shaft housing at 4 points to find the height average.

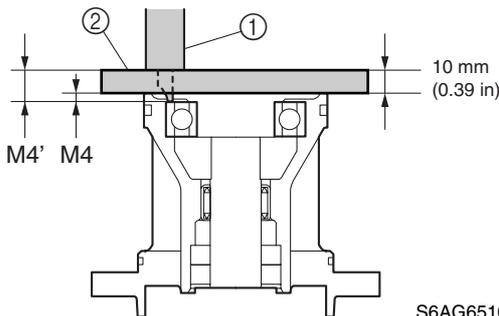
 Digital caliper ①: 90890-06704  
Shimming plate ②: 90890-06701



- Turn the ball bearing 2 or 3 times, and then measure the height from the ball bearing (M4) as shown.



S6AG6500



S6AG6510J

$M4 = M4' - 10 \text{ mm}$

- NOTE:**
- Select the shim thickness (T2) by using the specified measurement(s) and the calculation formula.
  - Measure the height from the ball bearing at 4 points to find the height average.

- Calculate the reverse gear shim thickness.

Calculate formula:  
 Reverse gear shim thickness (T2) =  
 $57.85 - (M3 - M4)$

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

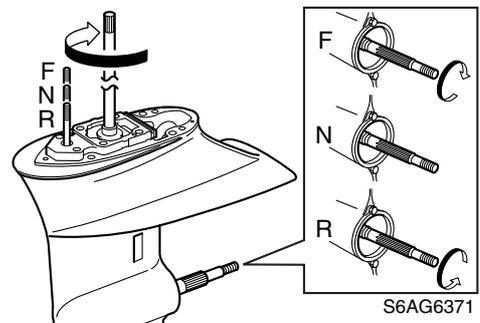
Calculated number	Shim thickness (mm)
0.31–0.40	0.30
0.41–0.50	0.40
0.51–0.60	0.50
0.61–0.70	0.60

Available shim thicknesses:  
 0.1, 0.2, 0.3, 0.4, and 0.5 mm

### Backlash Measuring the forward and reverse gear backlash

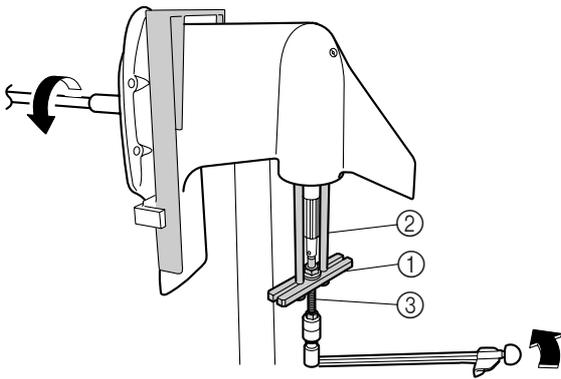
- NOTE:**
- Remove the water pump assembly before measuring the backlash.
  - Secure the drive shaft housing to the lower case using 6 bolts (M8 × 25 mm).

- Install the lower unit onto a repair stand.
- Set the shift rod to the neutral position at the lower unit.



S6AG6371

- Turn the lower unit so that the propeller shaft is facing down.
- Install the special service tools.
- Tighten the center bolt (3) to the specified torque while turning the drive shaft.

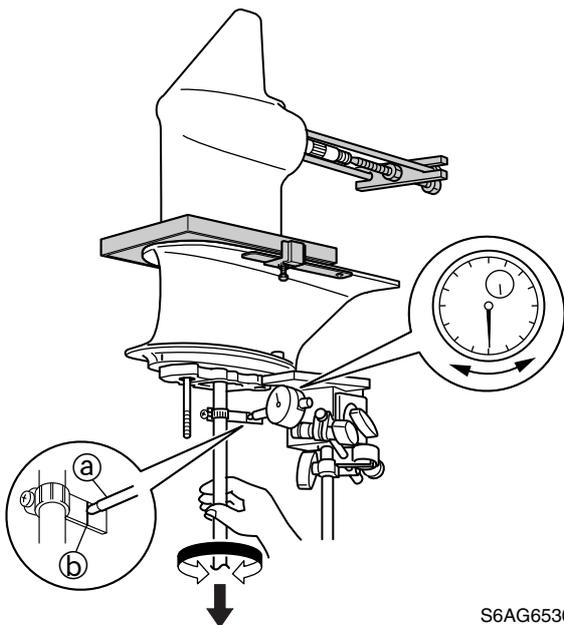


S6AG6520


 Stopper guide plate ①: 90890-06501  
 Bearing housing puller claw S ②:  
 90890-06564  
 Center bolt ③: 90890-06504


 Center bolt ③:  
 2 N·m (0.2 kgf·m, 1.5 ft·lb)

6. Turn the lower unit upside down.
7. Install the backlash indicator onto the drive shaft (13 mm [0.51 in] in diameter), and then install the dial gauge.



S6AG6530

**NOTE:** Install the dial gauge so that the plunger tip ① is aligned with the mark ② on the backlash indicator.


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

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

**NOTE:**

- Pull the drive shaft downward, and then turn it.
- Measure the backlash at 4 points to find the average.


 Forward gear backlash:  
 0.18–0.87 mm (0.0071–0.0343 in)

9. Adjust the current shim thickness if the forward gear backlash is out of specification.

Forward gear backlash	Shim thickness
Less than 0.18 mm (0.0071 in)	To be decreased by $(0.53 - M) \times 0.43$
More than 0.87 mm (0.0343 in)	To be increased by $(M - 0.53) \times 0.43$

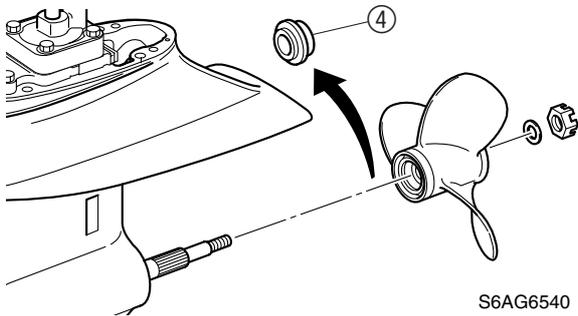
M: Measurement

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

10. Remove the special service tools from the propeller shaft.



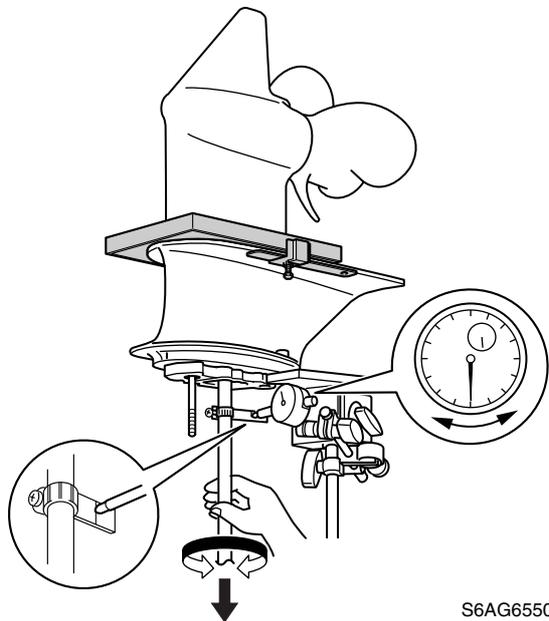
11. Install the propeller, washer, and nut, without installing the spacer ④.



12. Tighten the propeller nut to the specified torque.

	<p><b>Propeller nut:</b> 2 N·m (0.2 kgf·m, 1.5 ft·lb)</p>
--	---

13. Turn the lower unit upside down.
14. Slowly turn the drive shaft clockwise and counterclockwise and measure the backlash when the drive shaft stops in each direction.



- NOTE:** \_\_\_\_\_
- Pull the drive shaft downward, and then turn it.
  - Measure the backlash at 4 points to find the average.

	<p><b>Reverse gear backlash:</b> 0.95–1.66 mm (0.0374–0.0654 in)</p>
--	--

15. Adjust the current shim thickness if the reverse gear backlash is out of specification.

Reverse gear backlash	Shim thickness
Less than 0.95 mm (0.0374 in)	To be decreased by $(1.31 - M) \times 0.43$
More than 1.66 mm (0.0654 in)	To be increased by $(M - 1.31) \times 0.43$

M: Measurement

<p><b>Available shim thicknesses:</b> 0.1, 0.2, 0.3, 0.4, and 0.5 mm</p>
--

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

**NOTE:** \_\_\_\_\_  
Install the spacer and propeller.

17. Fill the gear oil to the correct level.

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— MEMO —

## Bracket unit

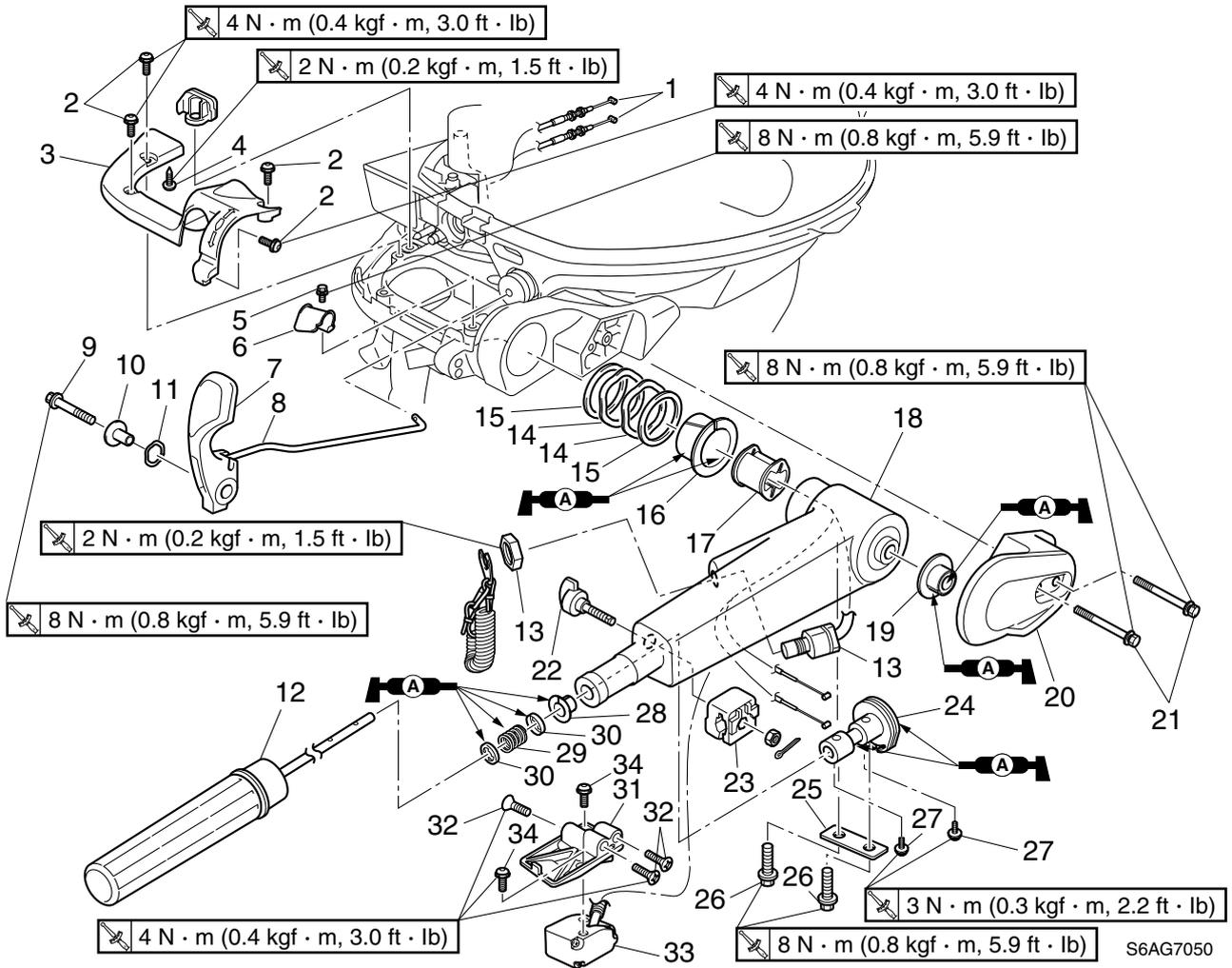
<b>Tiller handle (tiller handle model)</b> .....	<b>7-1</b>
Disassembling the tiller handle.....	7-3
Assembling the tiller handle.....	7-3
 <b>Friction plate (tiller handle model)</b> .....	 <b>7-5</b>
Disassembling the friction plate.....	7-6
Assembling the friction plate.....	7-6
 <b>Bottom cowling</b> .....	 <b>7-8</b>
 <b>Upper case and steering arm</b> .....	 <b>7-11</b>
Removing the upper case.....	7-15
Disassembling the upper case .....	7-15
Checking the drive shaft bushing (L-transom model) .....	7-15
Disassembling the exhaust manifold, oil pan, and exhaust guide .....	7-15
Checking the exhaust manifold, oil pan, and exhaust guide .....	7-16
Checking the oil strainer .....	7-16
Assembling the exhaust guide, oil pan, and exhaust manifold.....	7-16
Assembling the upper case .....	7-17
Removing the steering arm .....	7-18
Installing the steering arm .....	7-18
Installing the upper case.....	7-19
 <b>Clamp bracket and swivel bracket (manual tilt model)</b> .....	 <b>7-20</b>
Removing the clamp bracket.....	7-22
Disassembling the swivel bracket.....	7-22
Assembling the swivel bracket .....	7-23
Installing the clamp bracket.....	7-24
 <b>Clamp bracket and swivel bracket (power tilt model)</b> .....	 <b>7-25</b>
Removing the power tilt unit .....	7-27
Removing the clamp bracket.....	7-27
Installing the clamp bracket.....	7-28
Installing the power tilt unit .....	7-28
 <b>Power tilt motor (power tilt model)</b> .....	 <b>7-30</b>
Disassembling the power tilt motor.....	7-31
Checking the power tilt motor .....	7-32
Checking the brush holder and brush.....	7-33
Assembling the power tilt motor .....	7-33

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<b>Power tilt gear pump (power tilt model)</b> .....	<b>7-35</b>
Disassembling the gear pump .....	7-38
Checking the gear pump .....	7-38
Checking the valve seal.....	7-38
Checking the filter .....	7-39
Assembling the gear pump.....	7-39
<b>Power tilt cylinder (power tilt model) .....</b>	<b>7-41</b>
Disassembling the tilt cylinder .....	7-43
Checking the tilt cylinder and piston .....	7-43
Assembling the tilt cylinder .....	7-44
Bleeding the power tilt unit .....	7-46
<b>Power tilt electrical system (power tilt model).....</b>	<b>7-47</b>
Checking the fuse.....	7-47
Checking the power tilt relay .....	7-48
Checking the power tilt switch .....	7-49

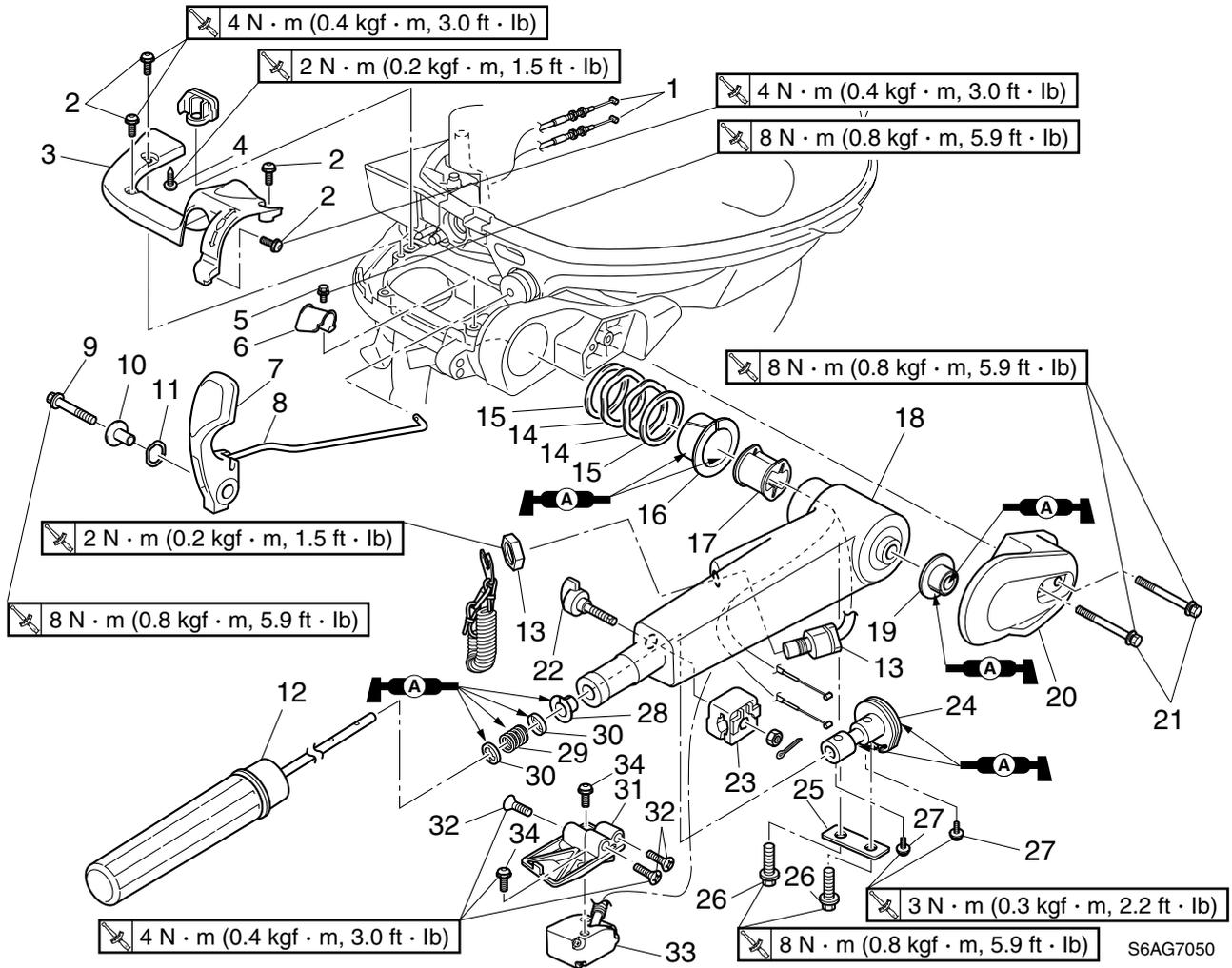


Tiller handle (tiller handle model)



No.	Part name	Q'ty	Remarks
1	Throttle cable	2	
2	Screw	4	ø6 × 18 mm
3	Steering bracket cover	1	
4	Screw	1	ø6 × 19 mm
5	Bolt	1	M6 × 18 mm
6	Holder	1	
7	Shift lever	1	
8	Shift link rod	1	
9	Bolt	1	M6 × 40 mm
10	Collar	1	
11	Wave washer	1	
12	Tiller handle	1	
13	Engine stop lanyard switch	1	
14	Wave washer	2	
15	Washer	2	
16	Bushing	1	
17	Grommet	1	

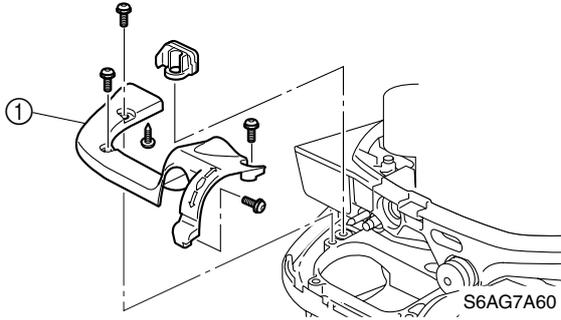
Tiller handle (tiller handle model)



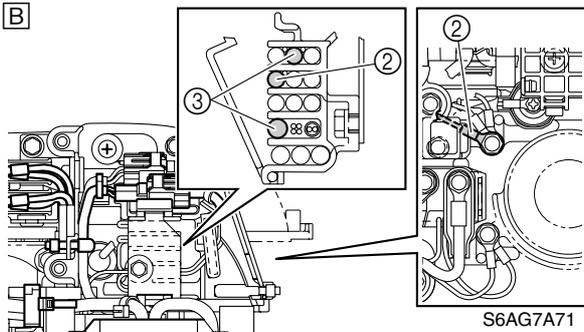
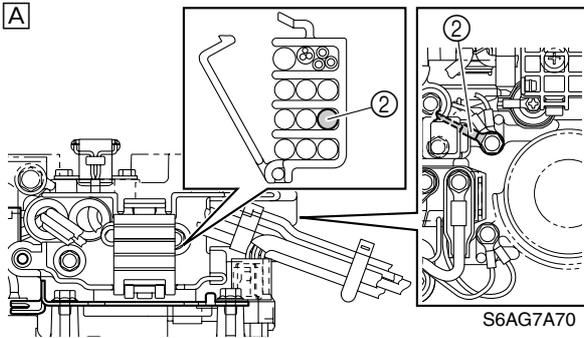
No.	Part name	Q'ty	Remarks
18	Tiller handle bracket	1	
19	Bushing	1	
20	Tiller handle bracket cover	1	
21	Bolt	2	M6 × 55 mm
22	Throttle friction adjuster	1	
23	Friction piece	1	
24	Throttle pulley	1	
25	Plate	1	
26	Bolt	2	M6 × 20 mm
27	Screw	2	ø5 × 12 mm
28	Bushing	1	
29	Spring	1	
30	Washer	2	
31	Bracket	1	Power tilt model
32	Screw	3	ø6 × 16 mm/Power tilt model
33	Power tilt switch	1	Power tilt model
34	Screw	2	ø6 × 20 mm/Power tilt model

**Disassembling the tiller handle**

1. Remove the steering bracket cover ①.

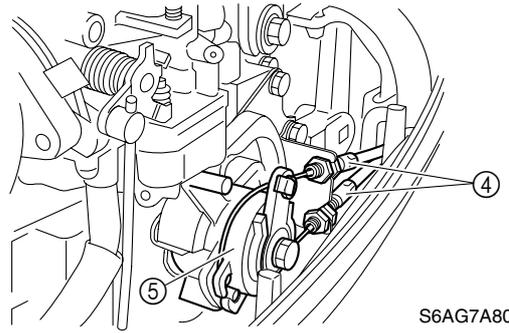


2. Disconnect the engine stop lanyard switch leads ② and power tilt switch leads ③ (power tilt model) and remove the leads from their holders.



- A Manual tilt model
- B Power tilt model

3. Disconnect the throttle cables ④ from the throttle cam ⑤.



4. Remove the tiller handle.

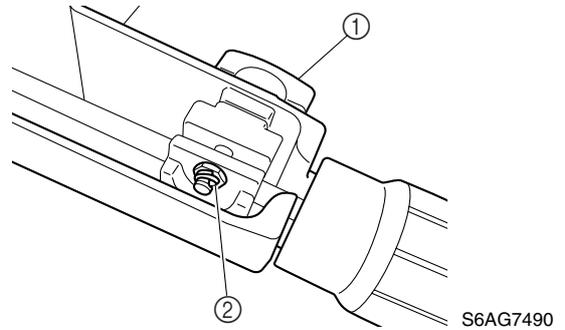
**NOTE:** \_\_\_\_\_  
See the exploded diagram for disassembly (7-1).

**Assembling the tiller handle**

1. Assemble the tiller handle.

**NOTE:** \_\_\_\_\_  
See the exploded diagram for assembly (7-1).

2. Install the throttle friction adjuster ①, and then install the cotter pin ②.

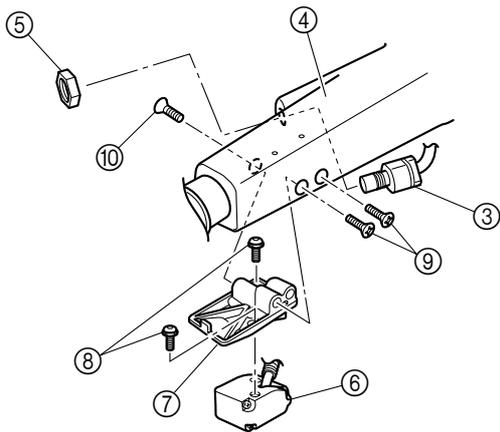


3. Install the engine stop lanyard switch ③ to the tiller handle bracket ④. Tighten the nut ⑤ to the specified torque. Pass the lead through the grommet.

4. Install the power tilt switch ⑥ to the bracket ⑦, and then tighten the bracket screws ⑧ to the specified torque. (Power tilt model)

5. Install the power tilt switch ⑥ to the tiller handle bracket ④. Pass the lead through the grommet. (Power tilt model)

## Tiller handle (tiller handle model)

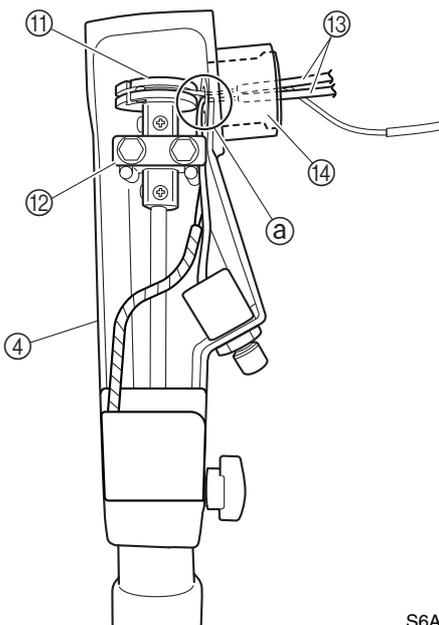


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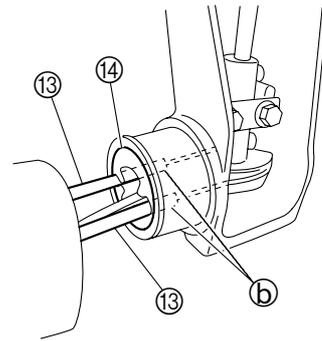
**NOTE:** \_\_\_\_\_  
Tighten the screws ⑨, and then tighten the screw ⑩.

	Engine stop lanyard switch nut ⑤: 2 N·m (0.2 kgf·m, 1.5 ft·lb)
	Power tilt switch bracket screw ⑧: 4 N·m (0.4 kgf·m, 3.0 ft·lb)
	Power tilt switch screw ⑨ and ⑩: 4 N·m (0.4 kgf·m, 3.0 ft·lb)

6. Connect the throttle cable ends to the throttle pulley ⑪.



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S6AG7470

**NOTE:** \_\_\_\_\_

- When routing the engine stop lanyard switch lead and power tilt switch lead (power tilt model), make sure that it is not pinched by the plate ⑫ and that there is no slack in the lead in the area ① shown.
- Make sure that the ends ② of the outer throttle cables ⑬ are fitted securely into the grommet ⑭ as shown.

7. Install the tiller handle bracket to the steering bracket, and then install the tiller handle bracket cover and tighten the bolts to the specified torque.

	Tiller handle bracket cover bolt: 8 N·m (0.8 kgf·m, 5.9 ft·lb)
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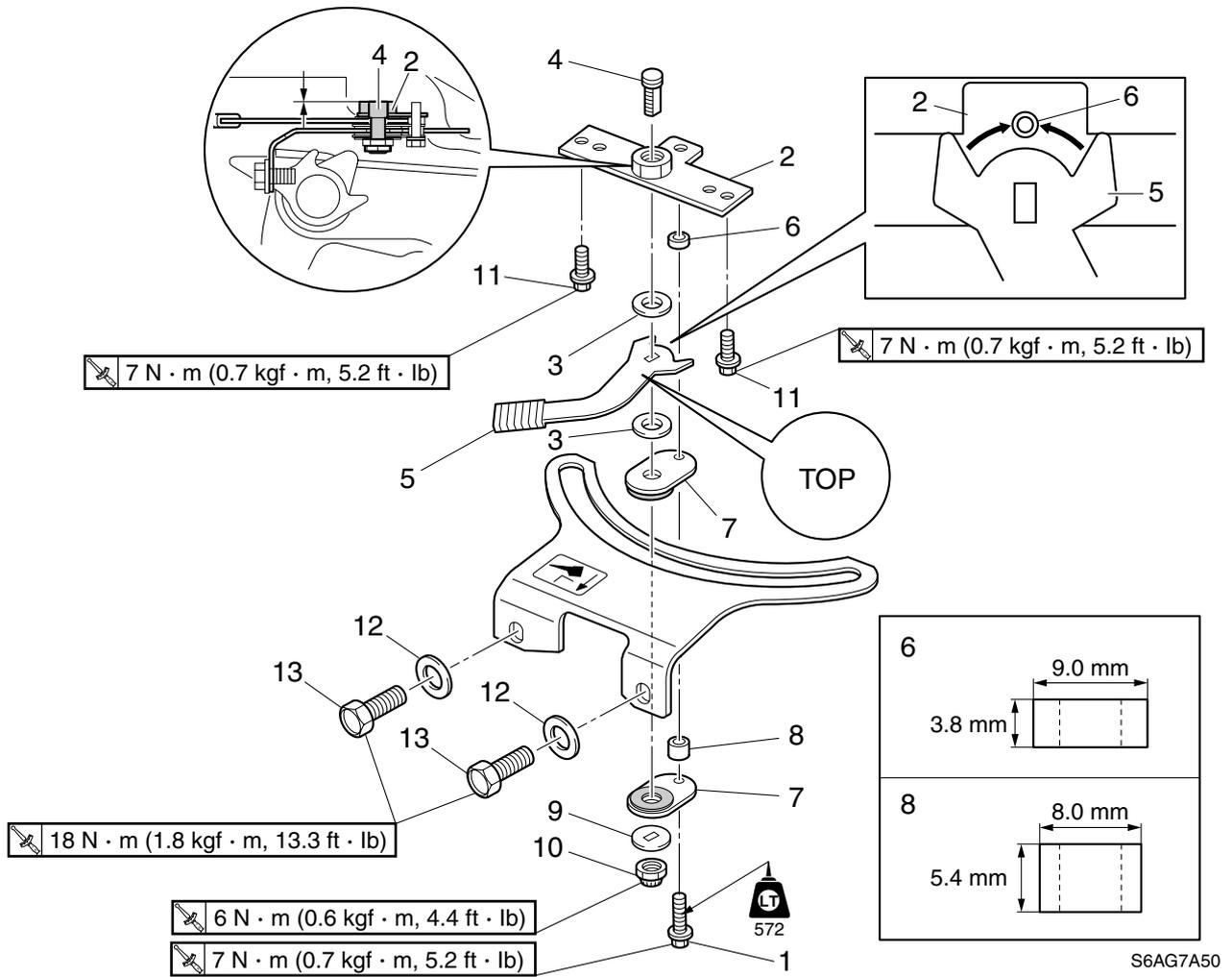
8. Connect the throttle cables to the throttle cam.

**NOTE:** \_\_\_\_\_

- To adjust the throttle cables, see “Adjusting the throttle cable (tiller handle model)” (3-7).
- When adjusting the throttle cables, make sure the ends ② of the outer cables are not pulled out of the grommet.
- Install the steering bracket cover after adjusting the throttle cables.

9. Connect the engine stop lanyard switch lead and power tilt switch lead (power tilt model) and fasten the leads.

**Friction plate (tiller handle model)**

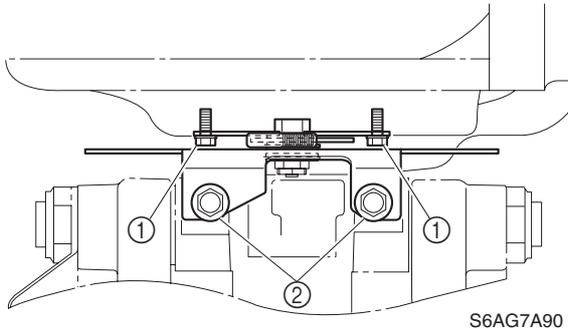


S6AG7A50

No.	Part name	Q'ty	Remarks
1	Bolt	1	M5 × 20 mm
2	Bracket	1	
3	Washer	2	
4	Steering lock shaft	1	
5	Steering lock lever	1	
6	Collar	1	Short
7	Friction piece	2	
8	Collar	1	Long
9	Steering lock washer	1	
10	Self-locking nut	1	
11	Bolt	2	M5 × 18 mm
12	Washer	2	
13	Bolt	2	M8 × 22 mm

### Disassembling the friction plate

1. Remove the friction plate bolts ① and ②, and then remove the friction plate assembly from the swivel bracket.



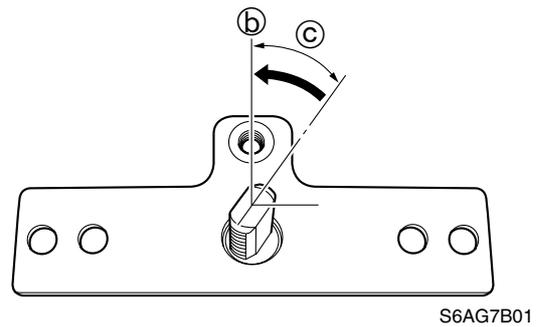
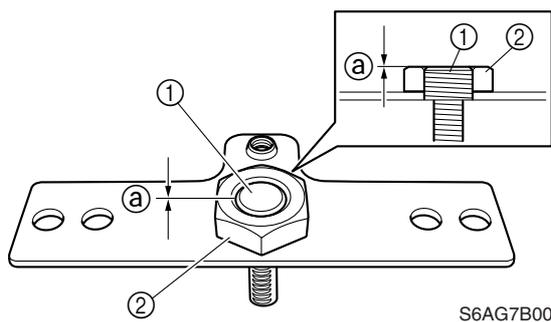
**NOTE:** Before removing the friction plate bolts ①, turn the outboard motor all the way to port or starboard.

2. Disassemble the friction plate assembly.

**NOTE:** See the exploded diagram for disassembly (7-5).

### Assembling the friction plate

1. Turn the steering lock shaft ① until it is flush with the end ③ of the nut ② on the plate.



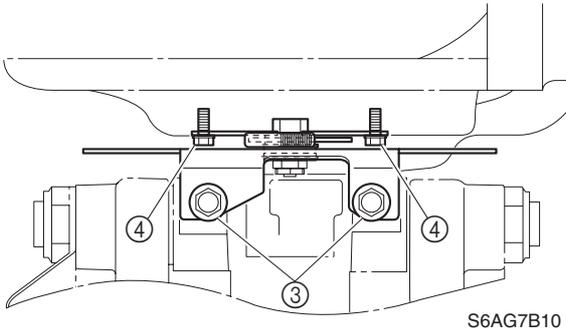
**NOTE:** If the steering lock shaft is not aligned with position (b), turn it less than 90° (c) until it is aligned.

2. Assemble the friction plate assembly.

**NOTE:**

- See the exploded diagram for assembly (7-5).
- Face the "TOP" mark on the steering lock lever up.
- Be sure to install the collars in the correct positions; the collar lengths are different.

3. Install the friction plate assembly onto the swivel bracket and tighten the friction plate bolts ③ and ④ temporarily.



**NOTE:** \_\_\_\_\_  
 To check and adjust the friction plate, see “Checking the steering operation (tiller handle model)” (3-13).  
 \_\_\_\_\_

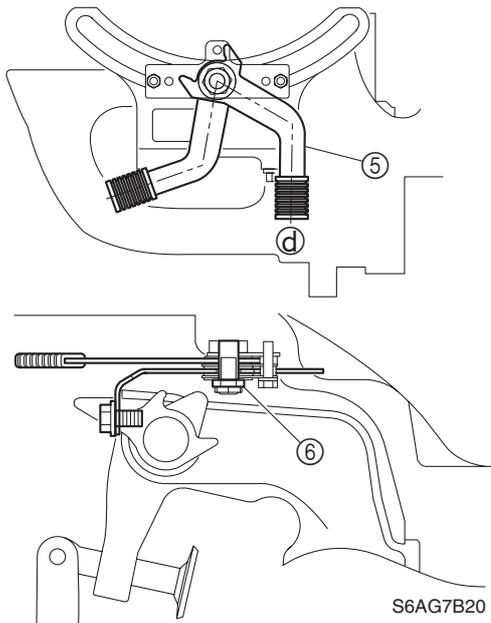
	Friction self-locking nut ⑥: 6 N·m (0.6 kgf·m, 4.4 ft·lb)
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**NOTE:** \_\_\_\_\_  
 Before installing the friction plate bolts ④, turn the outboard motor all the way to port or starboard.  
 \_\_\_\_\_

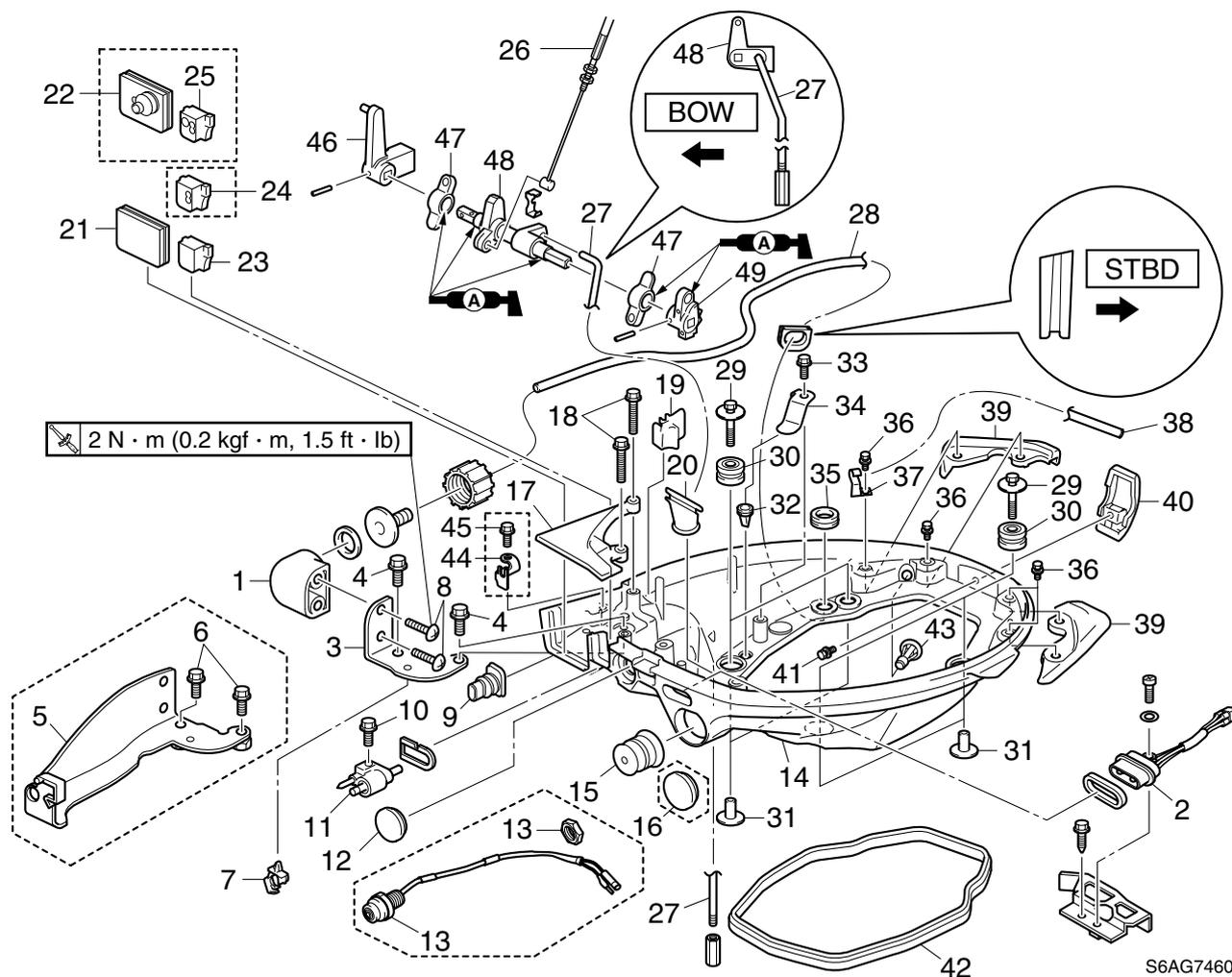
4. Tighten the friction plate bolts ③ and ④ to the specified torques.

	Friction plate bolt (M8) ③: 18 N·m (1.8 kgf·m, 13.3 ft·lb) Friction plate bolt (M5) ④: 7 N·m (0.7 kgf·m, 5.2 ft·lb)
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5. Move the steering lock lever ⑤ to position ④, and then tighten the self-locking nut ⑥ to the specified torque.

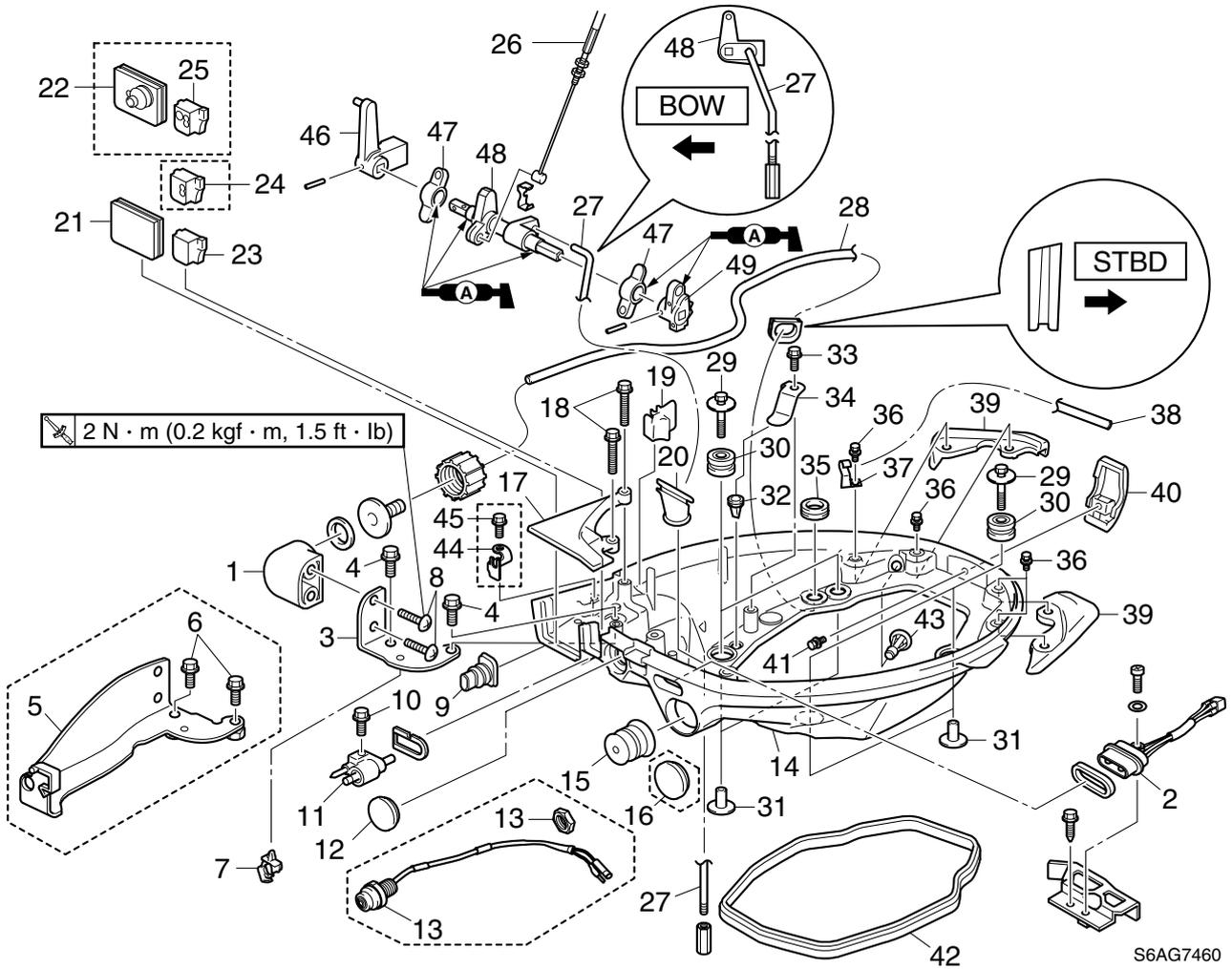


Bottom cowling



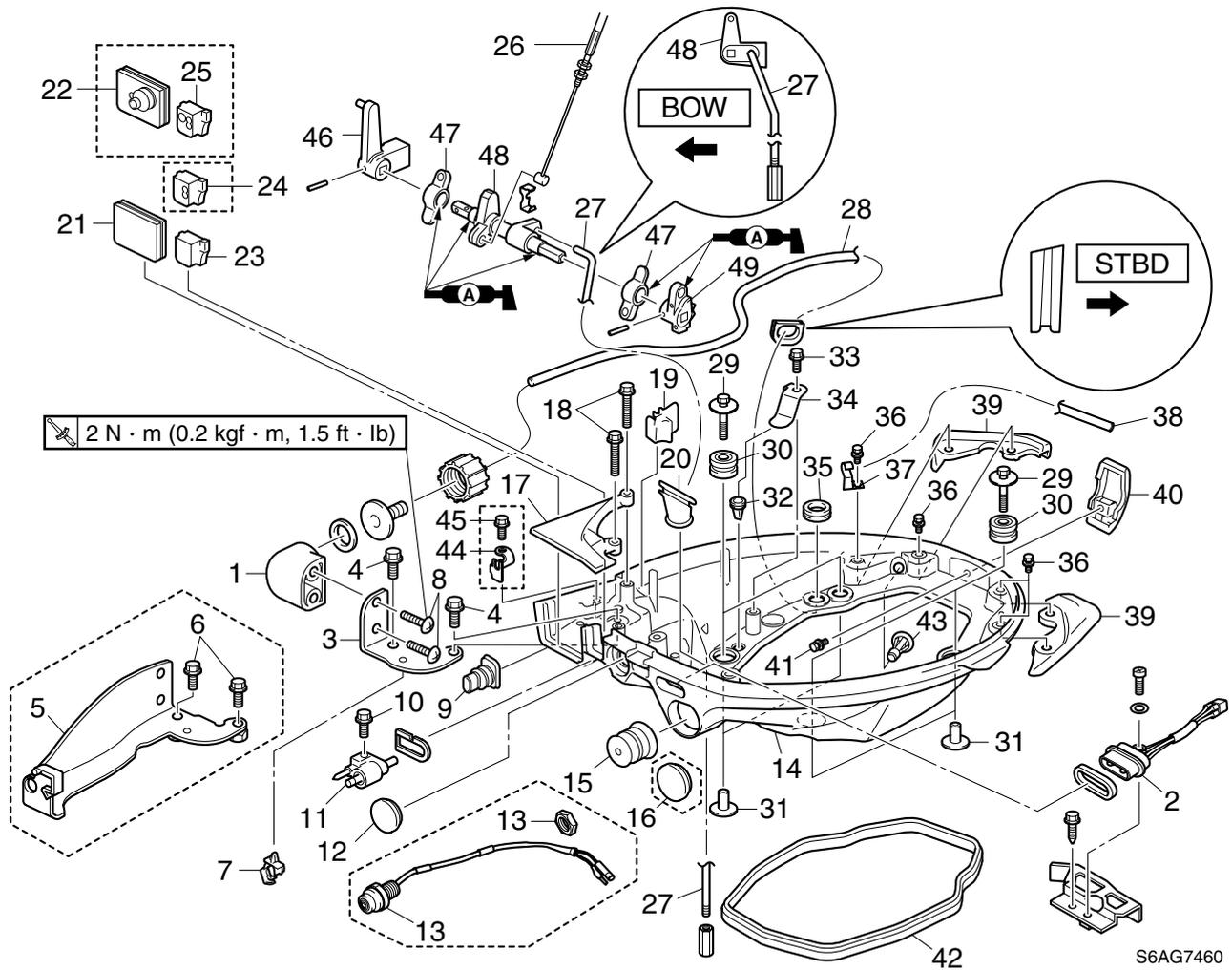
S6AG7460

No.	Part name	Q'ty	Remarks
1	Adapter	1	
2	Warning indicator assembly	1	
3	Bracket	1	Tiller handle model
4	Bolt	2	M6 × 10 mm/Tiller handle model
5	Bracket	1	Remote control model
6	Bolt	2	M6 × 14 mm/Remote control model
7	Holder	1	Power tilt model
8	Screw	2	ø6 × 20 mm
9	Grommet	1	
10	Bolt	1	M6 × 20 mm
11	Fuel joint	1	
12	Plug	1	Except for tiller handle model with electric starter
13	Engine start button	1	Tiller handle model with electric starter
14	Bottom cowling	1	
15	Grommet	1	Tiller handle model
16	Plug	1	Remote control model
17	Retaining plate	1	



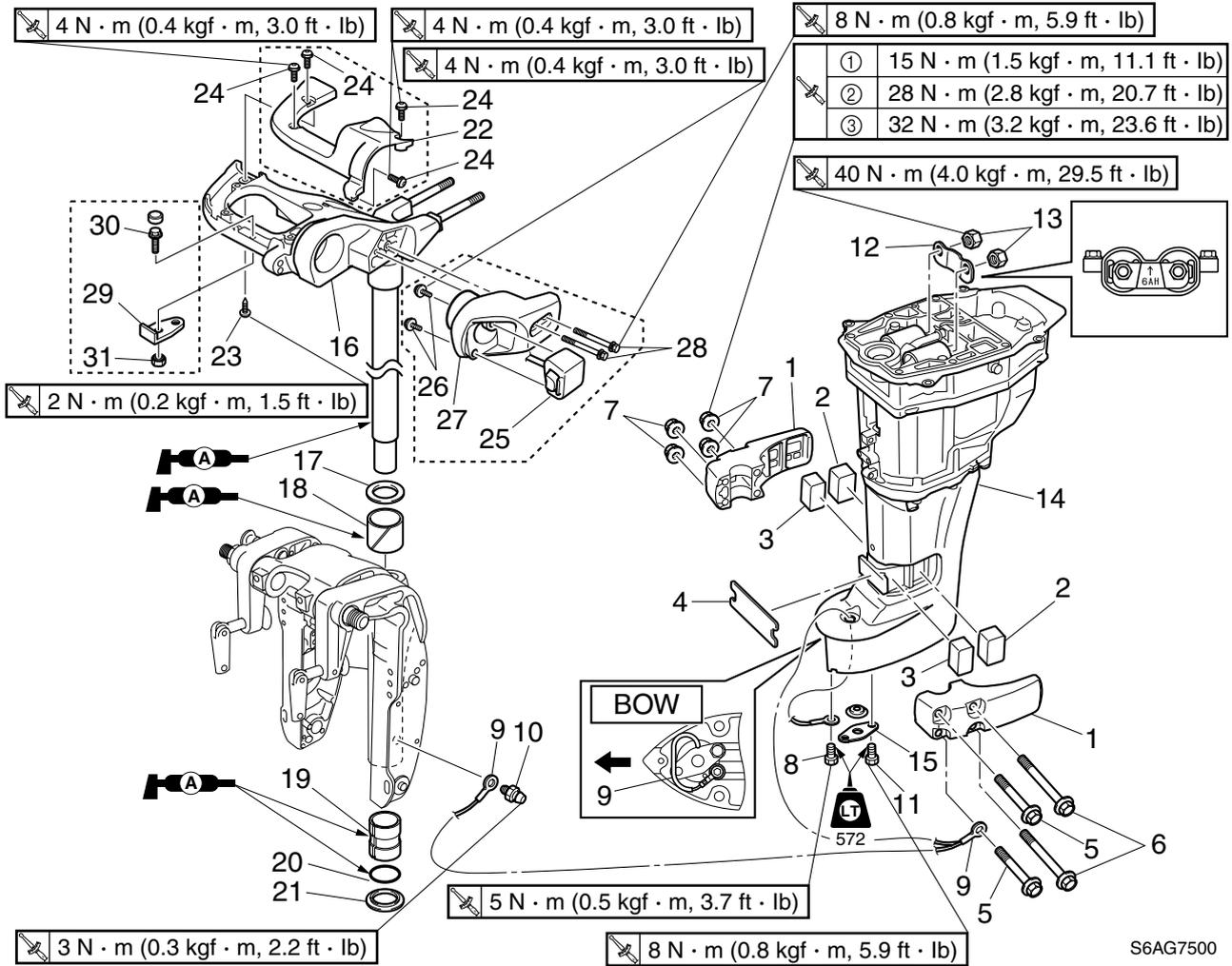
S6AG7460

No.	Part name	Q'ty	Remarks
18	Bolt	2	M6 × 30 mm
19	Damper	1	
20	Grommet	1	
21	Grommet	1	Tiller handle model
22	Grommet	1	Remote control model
23	Plug	1	Tiller handle model without electric starter
24	Plug	1	Tiller handle model with electric starter
25	Plug	1	Remote control model
26	Start-in-gear protection cable	1	Manual starter model
27	Shift rod	1	
28	Flushing hose	1	
29	Bolt	4	M6 × 35 mm
30	Grommet	4	
31	Collar	4	
32	Grommet	2	
33	Bolt	1	M6 × 20 mm
34	Plate	1	



No.	Part name	Q'ty	Remarks
35	Grommet	1	
36	Bolt	4	M6 × 12 mm
37	Holder	1	
38	Fuel hose	1	
39	Handgrip	2	
40	Cowling lock lever	1	
41	Bolt	1	M6 × 12 mm
42	Rubber seal	1	
43	Water outlet	1	
44	Cable guide	1	Remote control model
45	Bolt	1	M6 × 20 mm/Remote control model
46	Shift rod lever joint	1	
47	Bracket	2	
48	Shift rod lever	1	
49	Shift rod arm	1	

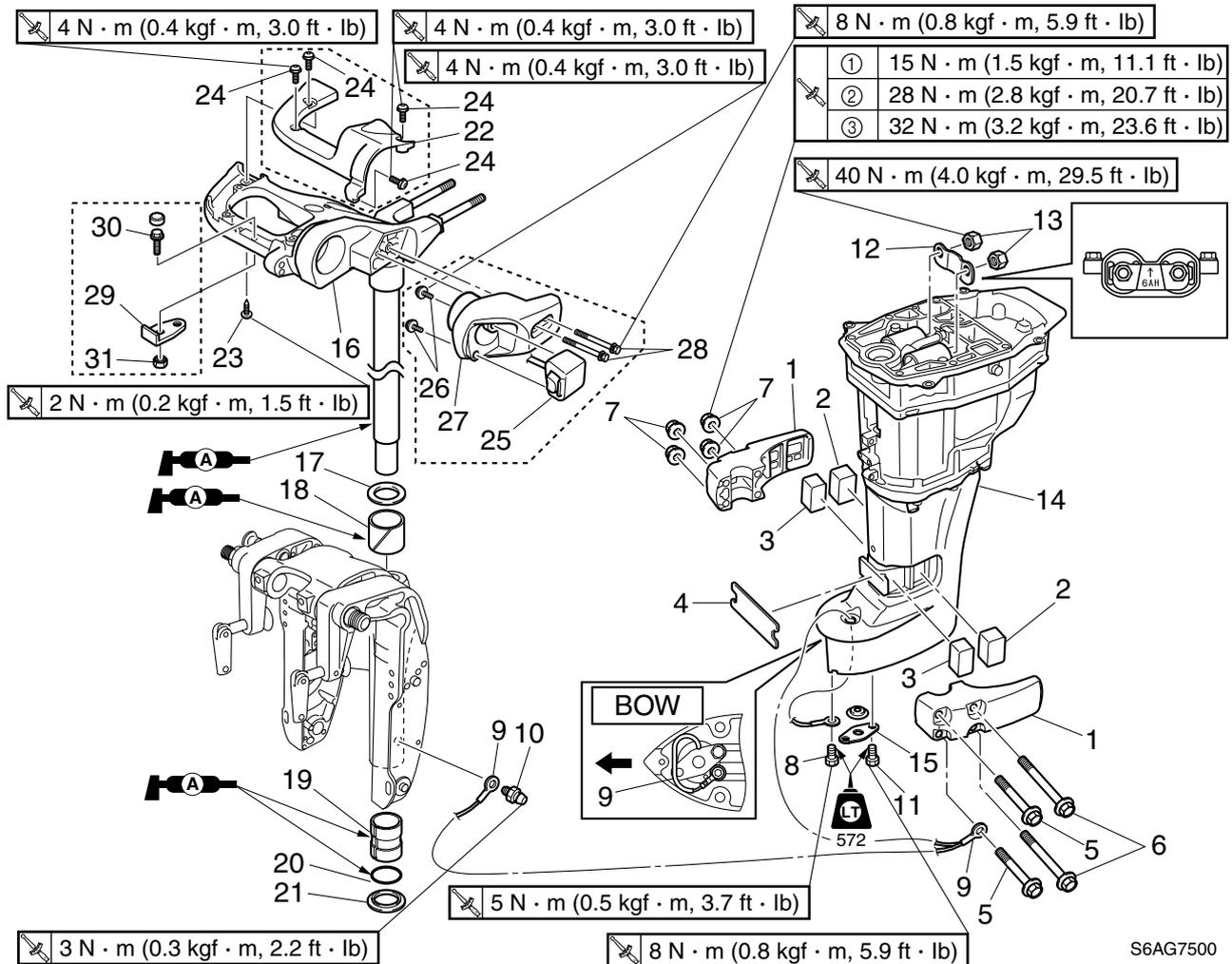
**Upper case and steering arm**



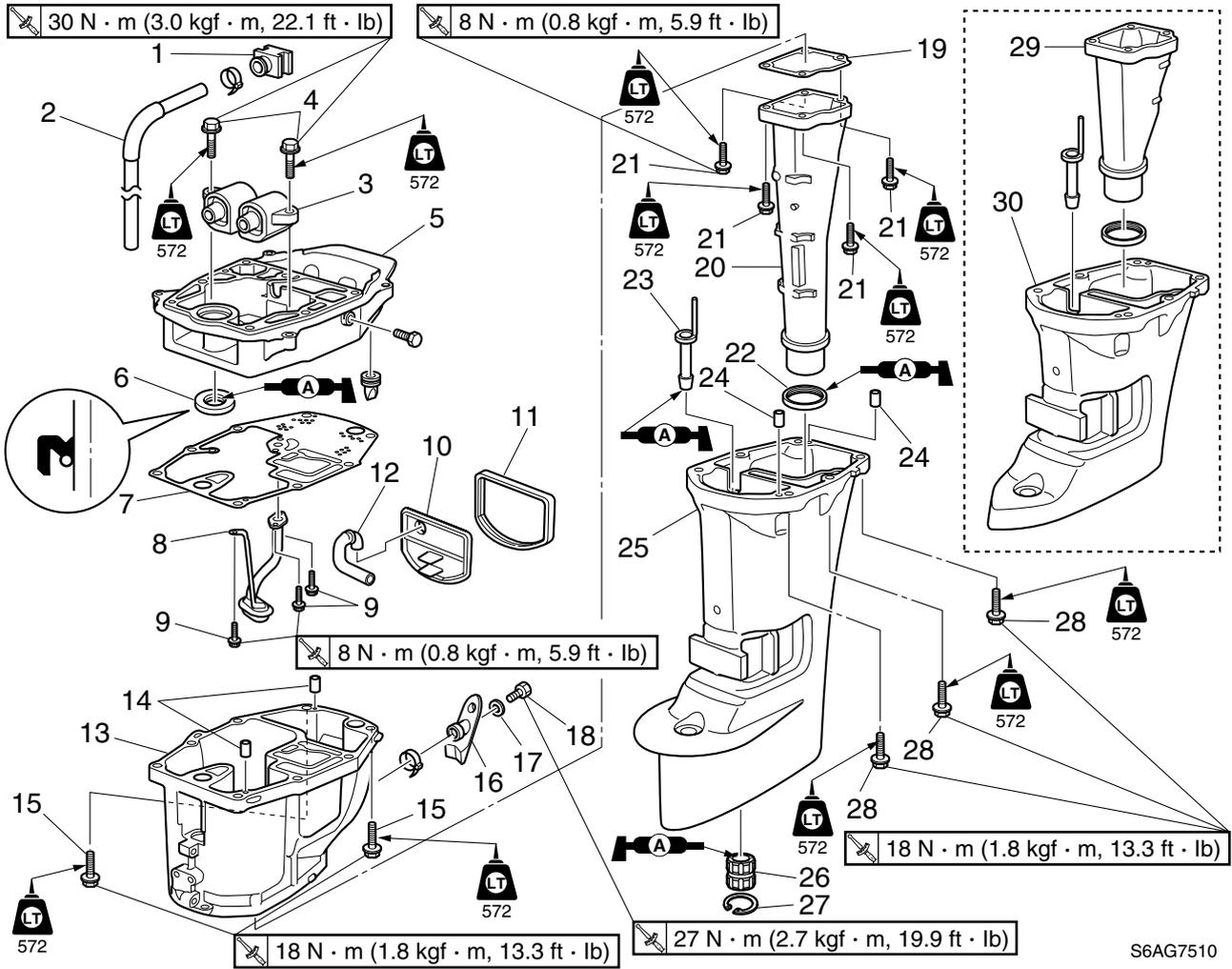
S6AG7500

No.	Part name	Q'ty	Remarks
1	Mount housing	2	
2	Rubber damper	2	Large
3	Rubber damper	2	Small
4	Rubber damper	1	
5	Bolt	2	M8 × 85 mm
6	Bolt	2	M8 × 105 mm
7	Nut	4	
8	Bolt	1	M5 × 10 mm
9	Ground lead	1	
10	Grease nipple	1	
11	Bolt	1	M6 × 8 mm
12	Plate	1	
13	Nut	2	
14	Upper case assembly	1	L-transom model/S-transom model
15	Plate	1	
16	Steering arm	1	L-transom model/S-transom model
17	Washer	1	

## Upper case and steering arm



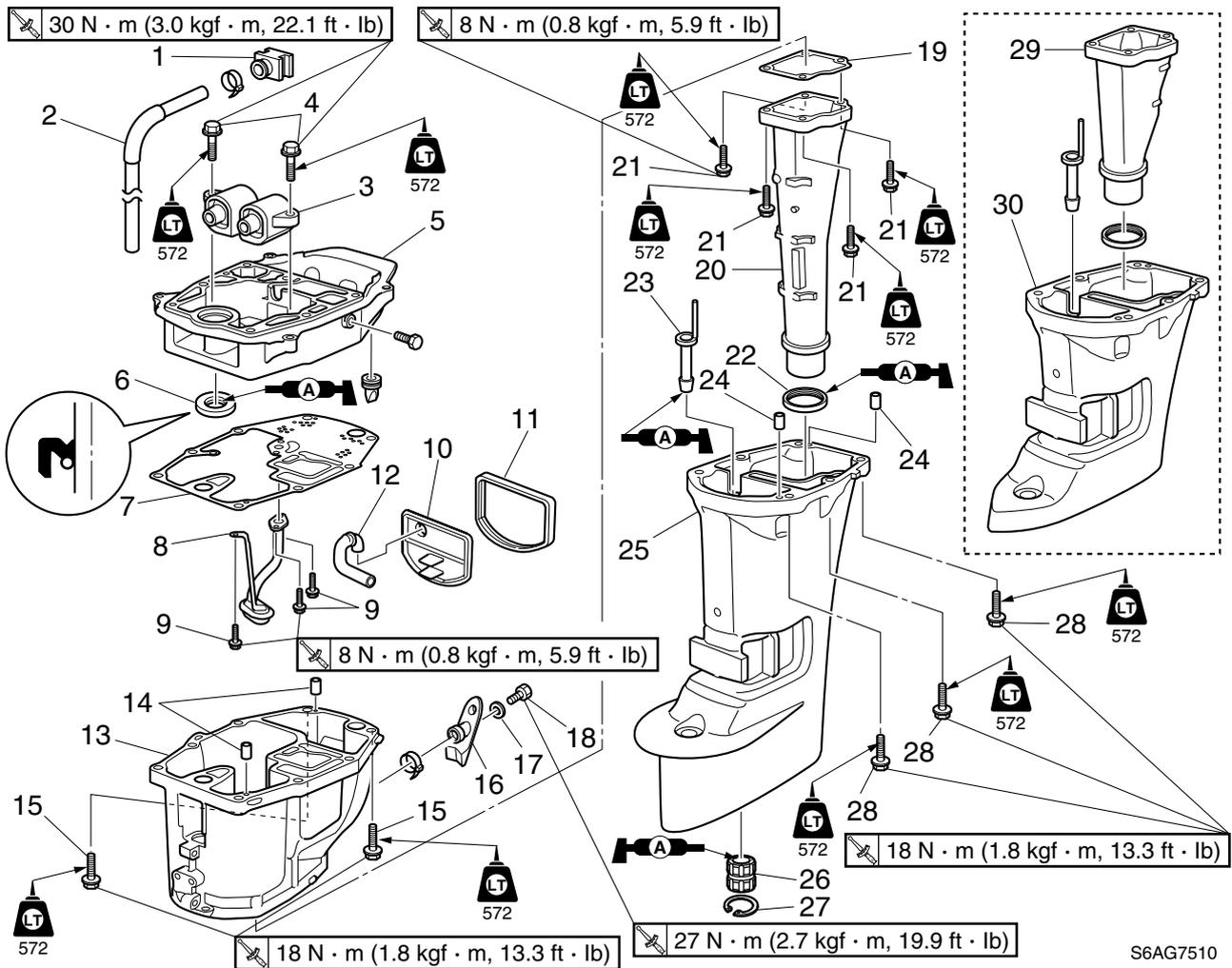
No.	Part name	Q'ty	Remarks
18	Bushing 1	1	
19	Bushing 2	1	
20	O-ring	1	<b>Not reusable</b>
21	Plate	1	
22	Steering bracket cover	1	Remote control model
23	Screw	1	ø6 × 20 mm/Remote control model
24	Screw	4	ø6 × 18 mm/Remote control model
25	Power tilt switch	1	Remote control model with power tilt
26	Screw	2	ø6 × 20 mm/Remote control model with power tilt
27	Cover	1	Remote control model
28	Bolt	2	M6 × 30 mm/Remote control model
29	Steering hook	1	Remote control model
30	Bolt	1	M8 × 25 mm/Remote control model
31	Nut	1	Remote control model



S6AG7510

No.	Part name	Q'ty	Remarks
1	Grommet	1	
2	Water pipe	1	L-transom model/S-transom model
3	Upper mount	1	
4	Bolt	2	M8 × 30 mm
5	Exhaust guide	1	
6	Oil seal	1	<b>Not reusable</b>
7	Gasket	1	<b>Not reusable</b>
8	Oil strainer	1	
9	Bolt	3	M6 × 16 mm
10	Baffle plate	1	
11	Seal	1	
12	Pipe	1	
13	Oil pan	1	
14	Dowel	2	
15	Bolt	2	M8 × 30 mm
16	Damper	1	
17	Gasket	1	<b>Not reusable</b>

## Upper case and steering arm



S6AG7510

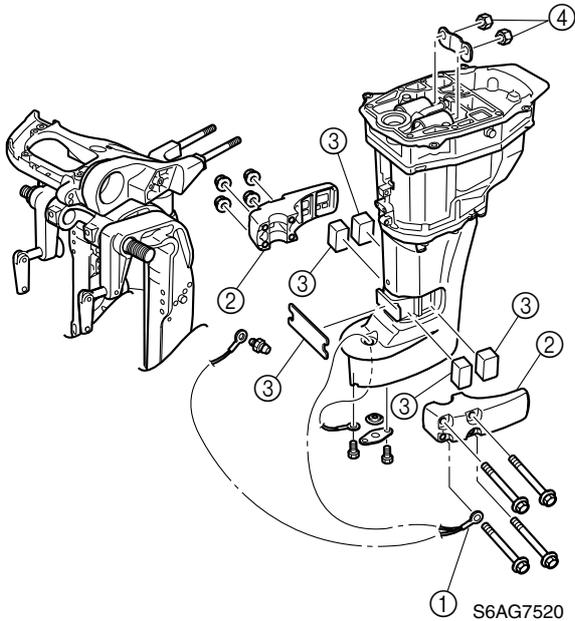
No.	Part name	Q'ty	Remarks
18	Drain bolt	1	
19	Gasket	1	<b>Not reusable</b>
20	Exhaust manifold	1	L-transom model
21	Bolt	4	M6 × 25 mm
22	Rubber seal	1	
23	Water pipe guide	1	
24	Dowel	2	
25	Upper case	1	L-transom model
26	Drive shaft bushing	1	L-transom model only
27	Circlip	1	L-transom model only
28	Bolt	6	M8 × 30 mm
29	Exhaust manifold	1	S-transom model
30	Upper case	1	S-transom model

**Removing the upper case**

**NOTE:**

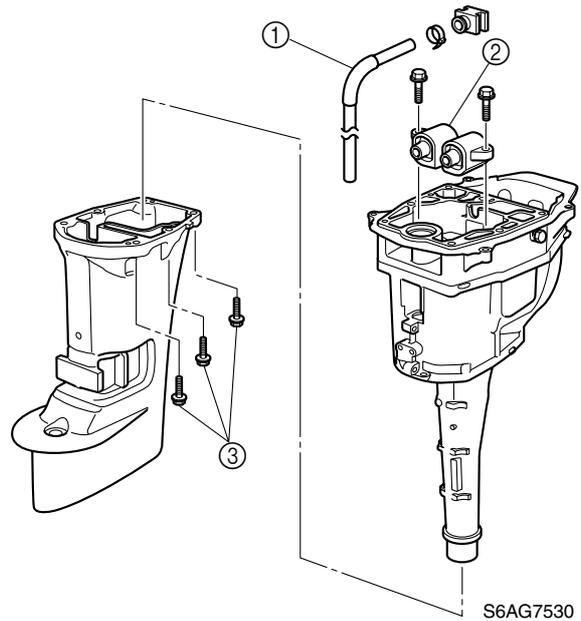
- Drain the engine oil before removing the upper case assembly.
- Be sure to remove the shift rod assembly before removing the upper case assembly from the clamp bracket.

1. Remove the ground lead terminal ① from the swivel bracket.
2. Remove the mount housings ②, and then remove the rubber dampers ③.
3. Remove the upper mounting nuts ④, and then remove the upper case assembly.

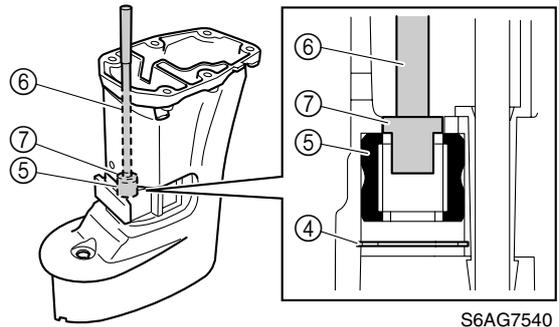


**Disassembling the upper case**

1. Remove the engine oil drain bolt and damper.
2. Remove the water pipe ① and upper mount ② from the upper case assembly.
3. Remove the oil pan assembly bolts ③, and then remove the oil pan assembly from the upper case.



4. Remove the circlip ④, and then remove the drive shaft bushing ⑤. (L-transom model)



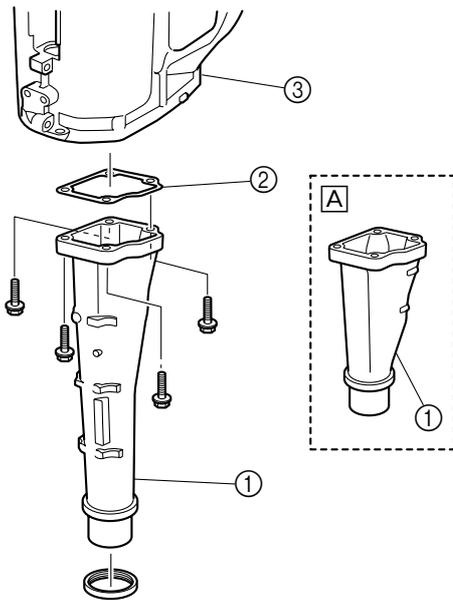
	Driver rod L3 ⑥: 90890-06652 Needle bearing attachment ⑦: 90890-06618
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**Checking the drive shaft bushing (L-transom model)**

1. Check the drive shaft bushing. Replace if cracked or worn.

**Disassembling the exhaust manifold, oil pan, and exhaust guide**

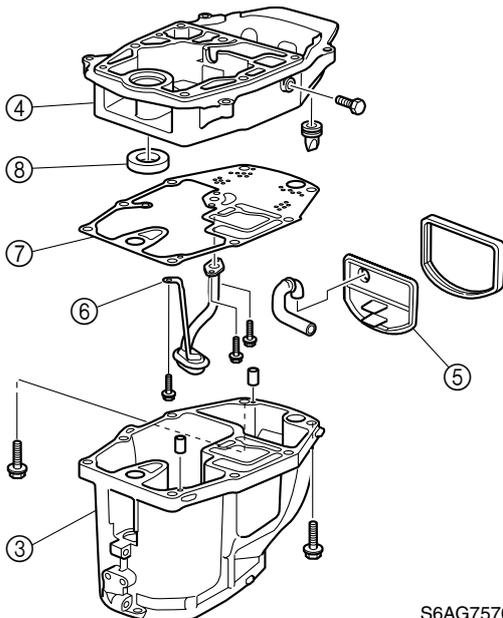
1. Remove the exhaust manifold ① and gasket ② from the oil pan ③.



S6AG7560

**A** S-transom model

2. Remove the oil pan ③ from the exhaust guide ④, and then remove the baffle plate ⑤.
3. Remove the oil strainer ⑥ and the gasket ⑦ from the exhaust guide.
4. Remove the oil seal ⑧ from the exhaust guide.



S6AG7570J

### Checking the exhaust manifold, oil pan, and exhaust guide

1. Check the exhaust manifold, oil pan and exhaust guide. Replace if cracked or corroded.

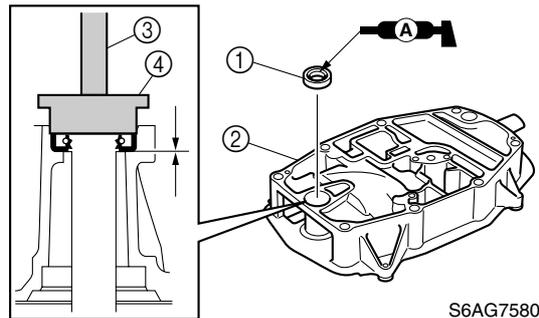
**NOTE:** \_\_\_\_\_  
Clean the removed parts before checking them.

### Checking the oil strainer

1. Check the oil strainer. Clean if there is dirt and residue.

### Assembling the exhaust guide, oil pan, and exhaust manifold

1. Install a new oil seal ① into the exhaust guide ②.

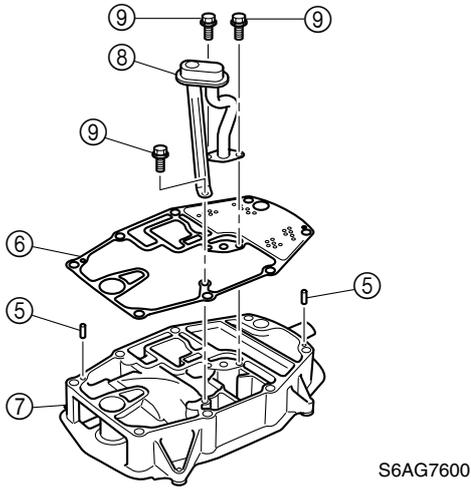


S6AG7580J



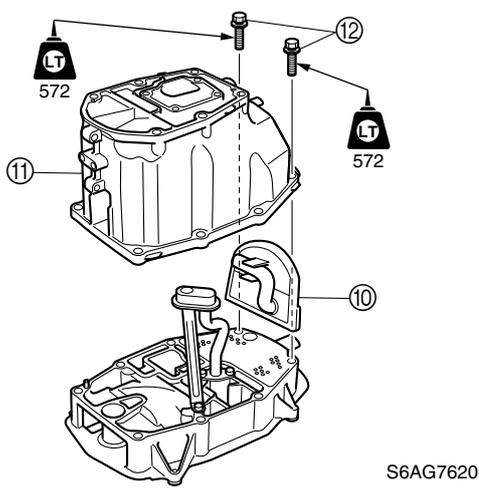
Driver rod L3 ③: 90890-06652  
Needle bearing attachment ④:  
90890-06612

2. Install the dowels ⑤ and a new gasket ⑥ onto the exhaust guide ⑦.
3. Install the oil strainer ⑧ and oil strainer bolts ⑨, and then tighten the bolts to the specified torque.



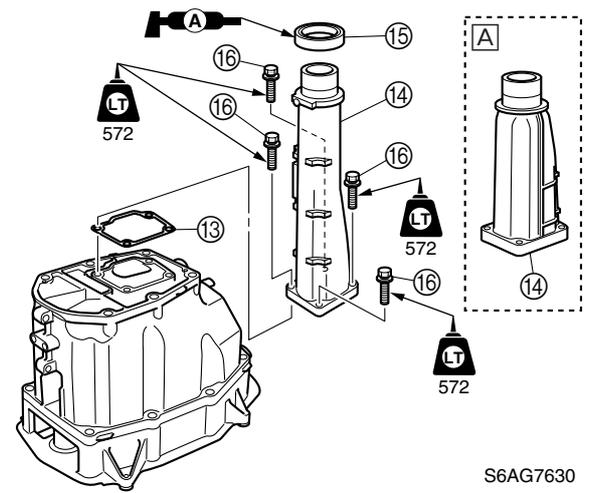
 Oil strainer bolt ⑨:  
8 N·m (0.8 kgf·m, 5.9 ft·lb)

4. Install the baffle plate ⑩ and oil pan ⑪, and then tighten the oil pan bolts ⑫ to the specified torque.



 Oil pan bolt ⑫:  
18 N·m (1.8 kgf·m, 13.3 ft·lb)

5. Install a new gasket ⑬, the exhaust manifold ⑭, and the rubber seal ⑮, and then tighten the exhaust manifold bolts ⑯ to the specified torque.

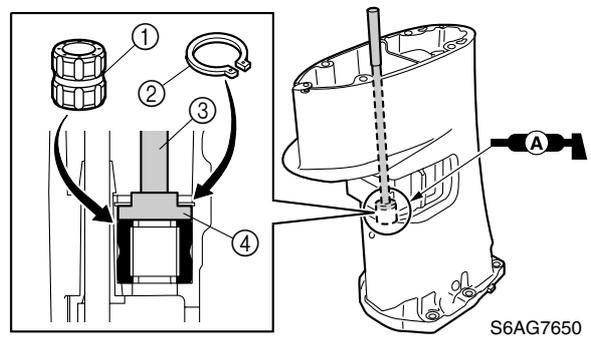


A S-transom model

 Exhaust manifold bolt ⑯:  
8 N·m (0.8 kgf·m, 5.9 ft·lb)

**Assembling the upper case**

1. Install the drive shaft bushing ① into the upper case, and then install the circlip ②. (L-transom model)

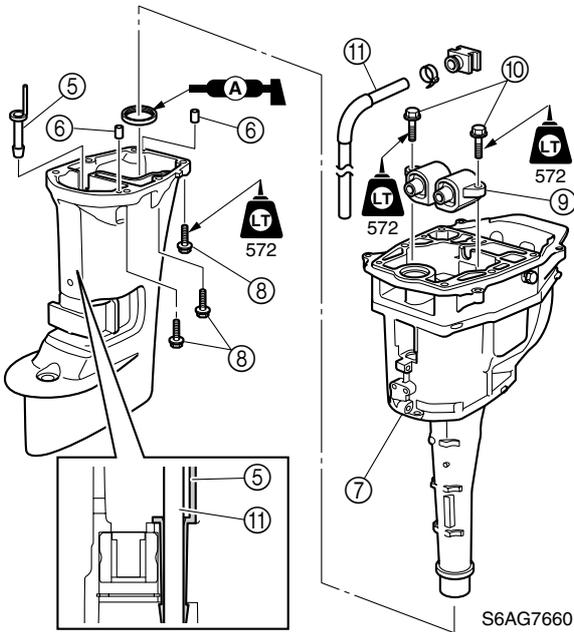


**NOTE:** After installing the drive shaft bushing, apply grease to the inside of the bushing.

 Driver rod L3 ③: 90890-06652  
Needle bearing attachment ④:  
90890-06613

2. Install the water pipe guide ⑤ onto the upper case.
3. Install the dowels ⑥, oil pan assembly ⑦, and oil pan assembly bolts ⑧, and then tighten the bolts to the specified torque.

4. Install the upper mount ⑨, and then tighten the upper mount bolts ⑩ to the specified torque.
5. Install the water pipe ⑪.



**NOTE:**  
Be sure to pass the water pipe ⑪ through the water pipe guide ⑤.

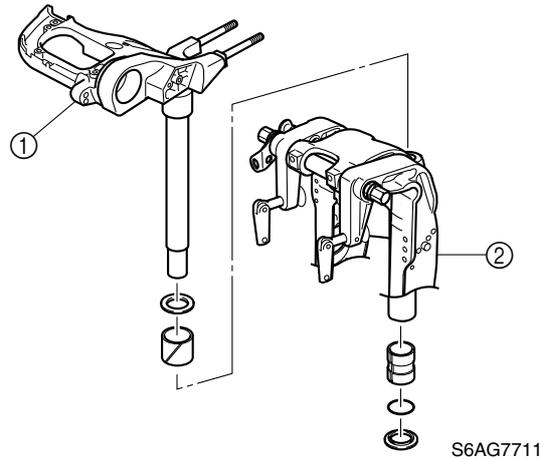
	Oil pan assembly bolt ⑧: 18 N·m (1.8 kgf·m, 13.3 ft·lb)
	Upper mount bolt ⑩: 30 N·m (3.0 kgf·m, 22.1 ft·lb)

6. Install the damper and engine oil drain bolt, and then tighten the drain bolt to the specified torque.

	Engine oil drain bolt: 27 N·m (2.7 kgf·m, 19.9 ft·lb)
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**Removing the steering arm**

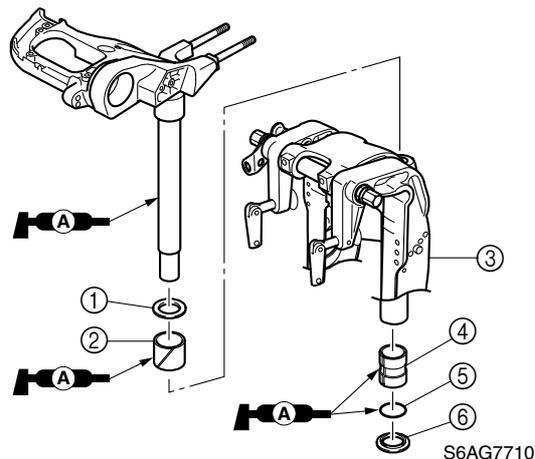
1. Remove the steering arm ① from the swivel bracket ② by pulling the arm off the bracket.



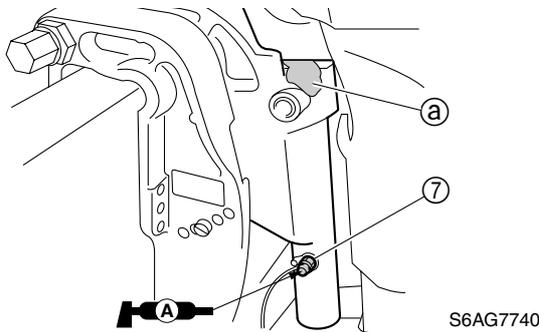
**NOTE:**  
To disassemble the clamp brackets, see “Removing the clamp bracket” (7-22) or “Removing the clamp bracket” (7-27).

**Installing the steering arm**

1. Install the washer ① and bushing 1 ② onto the steering arm.
2. Place the swivel bracket ③ in an upright position, and then install the steering arm onto the swivel bracket.
3. Install bushing 2 ④, a new O-ring ⑤, and the plate ⑥ onto the swivel bracket.



- Apply grease to the grease nipple ⑦ on the swivel bracket until it comes out from the upper bushing ①.



**NOTE:**

To assemble the clamp brackets, see “Installing the clamp bracket” (7-24) or “Installing the clamp bracket” (7-28).

**Installing the upper case**

- Install the upper case assembly ① to the clamp bracket.
- Install the plate and upper mounting nuts ②, and then tighten the upper mounting nuts to the specified torque.
- Install the rubber dampers ③ (small), ④ (large), and ⑤ (front), and then install the mount housings ⑥ and ground lead terminal ⑦ using the mount housing bolts ⑧ and ⑨ and the mount housing nuts ⑩.

**NOTE:**

- Be sure to remove any oil from the mount housing bolts ⑧ and ⑨.
- Install the ground lead terminal ⑦ so that it is within the range ① shown.

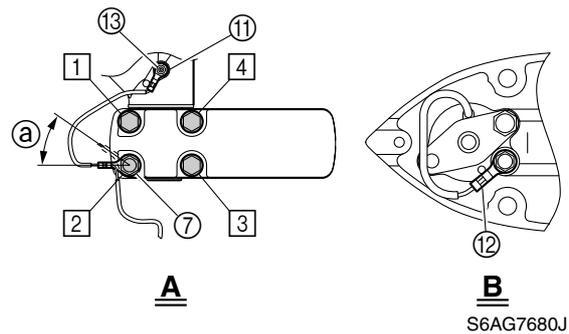
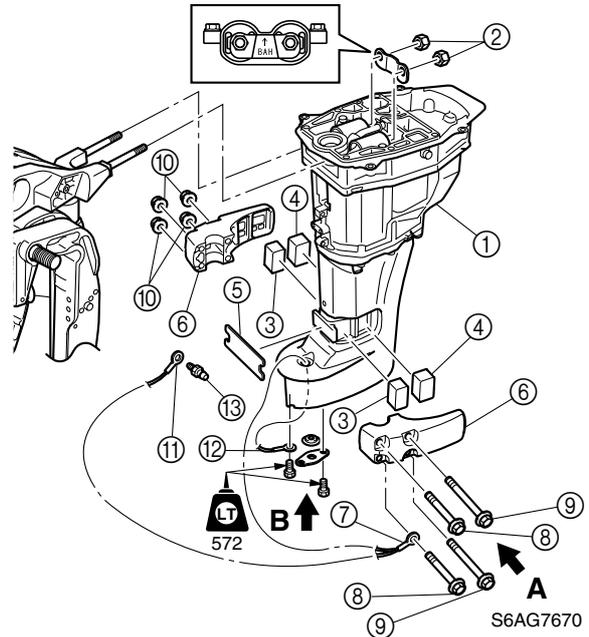
- Tighten the mount housing nuts ⑩ to the specified torques in 3 stages and in the sequence shown.

**NOTE:**

Tighten the mount housing nuts ⑩ evenly and in the following order: ①-②-③-④.

- Install the ground lead terminal ⑪ to the swivel bracket.

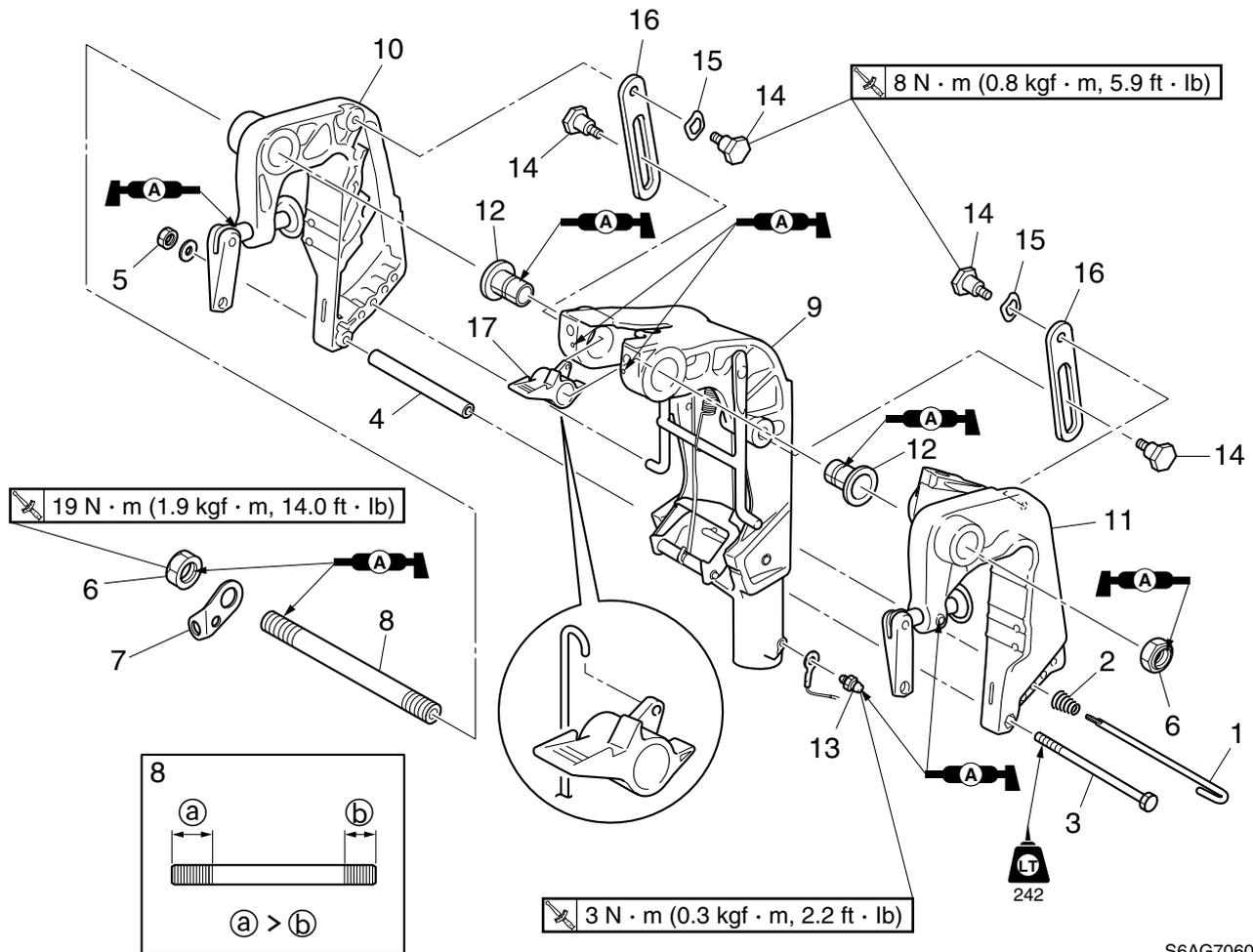
- Install the ground lead terminal ⑫ to the upper case as shown.



	Upper mounting nut ②: 40 N·m (4.0 kgf·m, 29.5 ft·lb)
	Mount housing nut ⑩: 1st: 15 N·m (1.5 kgf·m, 11.1 ft·lb) 2nd: 28 N·m (2.8 kgf·m, 20.7 ft·lb) 3rd: 32 N·m (3.2 kgf·m, 23.6 ft·lb)
	Grease nipple ⑬: 3 N·m (0.3 kgf·m, 2.2 ft·lb)

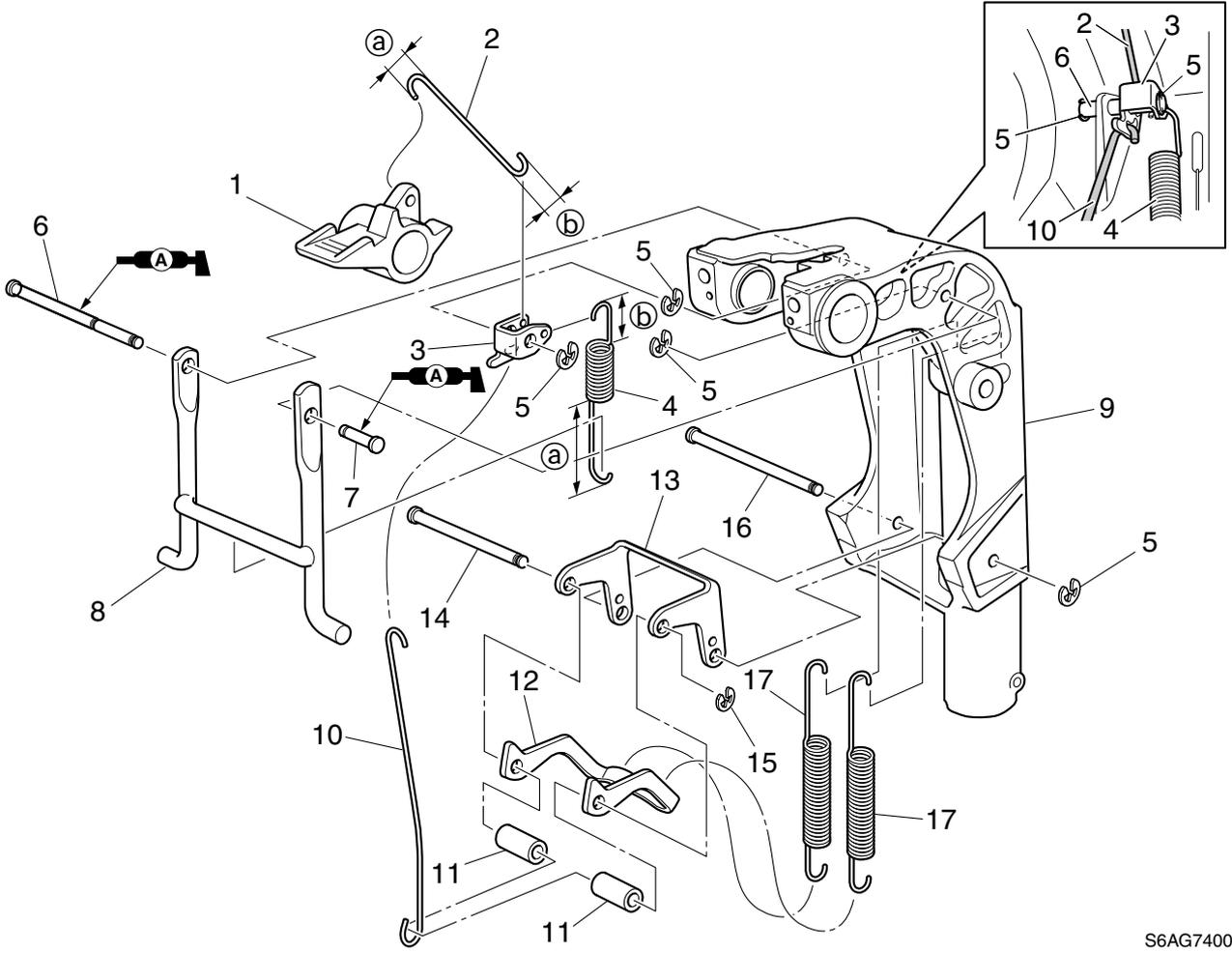
Upper case and steering arm / Clamp bracket and swivel bracket (manual tilt model)

Clamp bracket and swivel bracket (manual tilt model)



S6AG7060

No.	Part name	Q'ty	Remarks
1	Tilt pin	1	
2	Spring	1	
3	Bolt	1	M6 × 155 mm
4	Collar	1	
5	Nut	1	
6	Self-locking nut	2	
7	Hanger	1	
8	Through tube	1	
9	Swivel bracket	1	L-transom model/S-transom model
10	Clamp bracket	1	STBD
11	Clamp bracket	1	PORT
12	Bushing	2	
13	Grease nipple	1	
14	Bolt	4	
15	Wave washer	2	
16	Tilt stopper plate	2	
17	Tilt lock lever	1	



S6AG7400

No.	Part name	Q'ty	Remarks
1	Tilt lock lever	1	
2	Tilt lock rod 1	1	a > b
3	Tilt lever	1	
4	Spring	1	a > b
5	E-clip	4	
6	Tilt lever shaft	1	
7	Stopper shaft	1	
8	Receiver assembly	1	
9	Swivel bracket	1	L-transom model/S-transom model
10	Tilt lock rod 2	1	
11	Collar	2	
12	Tilt lock plate 1	1	
13	Tilt lock plate 2	1	
14	Tilt lock shaft	1	
15	E-clip	1	
16	Reverse lock shaft	1	
17	Spring	2	

## Clamp bracket and swivel bracket (manual tilt model)

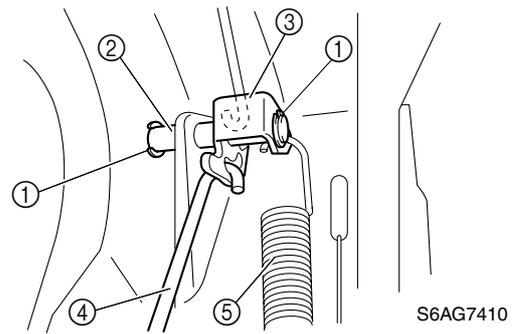
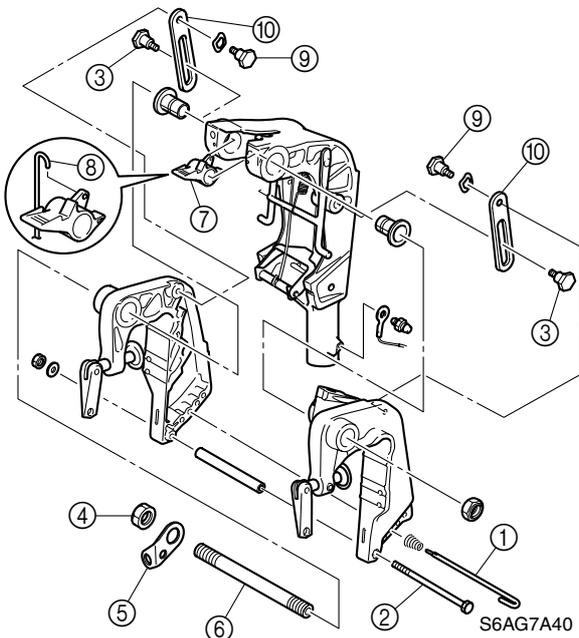
### Removing the clamp bracket

1. Remove the tilt pin ①, and then remove the clamp bracket bolt ②, clamp bracket nut, and collar.
2. Remove the tilt stopper plate bolts ③ (swivel bracket side).
3. Remove the self-locking nut ④ and hanger ⑤.
4. Remove the through tube ⑥ and tilt lock lever ⑦, and then disassemble the clamp brackets.

#### NOTE:

Unhook tilt lock rod 1 ⑧ from the tilt lock lever ⑦ when removing it.

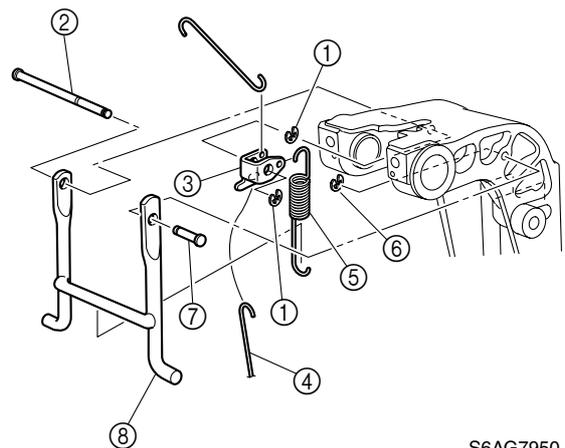
5. Remove the tilt stopper plate bolts ⑨ (clamp bracket side) and tilt stopper plates ⑩.



#### NOTE:

Unhook tilt lock rod 2 ④ from the tilt lever ③ when removing it.

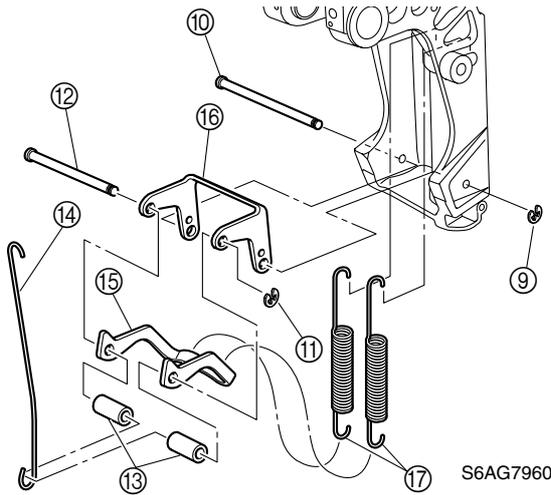
2. Remove the E-clip ⑥ from the stopper shaft ⑦, and then pull out the shaft and remove the receiver assembly ⑧.



### Disassembling the swivel bracket

1. Remove the spring ⑤. Remove the E-clips ① from the tilt lever shaft ②, and then pull out the shaft and remove the tilt lever ③ and tilt lock rod 2 ④.

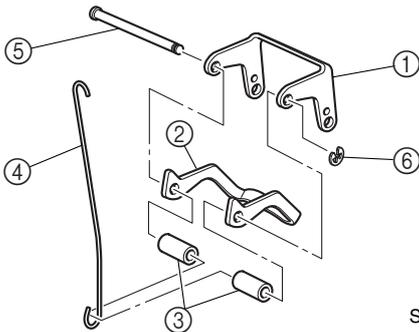
3. Remove the E-clip ⑨ from the reverse lock shaft ⑩, and then pull out the shaft.
4. Remove the springs ⑰.
5. Remove the E-clip ⑪ from the tilt lock shaft ⑫, and then pull out the shaft and remove the collars ⑬, tilt lock rod 2 ⑭, tilt lock plate 1 ⑮, and tilt lock plate 2 ⑯.



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**Assembling the swivel bracket**

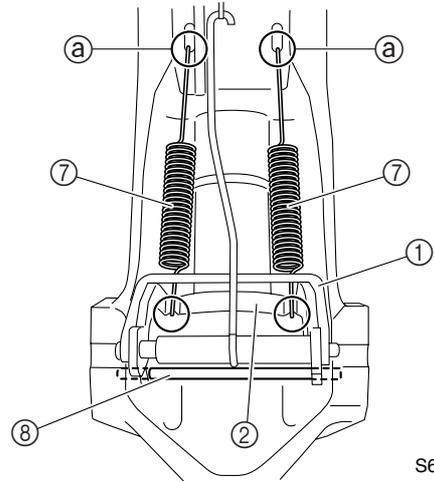
1. Assemble tilt lock plate 2 ①, tilt lock plate 1 ②, the collars ③, tilt lock rod 2 ④, and the tilt lock shaft ⑤, and then install the E-clip ⑥.



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**NOTE:** \_\_\_\_\_  
After installing the E-clip, turn it to make sure that it is installed securely.

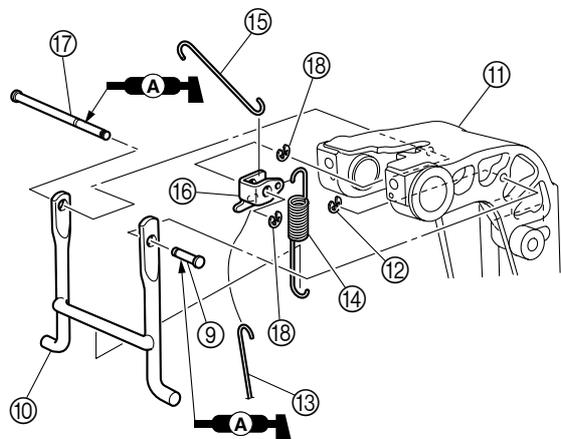
2. Pass the reverse lock shaft ⑧ through the swivel bracket and tilt lock plate 2 ①, and then install the E-clip. Hook the springs ⑦ onto tilt lock plate 1 ②, and then hook them onto the holes ① in the swivel bracket.



S6AG7440

**NOTE:** \_\_\_\_\_  
After installing the E-clip, turn it to make sure that it is installed securely.

3. Install the stopper shaft ⑨ and receiver assembly ⑩ to the swivel bracket ⑪, and then install the E-clip ⑫.
4. Hook tilt lock rod 2 ⑬, the spring ⑭, and tilt lock rod 1 ⑮ onto the tilt lever ⑯.
5. Install the tilt lever shaft ⑰ into the swivel bracket ⑪, making sure to pass the shaft through the receiver assembly ⑩ and tilt lever ⑯, and then install the E-clips ⑱.
6. Hook the spring ⑭ onto the receiver assembly ⑩.



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## Clamp bracket and swivel bracket (manual tilt model)

### NOTE:

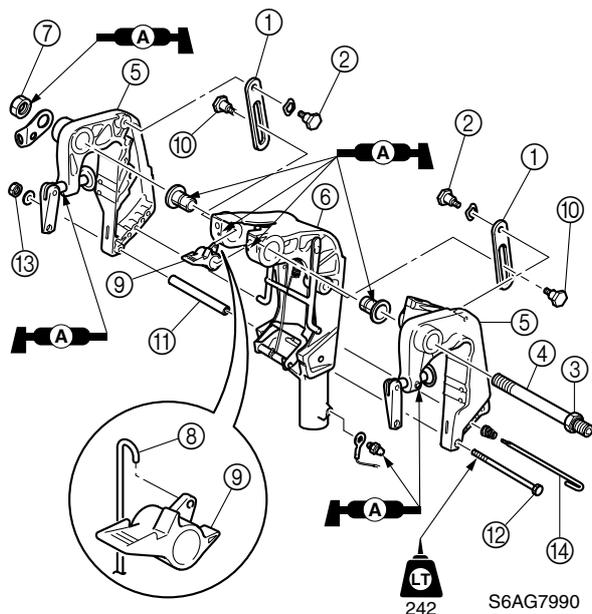
- See the exploded diagram for the installation directions of the spring (14) and tilt lock rod 1 (15) (7-21).
- Make sure that the E-clips are installed securely.

### Installing the clamp bracket

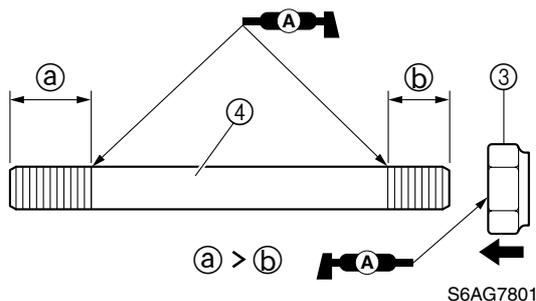
1. Install the tilt stopper plates (1) and tilt stopper plate bolts (2) to the clamp brackets, and then tighten the bolts to the specified torque.



Tilt stopper plate bolt (2):  
8 N·m (0.8 kgf·m, 5.9 ft·lb)



2. Tighten the self-locking nut (3) completely onto the shorter threaded end of the through tube (4).



3. Assemble the clamp brackets (5) and swivel bracket (6), and then install the through tube (4) from the port side.

### NOTE:

When installing the through tube (4), hook tilt lock rod 1 (8) onto the tilt lock lever (9).

4. Install the self-locking nut (7) onto the through tube, and then tighten it to the specified torque.



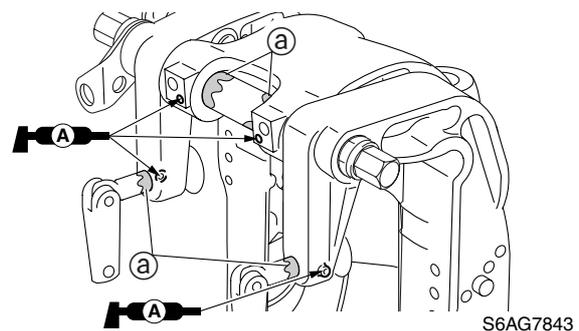
Self-locking nut (7):  
19 N·m (1.9 kgf·m, 14.0 ft·lb)

5. Install the tilt stopper plates (1) and tilt stopper plate bolts (10) to the swivel bracket, and then tighten the bolts to the specified torque.



Tilt stopper plate bolt (10):  
8 N·m (0.8 kgf·m, 5.9 ft·lb)

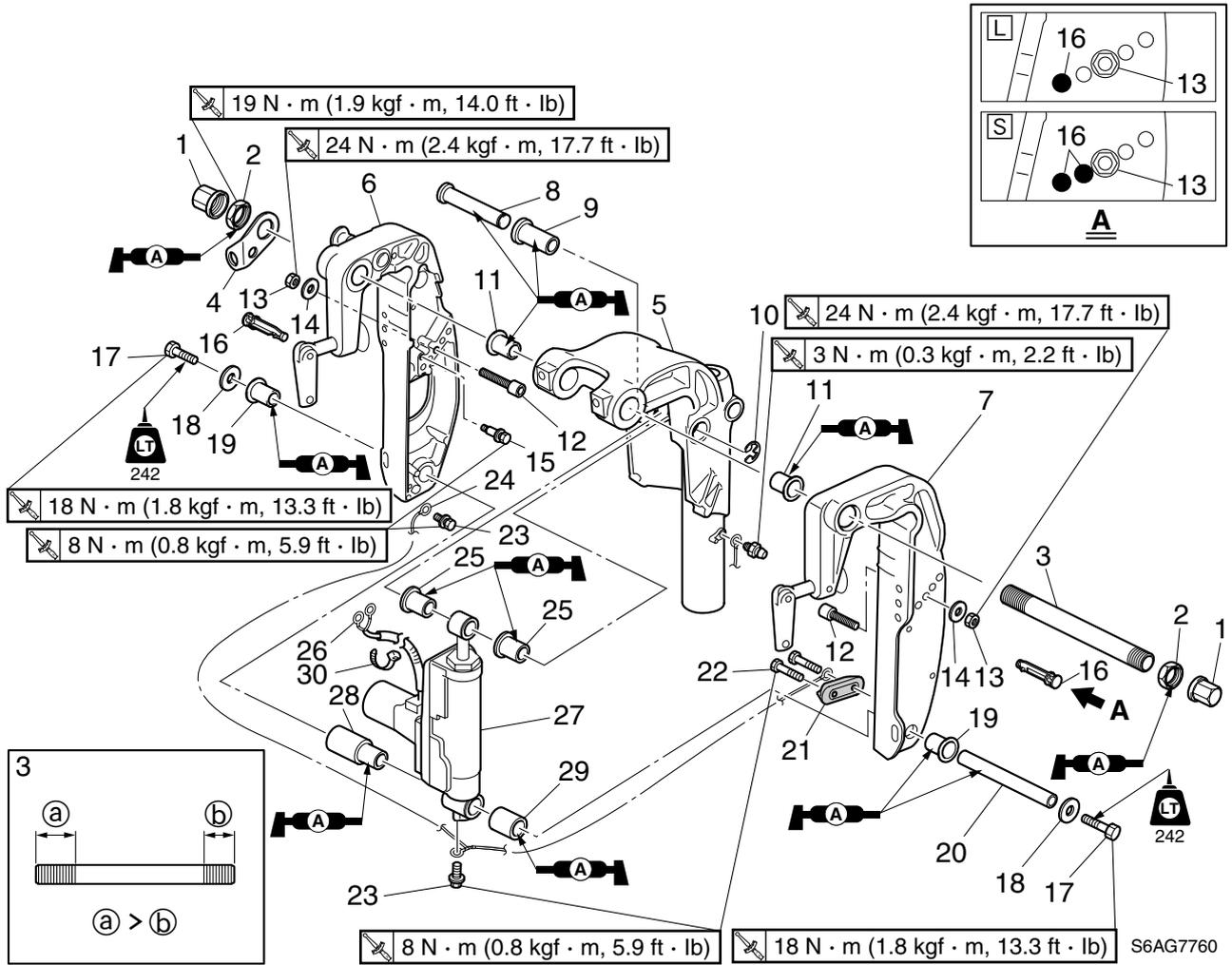
6. Install the collar (11) and clamp bracket bolt (12), and then tighten the clamp bracket nut (13).
7. Install the tilt pin (14).
8. Apply grease to all grease nipples until it comes out from the areas (a).



### NOTE:

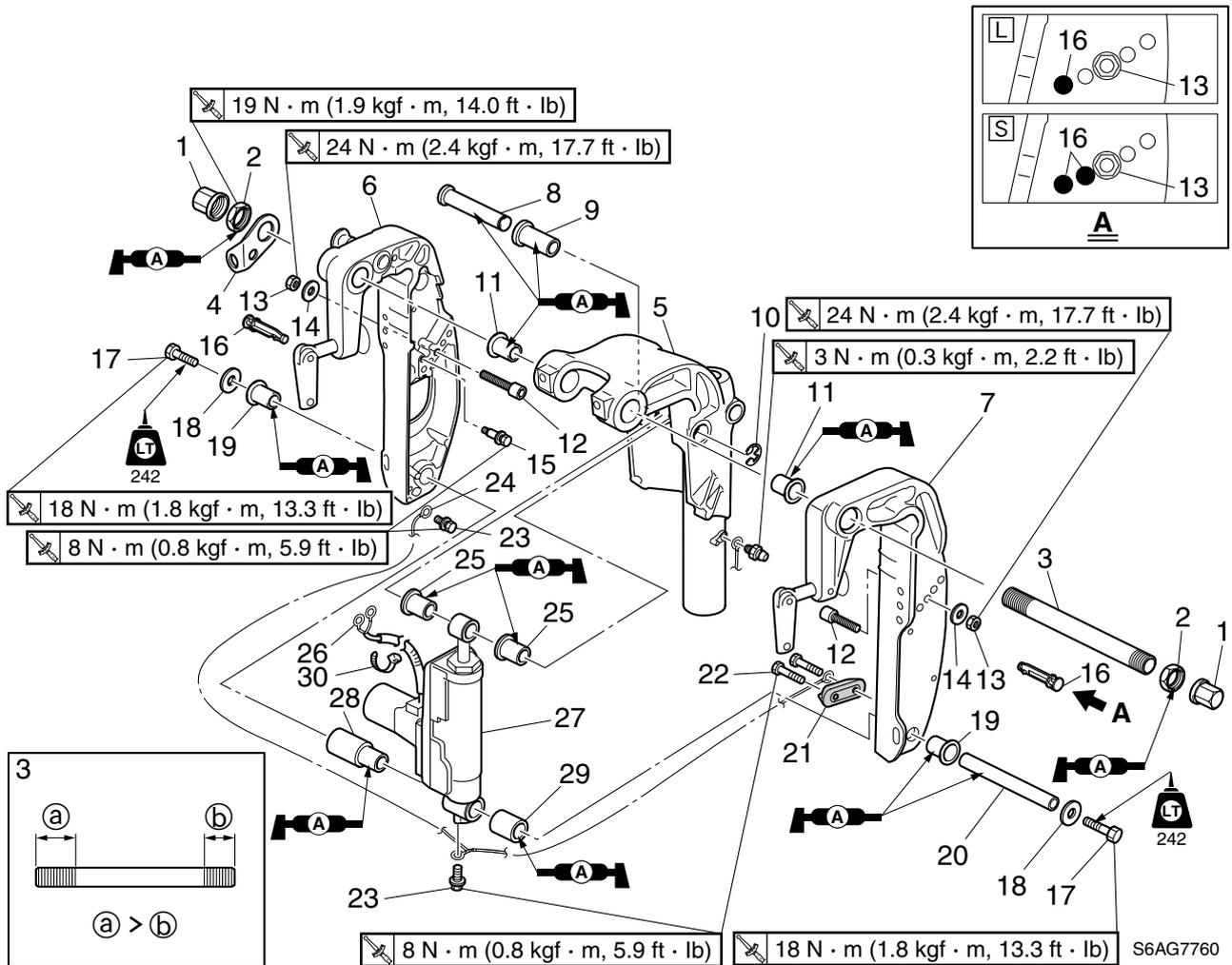
To check the tilt operation, see "Checking the tilt system (manual tilt model)" (1-17).

**Clamp bracket and swivel bracket (power tilt model)**



No.	Part name	Q'ty	Remarks
1	Cap	2	
2	Self-locking nut	2	
3	Through tube	1	
4	Hanger	1	
5	Swivel bracket	1	
6	Clamp bracket	1	STBD
7	Clamp bracket	1	PORT
8	Shaft	1	
9	Collar	1	
10	E-clip	1	<b>Not reusable</b>
11	Collar	2	
12	Stopper	2	
13	Nut	2	
14	Washer	2	
15	Bolt	1	
16	Plug	2/4	 : L-transom model/  : S-transom model
17	Bolt	2	M8 × 16 mm

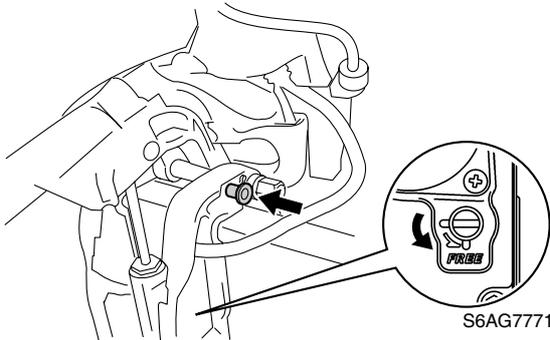
## Clamp bracket and swivel bracket (power tilt model)



No.	Part name	Q'ty	Remarks
18	Washer	2	
19	Collar	2	
20	Shaft	1	
21	Anode	1	
22	Bolt	2	M6 × 20 mm
23	Bolt	2	M6 × 10 mm
24	Ground lead	1	
25	Collar	2	
26	Power tilt motor lead	1	
27	Power tilt unit	1	
28	Collar	1	
29	Collar	1	
30	Plastic tie	1	

**Removing the power tilt unit**

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



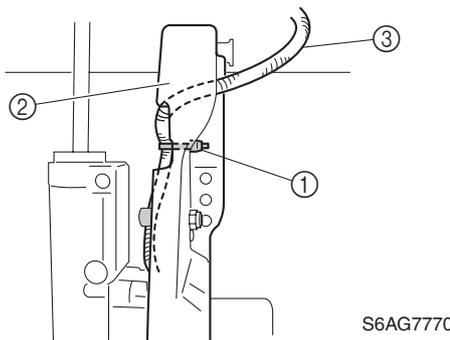
**⚠ WARNING**

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 power tilt unit should lose fluid pressure.

**NOTE:**

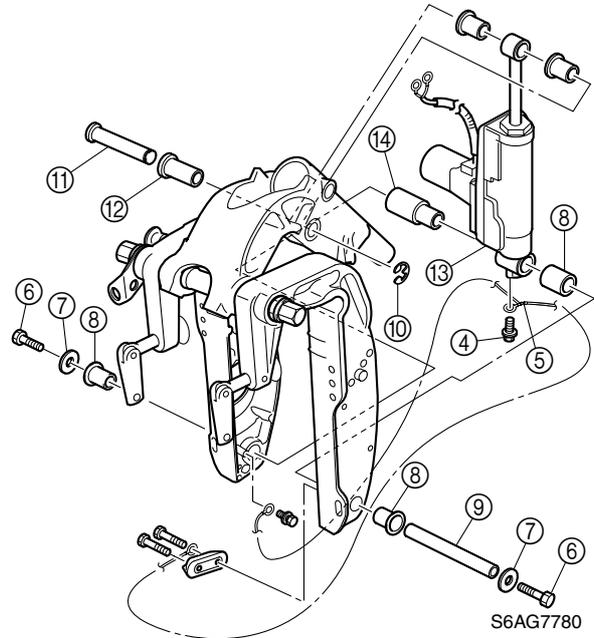
If the power tilt unit does not operate, open the manual valve by turning it counterclockwise, and then tilt the outboard motor up manually.

2. Remove the plastic tie ① from the clamp bracket ②, and then pull out the power tilt motor lead ③.



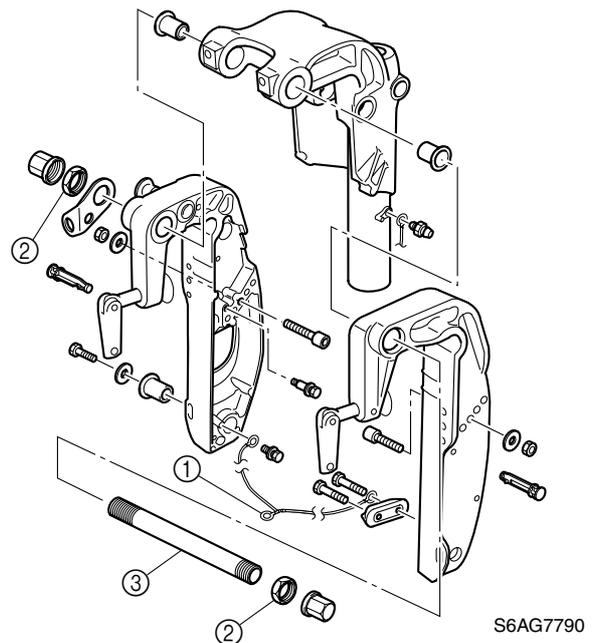
3. Remove the bolt ④ and ground lead ⑤ from the power tilt unit.
4. Remove the bolts ⑥, washers ⑦, collars ⑧, and shaft ⑨.

5. Remove the E-clip ⑩, shaft ⑪, and collar ⑫, and then remove the upper end of the tilt rod from the swivel bracket.
6. Remove the power tilt unit ⑬, and then remove the collar ⑭.



**Removing the clamp bracket**

1. Remove the ground lead terminal ① and self-locking nuts ② of the through tube ③, and then remove the clamp brackets.



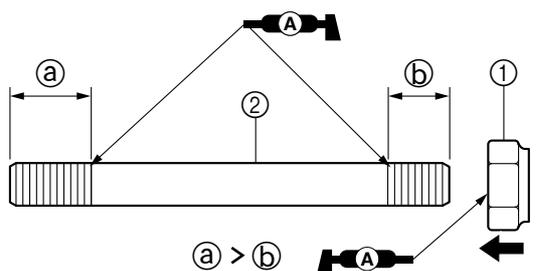
## Clamp bracket and swivel bracket (power tilt model)

### NOTE:

Be sure to remove the ground lead terminal ① before removing the self-locking nuts ②.

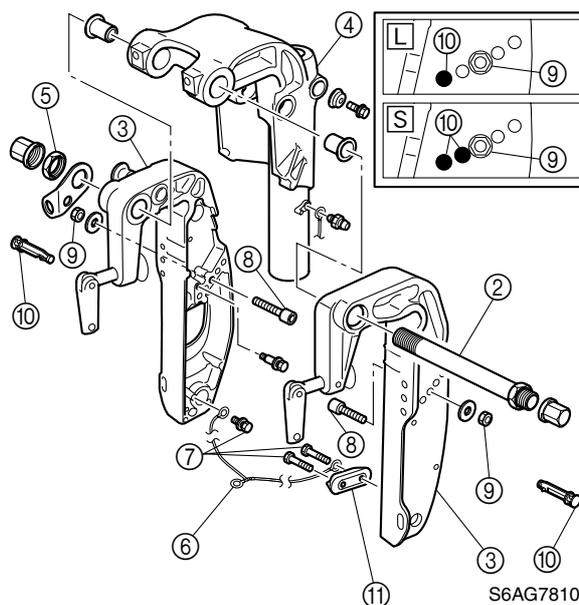
### Installing the clamp bracket

1. Apply grease to the threads of the self-locking nut, and then tighten the nut ① completely onto the shorter threaded end of the through tube ②.



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2. Assemble the clamp brackets ③ and swivel bracket ④, and then install the through tube ② from the port side.
3. Install the self-locking nut ⑤ onto the through tube, and then tighten it to the specified torque.
4. Install the ground lead terminals ⑥ to the brackets using the bolts ⑦.
5. Install the stoppers ⑧, stopper nuts ⑨ and plugs ⑩.



L L-transom model

S S-transom model

S6AG7810

### NOTE:

Install the anode ⑪ with the projection facing towards the bow.



Self-locking nut ⑤:

19 N·m (1.9 kgf·m, 14.0 ft·lb)

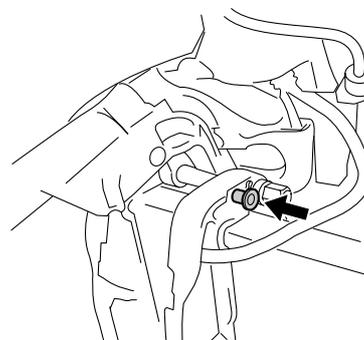
Bolt ⑦: 8 N·m (0.8 kgf·m, 5.9 ft·lb)

Tilt stopper nut ⑨:

24 N·m (2.4 kgf·m, 17.7 ft·lb)

### Installing the power tilt unit

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



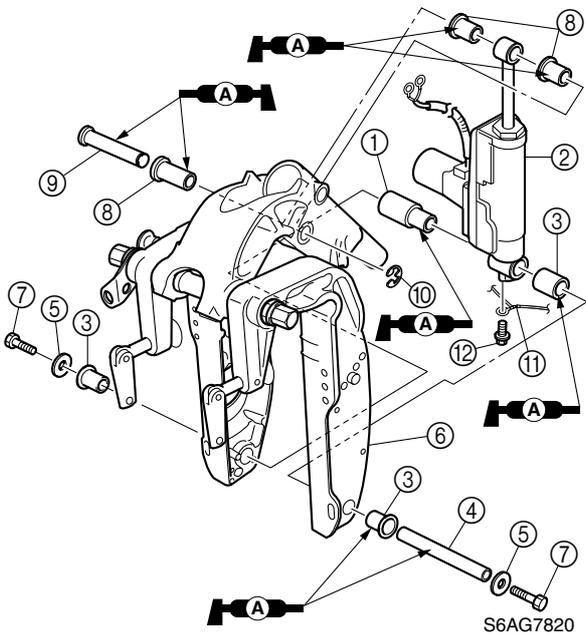
S6AG3220U

### WARNING

After tilting the outboard motor up, be sure to support it with the tilt stop lever.

7

2. Install the collar ① onto the power tilt unit ②.
3. Install the power tilt unit ②, collars ③, shaft ④, and washers ⑤ onto the clamp bracket ⑥, and then tighten the bolts ⑦ to the specified torque.
4. Install the collars ⑧, upper end of the tilt ram, shaft ⑨, and E-clip ⑩ to the swivel bracket.
5. Install the ground lead terminal ⑪ to the power tilt unit.

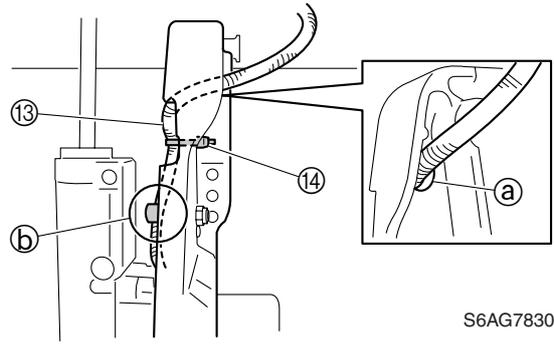


S6AG7820

**NOTE:** \_\_\_\_\_  
Install the ground lead ⑪ as shown.

	Power tilt unit mounting shaft bolt ⑦:
	18 N·m (1.8 kgf·m, 13.3 ft·lb)
	Ground lead bolt ⑫:
	8 N·m (0.8 kgf·m, 5.9 ft·lb)

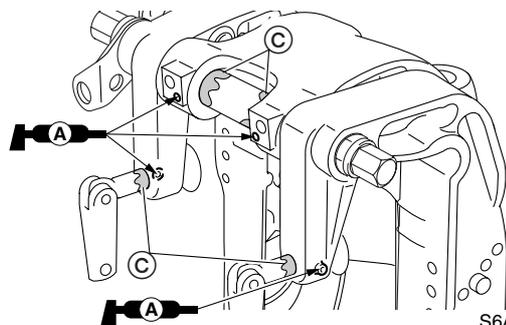
6. Pass the power tilt motor lead ⑬ through the hole ③ in the clamp bracket (STBD).
7. Fasten the power tilt motor lead ⑬ to the clamp bracket with a plastic tie ⑭.



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**NOTE:** \_\_\_\_\_  
Route the power tilt motor lead ⑬ to the front of the stopper ⑬.

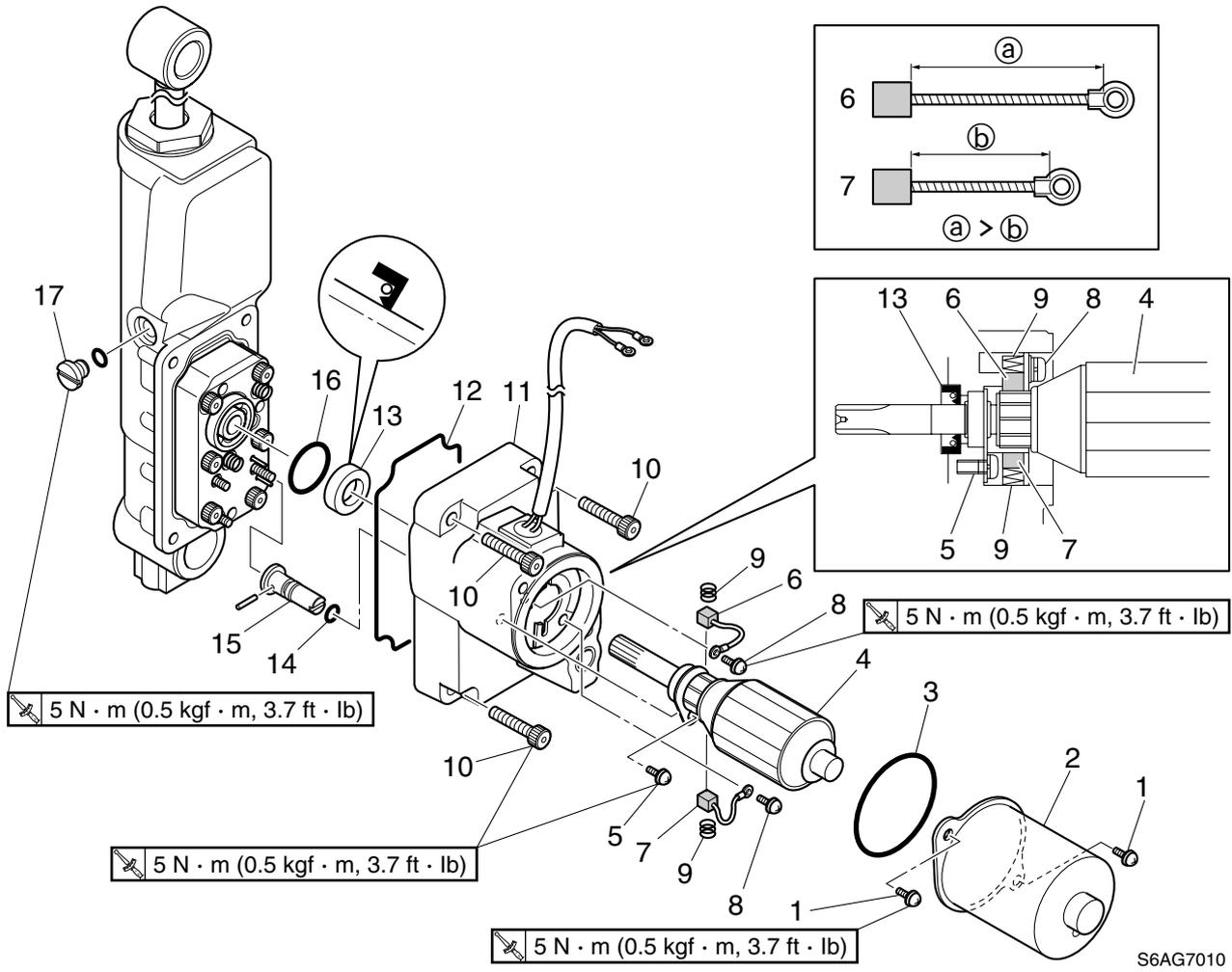
8. Apply grease to all grease nipples until it comes out from the areas ③.



S6AG7840

**Clamp bracket and swivel bracket (power tilt model) / Power tilt motor (power tilt model)**

**Power tilt motor (power tilt model)**



S6AG7010

No.	Part name	Q'ty	Remarks
1	Screw	2	ø4 × 10 mm
2	Stator	1	
3	O-ring	1	<b>Not reusable</b>
4	Armature	1	
5	Screw	1	ø4 × 8 mm
6	Brush	1	Long lead
7	Brush	1	Short lead
8	Screw	2	ø4 × 10 mm
9	Brush spring	2	
10	Bolt	4	M5 × 25 mm
11	Power tilt motor base	1	
12	Gasket	1	<b>Not reusable</b>
13	Oil seal	1	<b>Not reusable</b>
14	O-ring	1	<b>Not reusable</b>
15	Manual valve	1	
16	O-ring	1	<b>Not reusable</b>
17	Reservoir cap	1	

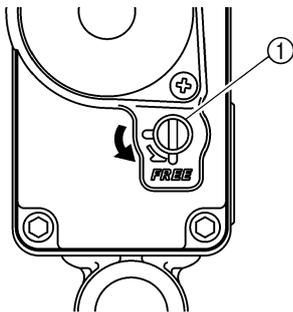


**Disassembling the power tilt motor**

1. Remove the power tilt unit from the bracket.

**NOTE:** \_\_\_\_\_  
 To remove the power tilt unit, see “Removing the power tilt unit” (7-27).

2. Fully extend the tilt ram, and then open the manual valve ① by turning it counter-clockwise.



S6AG7335

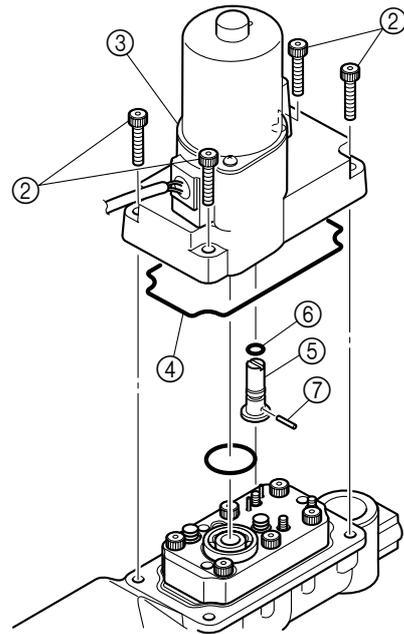
**⚠ WARNING**

**Make sure that the tilt ram is fully extended before removing the power tilt motor, otherwise fluid can spurt out from the unit due to internal pressure.**

**NOTE:** \_\_\_\_\_  
 To prevent the internal power tilt unit parts from falling out, lay the power tilt unit on its side so that the power tilt motor is in an upright position before removing it.

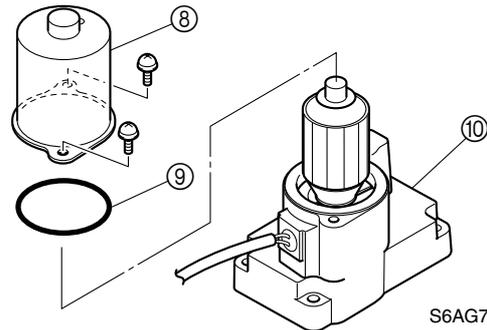
3. Remove the bolts ②, and then remove the power tilt motor assembly ③ and gasket ④ from the tilt cylinder.

4. Remove the manual valve ⑤, O-ring ⑥, and pin ⑦.



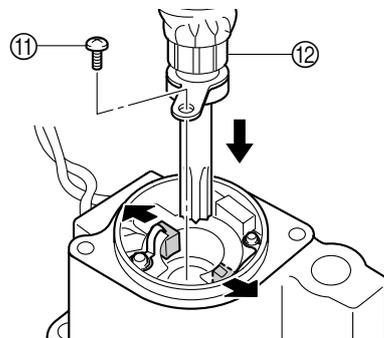
S6AG7070

5. Remove the stator ⑧ and O-ring ⑨ from the power tilt motor base ⑩.



S6AG7145

6. Remove the armature plate screw ⑪, and then remove the armature assembly ⑫.



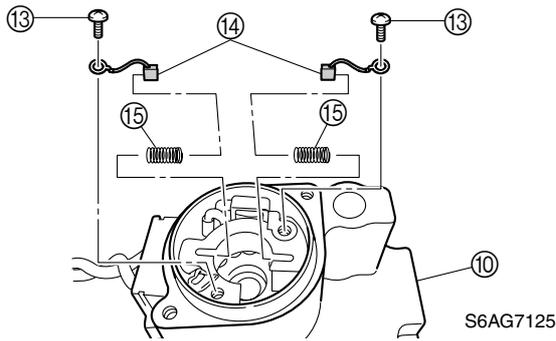
S6AG7086

**Power tilt motor (power tilt model)**

**NOTE:**

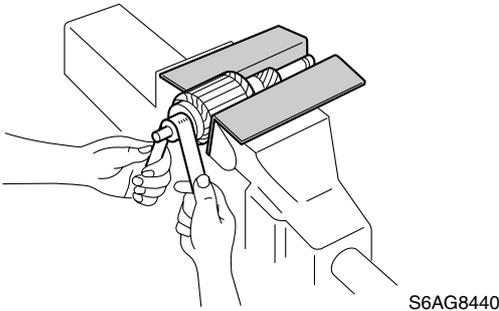
- Push the brushes apart, and then remove the armature assembly.
- Do not remove the bearing from the armature assembly.

7. Remove the brush holder screws (13), brushes (14), springs (15), and oil seal from the power tilt motor base (10).

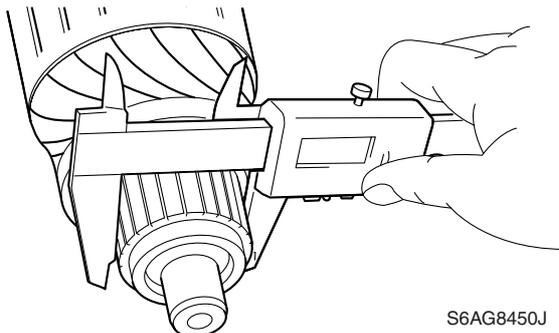


**Checking the power tilt motor**

1. Check the commutator. Clean with 600-grit sandpaper and compressed air if dirty.

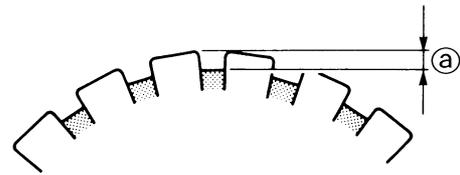


2. Measure the commutator diameter. Replace the armature if below specification.



	Motor commutator standard diameter:
	16.5 mm (0.65 in)
	Wear limit: 15.5 mm (0.61 in)

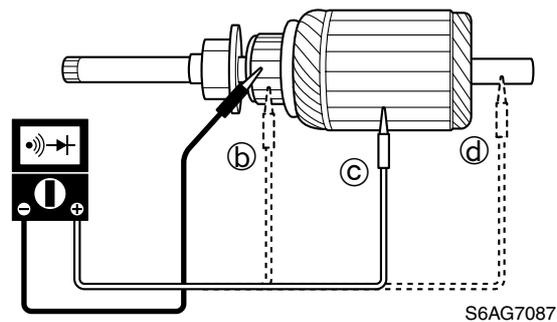
3. Measure the commutator undercut (a). Replace the armature if below specification.



S69J8410

	Motor commutator standard undercut (a):
	1.00 mm (0.039 in)
	Wear limit: 0.50 mm (0.020 in)

4. Check the armature for continuity. Replace the armature if out of specification.

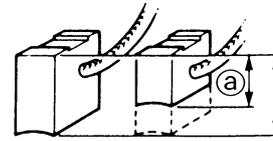


Armature continuity	
Commutator segments (b)	Continuity
Segment – Armature core (c)	No continuity
Segment – Armature shaft (d)	No continuity

5. Check the bearing. Replace if damaged.

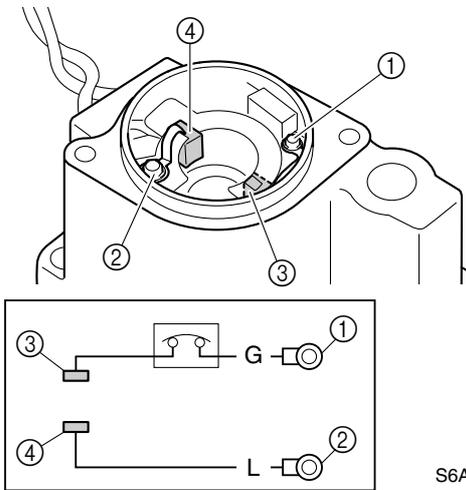
**NOTE:**

- If the bearing is damaged, replace the armature assembly.
- Do not reuse the oil seal.



**Checking the brush holder and brush**

1. Check the brush holder assembly for continuity. Replace the power tilt motor base if out of specification.



S6AG7090

**NOTE:**

The brush holder and circuit breaker cannot be removed from the power tilt motor base assembly; if either part is damaged, replace the power tilt motor base.

 Power tilt motor base continuity	
Terminal ①-③ (G) Terminal ②-④ (L)	Continuity
For all terminal combinations not listed above.	No continuity

2. Measure the length of each brush. Replace the brushes if below specification.

S69J8430

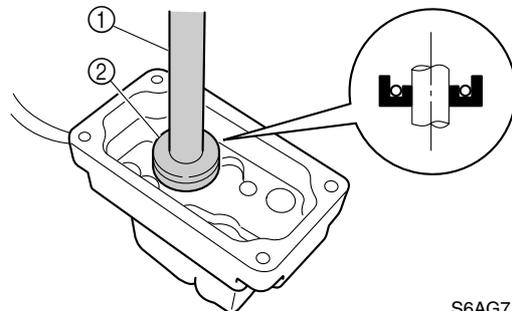
	Motor brush standard length: 6.0 mm (0.24 in)
	Wear limit ③: 3.0 mm (0.12 in)

**Assembling the power tilt motor**

**CAUTION:**

- Do not reuse the O-ring, always replace it with a new one.
- Do not allow grease or oil to contact the commutator of the armature.

1. Install a new oil seal into the power tilt motor base as shown.

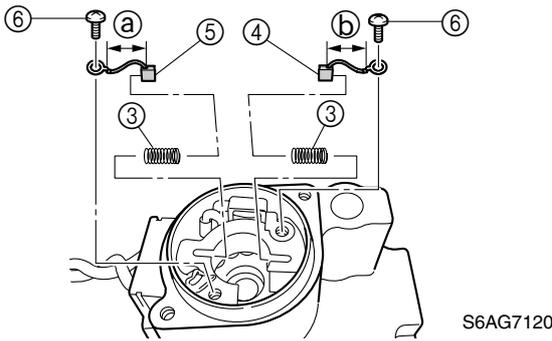


S6AG7100

	Driver rod L3 ①: 90890-06652
	Needle bearing attachment ②: 90890-06614

2. Install the springs ③, brushes (short lead) ④ and (long lead) ⑤, and brush holder screws ⑥ to the power tilt motor base as shown.

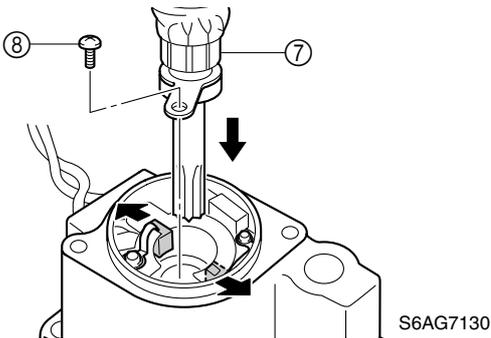
**Power tilt motor (power tilt model)**



 **Brush holder screw ⑥:**  
5 N·m (0.5 kgf·m, 3.7 ft·lb)

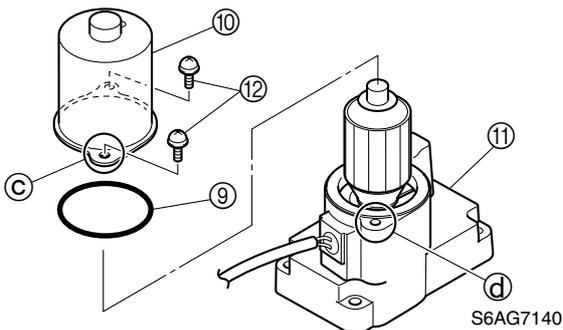
 **Brush lead length: ① > ②**

3. Push the brushes into the holders, and then install the armature ⑦ and tighten the armature plate screw ⑧ to the specified torque.



 **Armature plate screw ⑧:**  
5 N·m (0.5 kgf·m, 3.7 ft·lb)

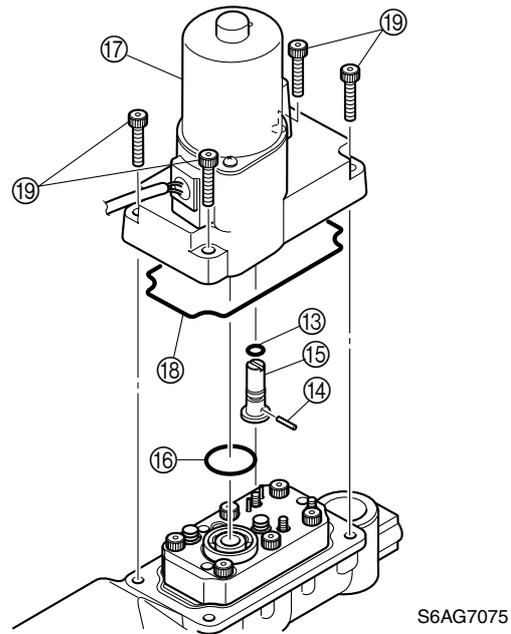
4. Install a new O-ring ⑨ and the stator ⑩ to the power tilt motor base ⑪, and then tighten the screws ⑫ to the specified torque.



**NOTE:** \_\_\_\_\_  
Align the rounded section ③ of the stator ⑩ with the rounded section ④ of the power tilt motor base ⑪.

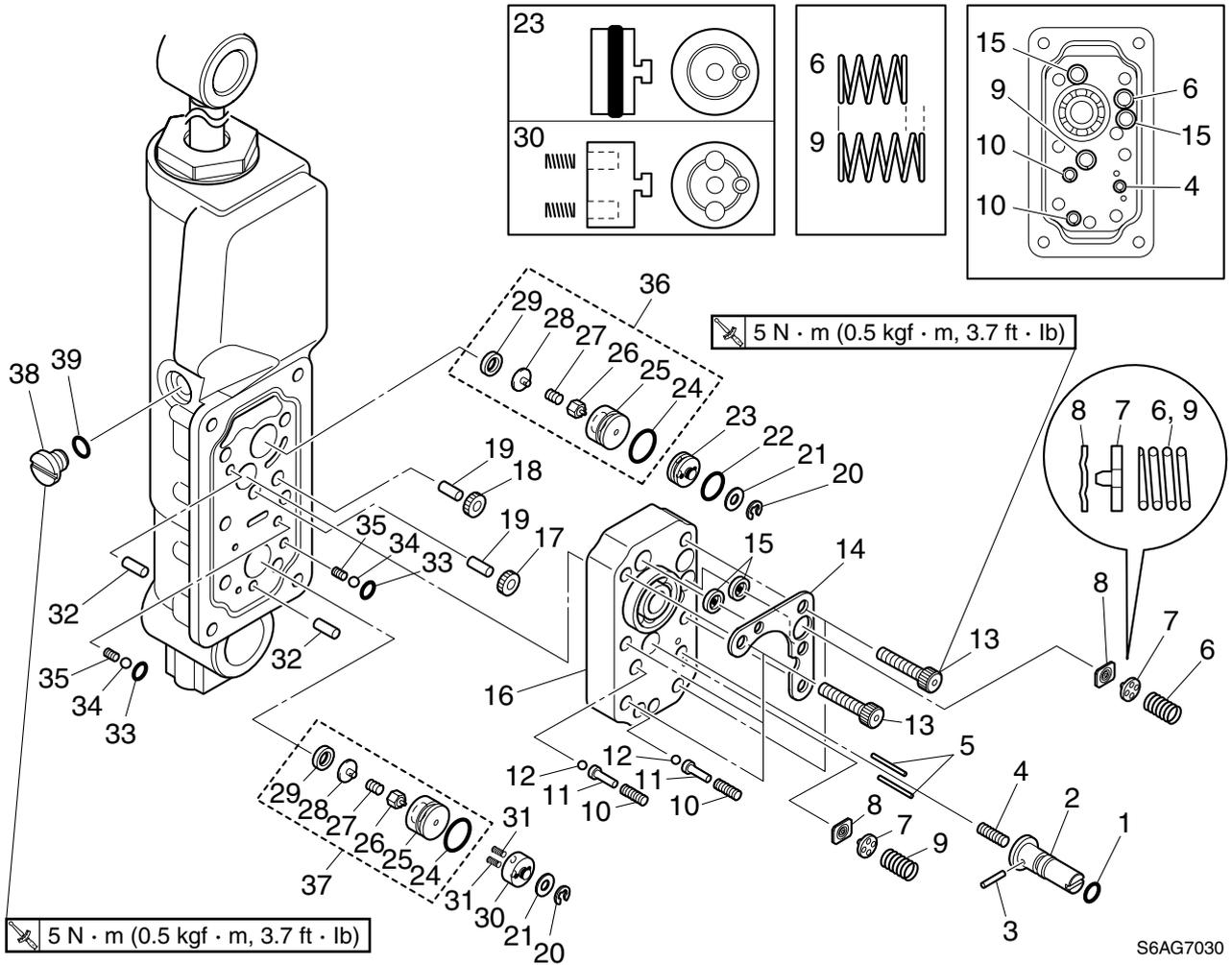
 **Stator screw ⑫:**  
5 N·m (0.5 kgf·m, 3.7 ft·lb)

5. Install a new O-ring ⑬, the pin ⑭, the manual valve ⑮, and a new O-ring ⑯ to the power tilt motor assembly ⑰.
6. Install a new gasket ⑱ and the power tilt motor assembly ⑰ to the tilt cylinder, and then tighten the power tilt motor base bolts ⑲ to the specified torque.



 **Power tilt motor base bolt ⑲:**  
5 N·m (0.5 kgf·m, 3.7 ft·lb)

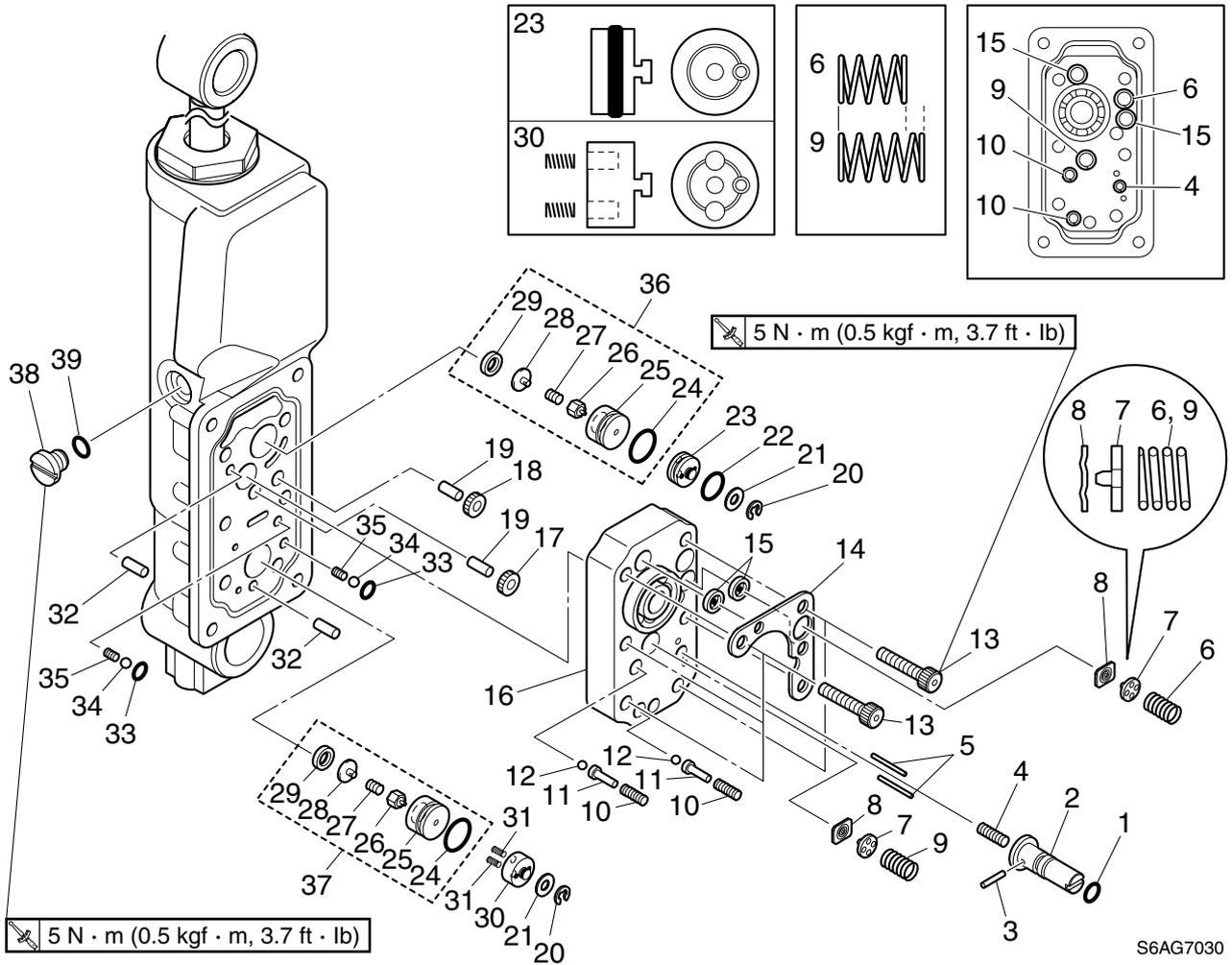
**Power tilt gear pump (power tilt model)**



S6AG7030

No.	Part name	Q'ty	Remarks
1	O-ring	1	<b>Not reusable</b>
2	Manual valve	1	
3	Pin	1	
4	Spring	1	
5	Manual release pin	2	
6	Spring	1	Length: 14.7 mm (0.58 in)
7	Valve pin	2	
8	Valve seal	2	
9	Spring	1	Length: 16.0 mm (0.63 in)
10	Spring	2	
11	Absorber valve pin	2	
12	Ball	2	
13	Bolt	6	M5 × 25 mm
14	Plate	1	
15	Filter	2	
16	Gear pump housing	1	
17	Drive gear	1	

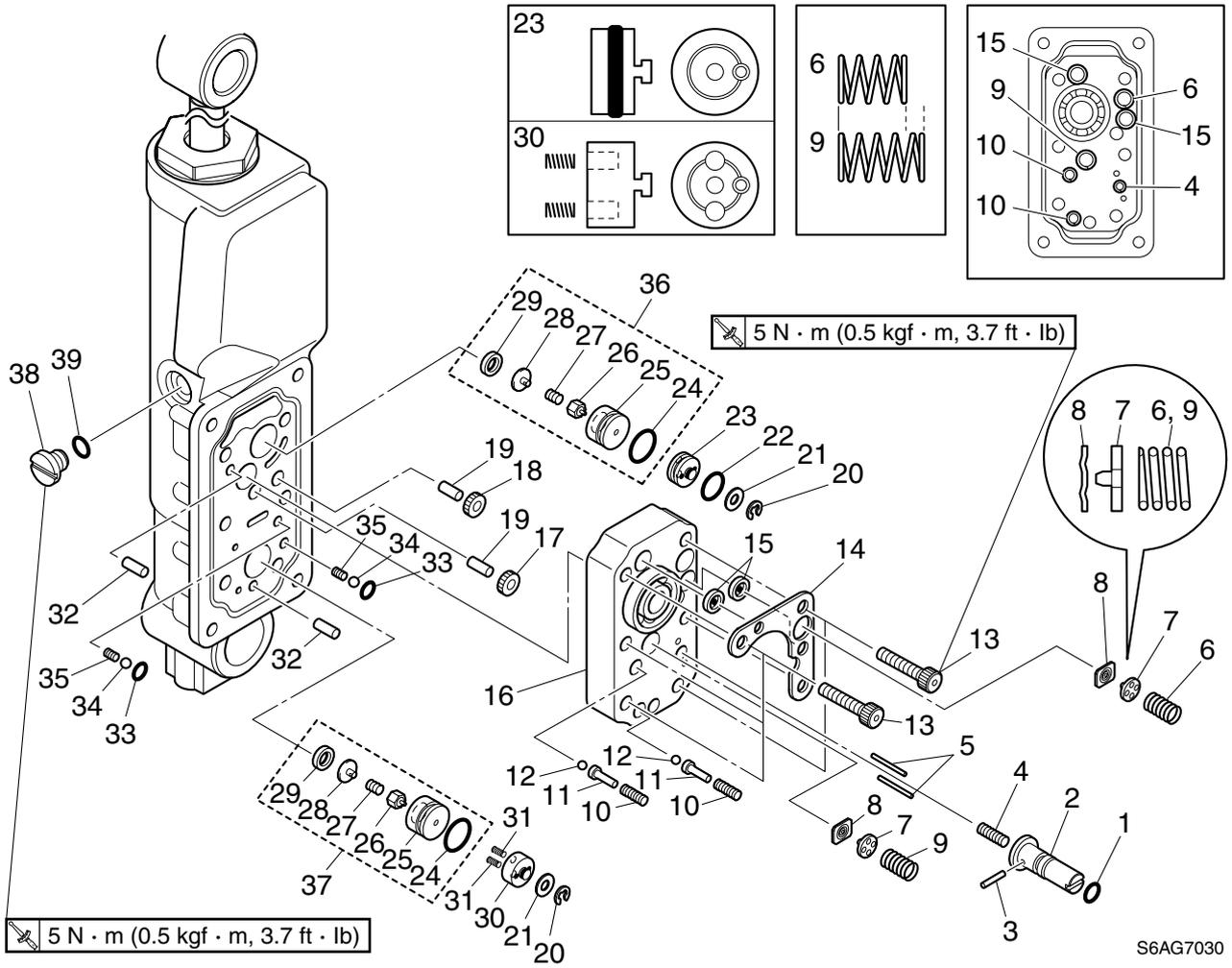
Power tilt gear pump (power tilt model)



S6AG7030

No.	Part name	Q'ty	Remarks
18	Driven gear	1	
19	Pin	2	<b>Not reusable</b>
20	E-clip	2	
21	Main valve seal	2	
22	O-ring	1	<b>Not reusable</b>
23	Shuttle piston 1	1	
24	O-ring	2	<b>Not reusable</b>
25	Valve seat	2	
26	Main valve	2	
27	Spring	2	
28	Spacer	2	
29	Filter	2	
30	Shuttle piston 2	1	
31	Spring	2	
32	Dowel	2	
33	O-ring	2	<b>Not reusable</b>
34	Ball	2	

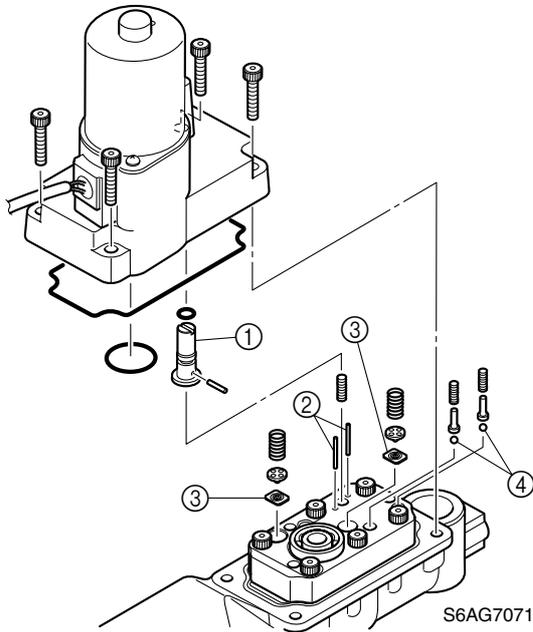
7



No.	Part name	Q'ty	Remarks
35	Spring	2	
36	Down-main valve	1	
37	Up-main valve	1	
38	Reservoir cap	1	
39	O-ring	1	<b>Not reusable</b>

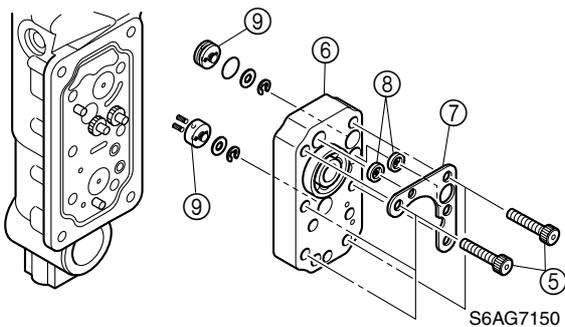
### Disassembling the gear pump

1. Remove the manual valve ①, manual release pins ②, relief valve seals ③, and balls ④.

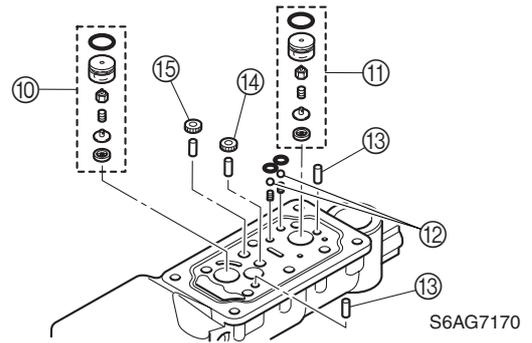


2. Remove the gear housing bolts ⑤, and then remove the gear pump housing ⑥, plate ⑦, and filters ⑧.

3. Remove the shuttle pistons ⑨.



4. Remove the down-main valve ⑩, up-main valve ⑪, balls ⑫, dowels ⑬, drive gear ⑭, and driven gear ⑮.

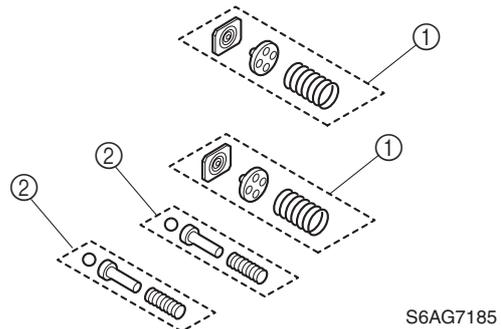


### Checking the gear pump

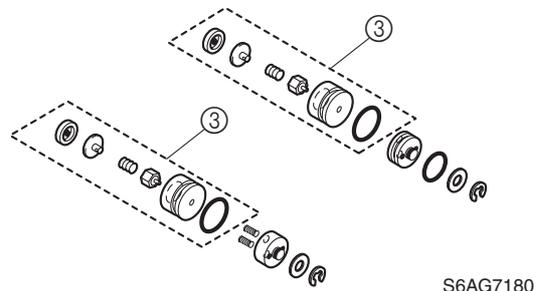
1. Check the drive gear and driven gear. Replace if damaged or excessively worn.
2. Check the gear pump housing. Replace if scratched.

### Checking the valve seal

1. Check the valve seals ①, and absorber valve pins ②. Replace if damaged.



2. Check the main valves ③. Replace if damaged.



3. Check the manual valve and spring. Replace if damaged.

**Checking the filter**

1. Check the gear pump filters. Clean if there is dirt or residue.

**NOTE:** \_\_\_\_\_  
See the exploded diagram for the filter installation position (7-35).

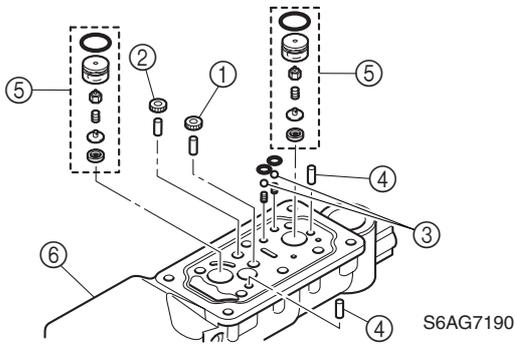
**Assembling the gear pump**

**CAUTION:** \_\_\_\_\_

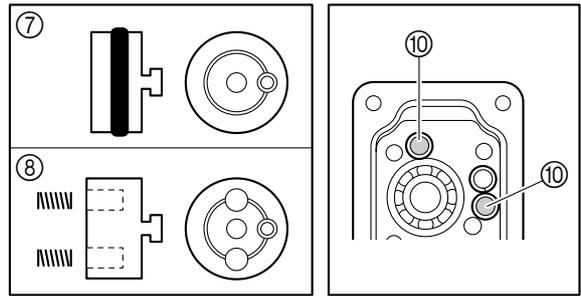
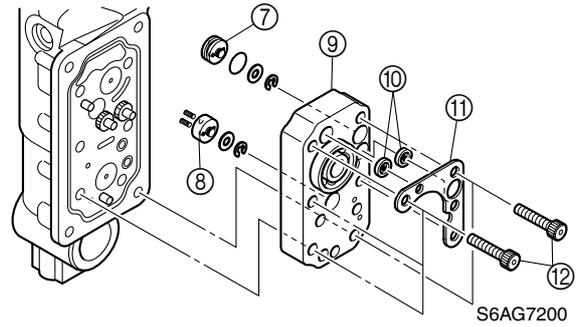
- Do not use a rag when assembling the power tilt unit as dust and particles on the power tilt unit components can lead to poor performance.
- Do not reuse the O-ring, always replace it with a new one.

**NOTE:** \_\_\_\_\_  
Lubricate the parts with ATF Dexron II during assembly.

1. Install the drive gear ①, driven gear ②, balls ③, dowels ④, and main valves ⑤ to the tilt cylinder ⑥.



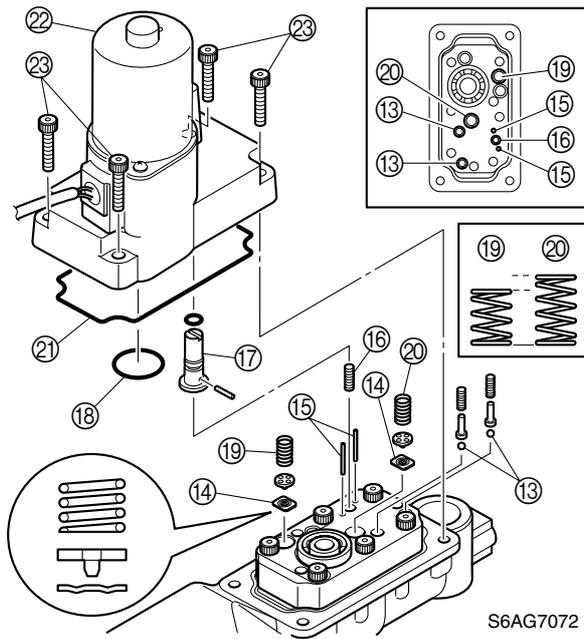
2. Install shuttle piston 1 ⑦ and shuttle piston 2 ⑧ to the gear pump housing ⑨, and then install the gear pump housing ⑨ to the tilt cylinder.
3. Install the filters ⑩, plate ⑪ and gear housing bolts ⑫, and then tighten the bolts to the specified torque.



**NOTE:** \_\_\_\_\_  
Be sure to install shuttle piston 1 ⑦ and shuttle piston 2 ⑧ in the correct positions; the piston shapes are different.

 **Gear housing bolt ⑫:**  
5 N·m (0.5 kgf·m, 3.7 ft·lb)

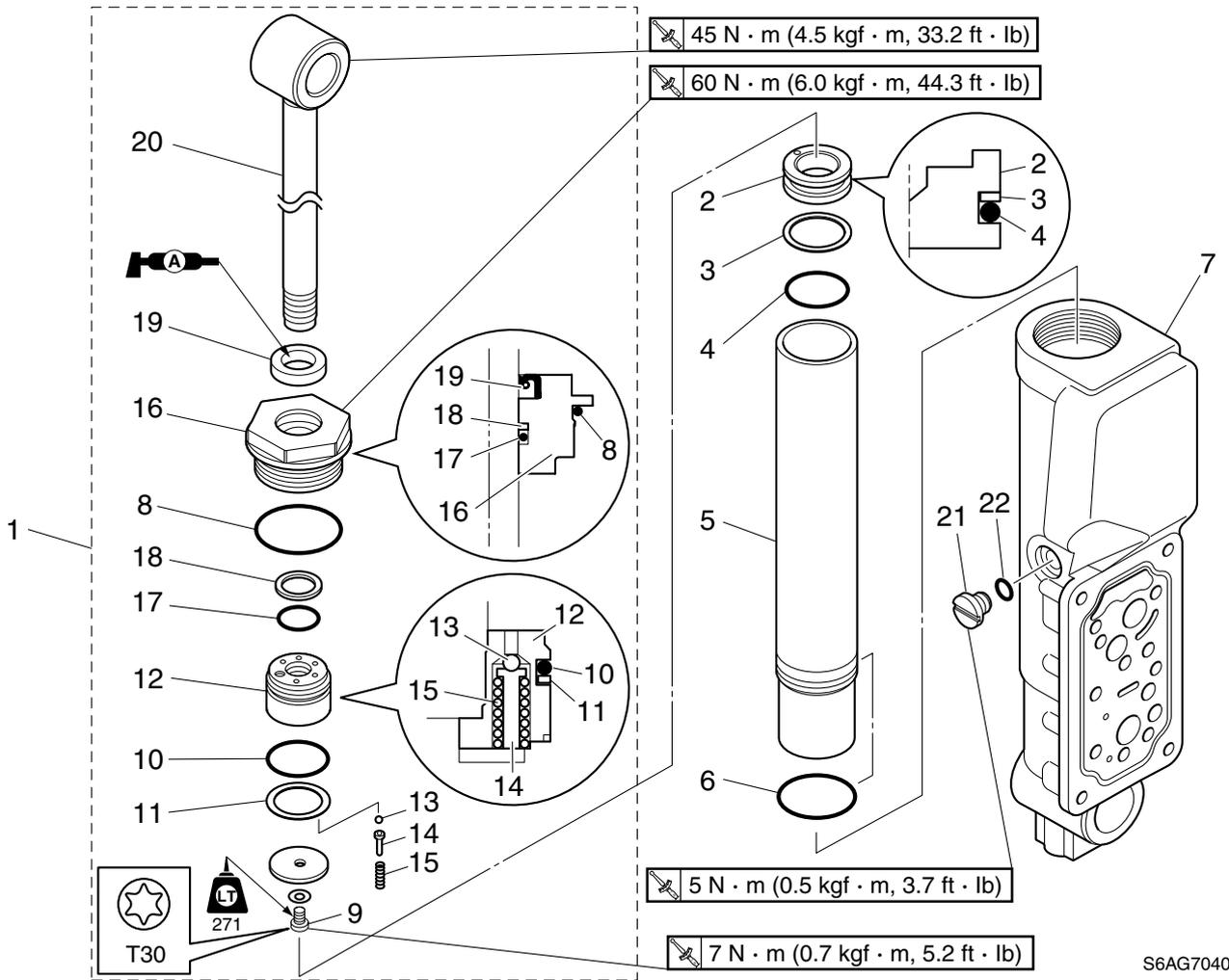
4. Install the balls ⑬, relief valve seals ⑭, manual release pins ⑮, and spring ⑯ to the tilt cylinder.
5. Install the manual valve ⑰ and O-ring ⑱ to the power tilt motor base.



6. Install a new gasket ⑳ and the power tilt motor assembly ㉒ to the tilt cylinder, and then tighten the power tilt motor base bolts ㉓ to the specified torque.

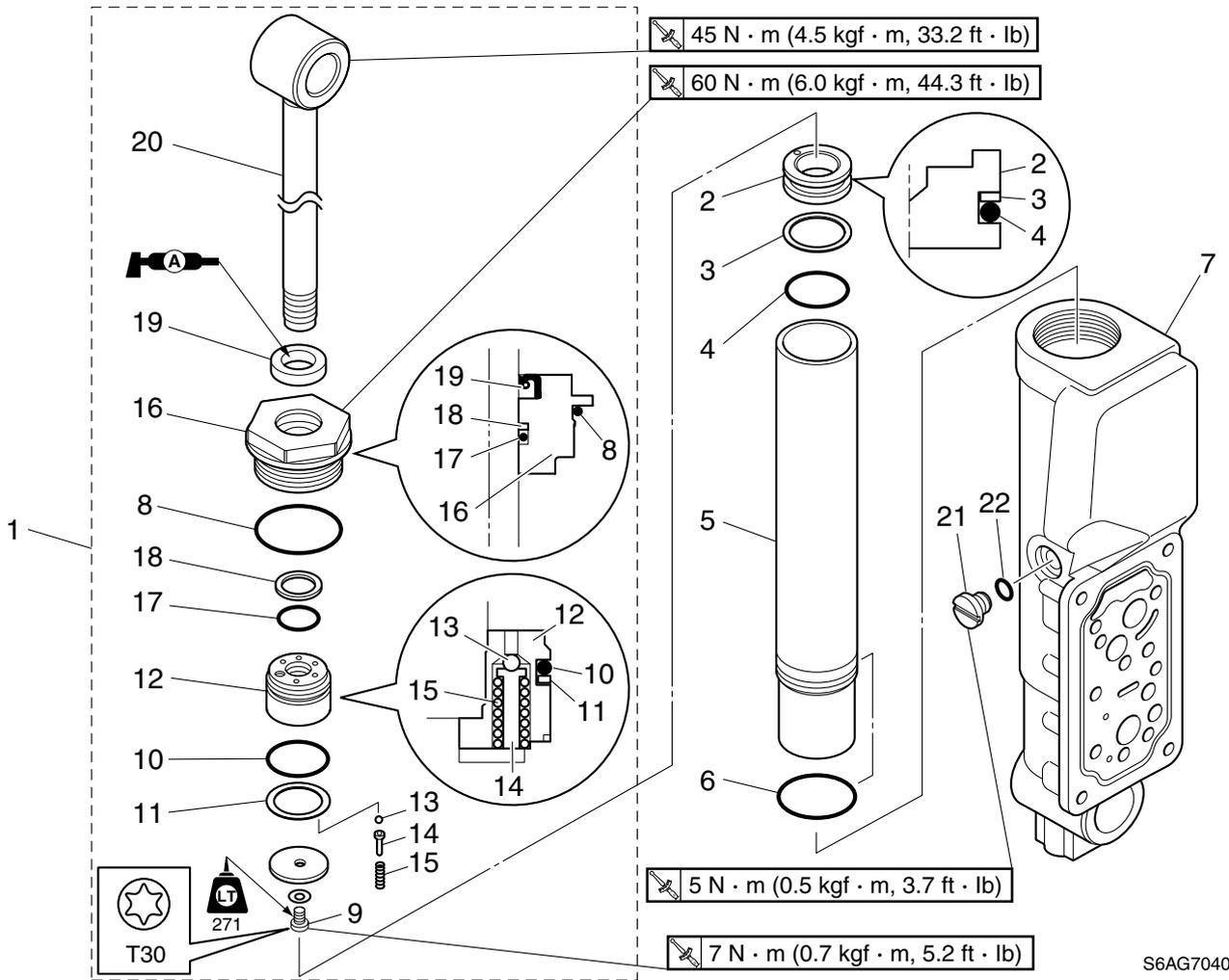
	Power tilt motor base bolt ㉓: 5 N·m (0.5 kgf·m, 3.7 ft·lb)
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**Power tilt cylinder (power tilt model)**



No.	Part name	Q'ty	Remarks
1	Tilt ram assembly	1	
2	Free piston	1	
3	Backup ring	1	
4	O-ring	1	<b>Not reusable</b>
5	Cylinder liner	1	
6	O-ring	1	<b>Not reusable</b>
7	Cylinder	1	
8	O-ring	1	<b>Not reusable</b>
9	Bolt	1	M6 × 10 mm/T30
10	O-ring	1	<b>Not reusable</b>
11	Backup ring	1	
12	Tilt piston	1	
13	Ball	5	
14	Pin	5	
15	Spring	5	
16	Tilt cylinder end screw	1	
17	O-ring	1	<b>Not reusable</b>

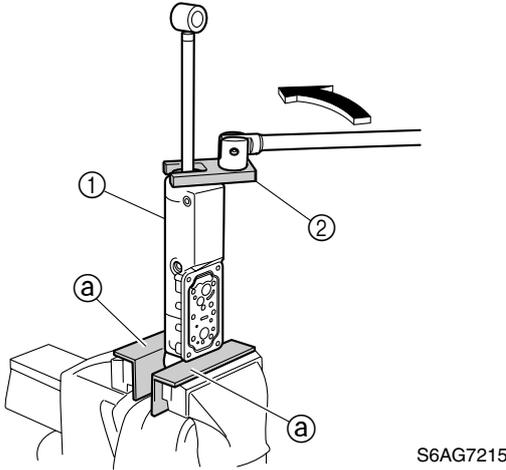
**Power tilt cylinder (power tilt model)**



No.	Part name	Q'ty	Remarks
18	Backup ring	1	
19	Dust seal	1	<b>Not reusable</b>
20	Tilt ram	1	
21	Reservoir cap	1	
22	O-ring	1	<b>Not reusable</b>

**Disassembling the tilt cylinder**

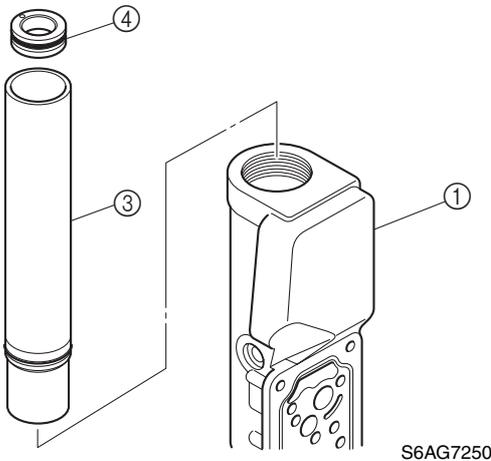
1. Hold the tilt cylinder ① in a vise using aluminum plates ② on both sides.
2. Loosen the tilt cylinder end screw, and then remove the tilt ram assembly.



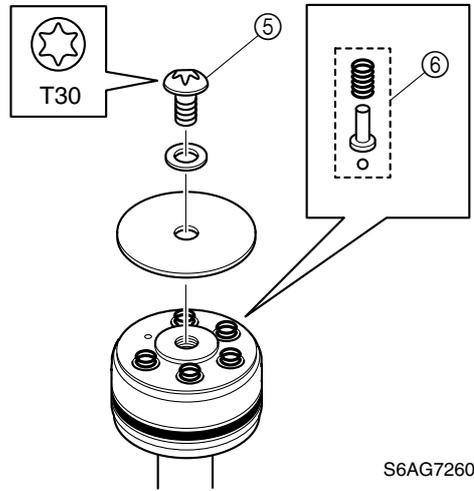
**⚠ WARNING**  
**Make sure that the ram is fully extended before removing the end screw.**

 Power tilt wrench ②: 90890-06560

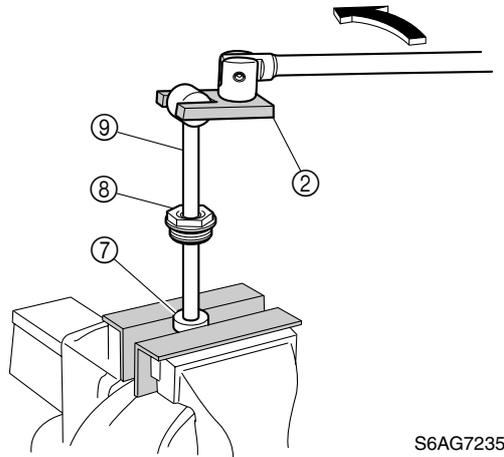
3. Drain the power tilt fluid.
4. Remove the cylinder liner ③ and free piston ④ from the cylinder ①.



5. Remove the bolt ⑤, and then remove the piston absorber valves ⑥ from the tilt piston.



6. Hold the tilt piston ⑦ in a vise using aluminum plates on both sides, and then remove the tilt piston ⑦ and tilt cylinder end screw ⑧ from the tilt ram assembly ⑨.



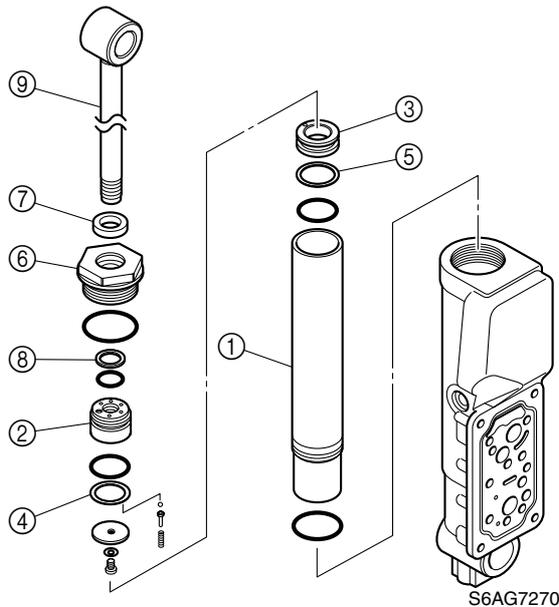
 Power tilt wrench ②: 90890-06560

**Checking the tilt cylinder and piston**

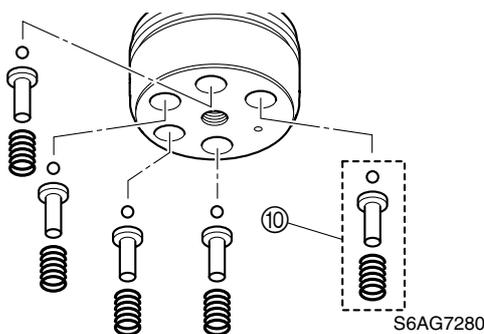
1. Check the cylinder liner ①. Replace if cracked or scratched.
2. Check the tilt piston ②, free piston ③, and backup rings ④ and ⑤. Replace if cracked or scratched.

## Power tilt cylinder (power tilt model)

3. Check the tilt cylinder end screw ⑥, dust seal ⑦, and backup ring ⑧. Replace if cracked or scratched.
4. Check the tilt ram ⑨. Polish with 400–600-grit sandpaper if there is light rust or replace if bent or excessively corroded.



5. Check the tilt piston absorber valves ⑩. Clean if there is dirt or residue.



### Assembling the tilt cylinder

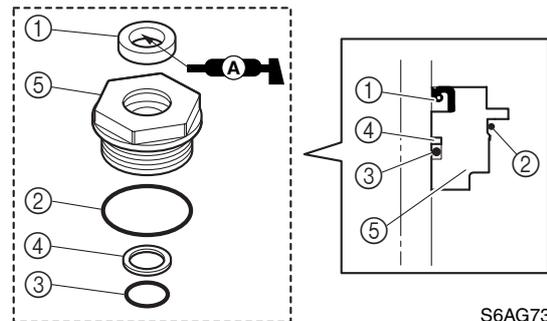
#### CAUTION:

- Do not use a rag when assembling the power tilt unit as dust and particles on the power tilt unit components can lead to poor performance.
- Do not reuse the O-ring, always replace it with a new one.

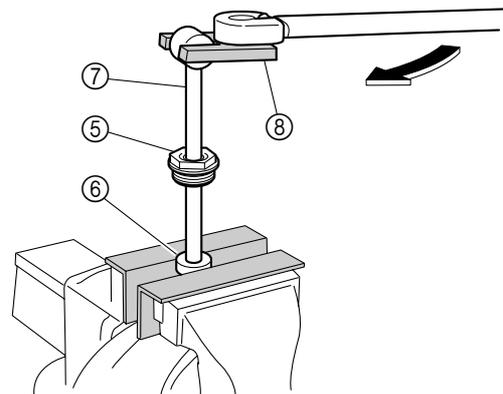
#### NOTE:

Lubricate the parts with ATF Dexron II during assembly.

1. Install a new dust seal ①, new O-rings ② and ③, and the backup ring ④ into the tilt cylinder end screw ⑤.



2. Install the tilt cylinder end screw ⑤ and tilt piston ⑥ to the tilt ram ⑦.
3. Hold the tilt piston in a vise using aluminum plates on both sides.
4. Tighten the tilt ram ⑦ to the specified torque.



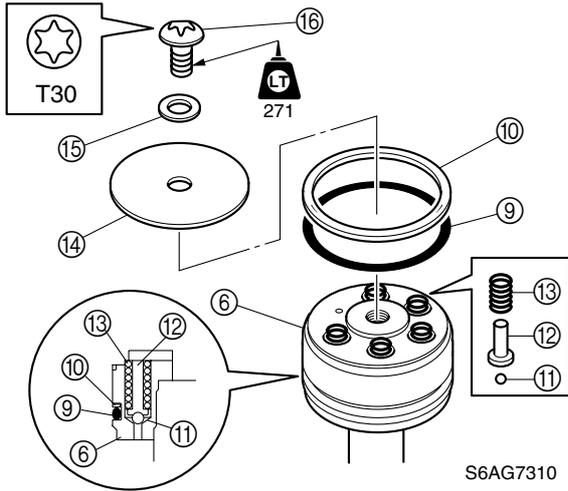
Power tilt wrench ⑧: 90890-06560



Tilt ram ⑦:  
45 N·m (4.5 kgf·m, 33.2 ft·lb)

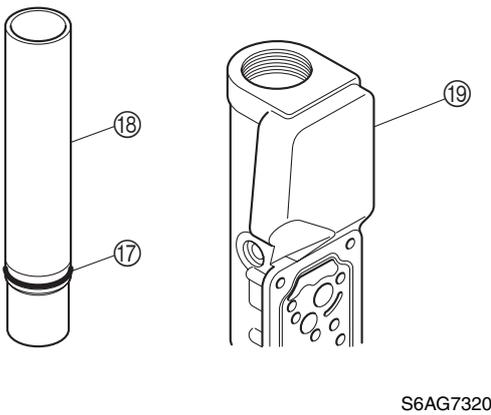
7

5. Install a new O-ring ⑨ and the backup ring ⑩ onto the tilt piston.
6. Install the balls ⑪, absorber valve pins ⑫, and springs ⑬ as shown.
7. Install the plate ⑭, washer ⑮, and bolt ⑯ to the tilt piston ⑥, and then tighten the bolt to the specified torque.



 Tilt piston bolt ⑯:  
7 N·m (0.7 kgf·m, 5.2 ft·lb)

8. Install a new O-ring ⑰ to the cylinder liner ⑱, and then install the cylinder liner ⑱ into the tilt cylinder ⑲.



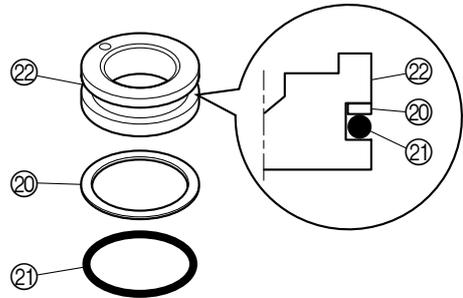
9. Install the power tilt gear pump, power tilt motor assembly, and reservoir cap to the tilt cylinder.

**NOTE:**  
To install the power tilt motor assembly and gear pump assembly, see “Assembling the gear pump” (7-39).

10. Fill the tilt cylinder with the recommended fluid to about 60%.

 Recommended power tilt fluid:  
ATF Dexron II

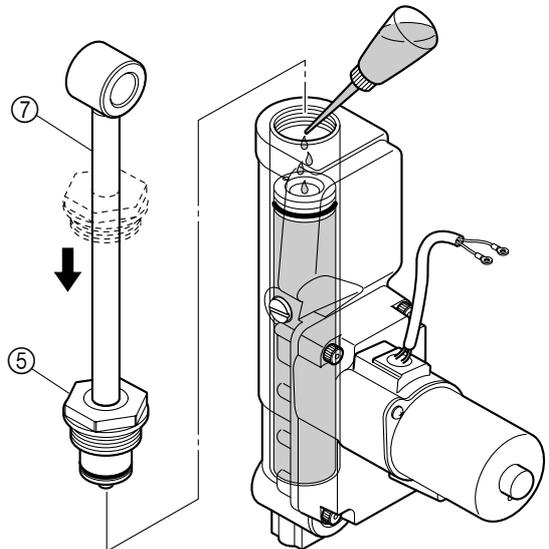
11. Install the backup ring ⑳ and a new O-ring ㉑ to the free piston ㉒, and then install the free piston into the tilt cylinder ⑲.



S6AG7311

12. Place the tilt cylinder end screw ⑤ at the bottom of the tilt ram ⑦.

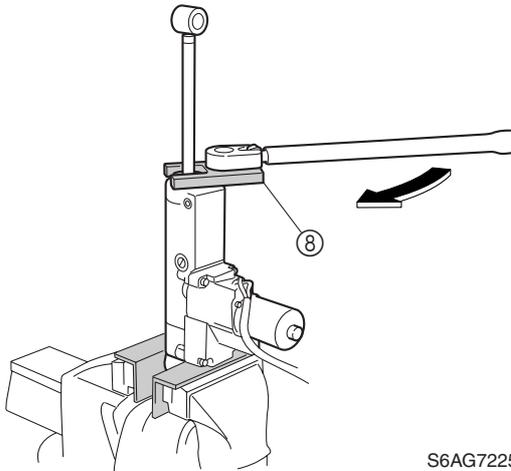
13. Install the tilt piston assembly into the tilt cylinder.



S6AG7330

## Power tilt cylinder (power tilt model)

14. Tighten the tilt cylinder end screw to the specified torque.



S6AG7225



Power tilt wrench ⑧: 90890-06560

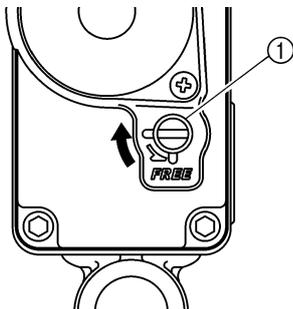


Tilt cylinder end screw ⑤:  
60 N·m (6.0 kgf·m, 44.3 ft·lb)

### Bleeding the power tilt unit

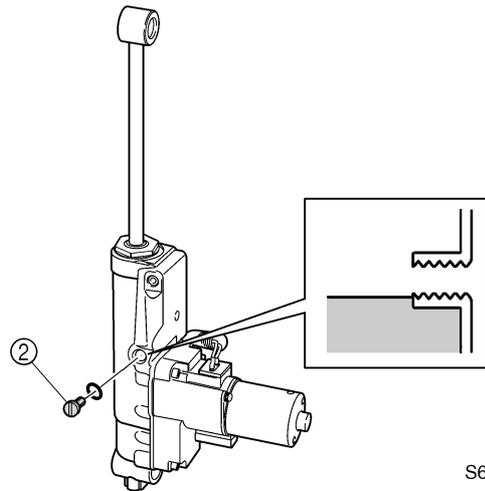
**NOTE:** \_\_\_\_\_  
Make sure that the tilt ram is fully extended.

1. Place the power tilt unit in an upright position.
2. Turn the manual valve ① clockwise 90° to close it.



S6AG7341

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



S6AG7360

**NOTE:** \_\_\_\_\_

- If the fluid is at the correct level, a small amount of fluid should overflow out of the filler hole.
- If fluid is below the correct level, add the recommended fluid.



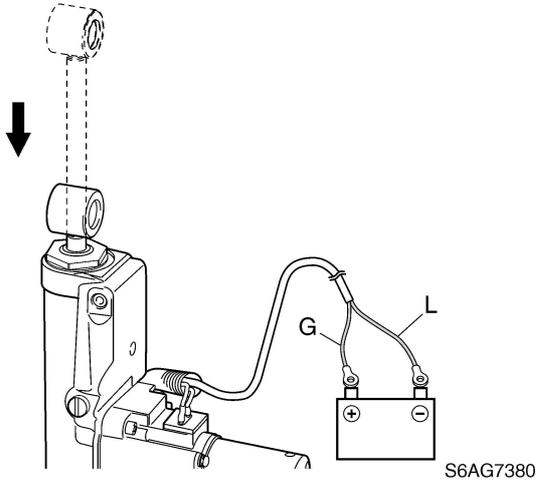
Recommended power tilt fluid:  
ATF Dexron II

4. Install the reservoir cap ②, and then tighten it to the specified torque.



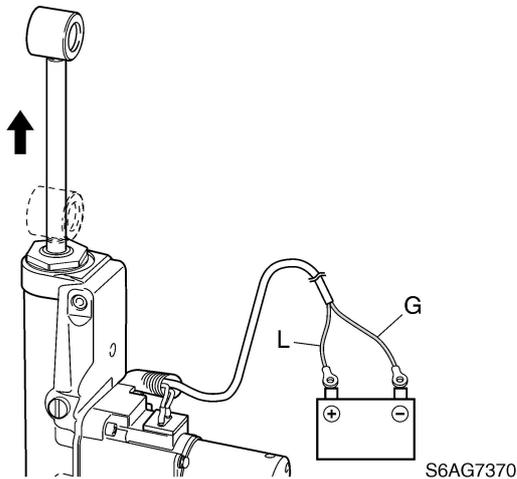
Reservoir cap ②:  
5 N·m (0.5 kgf·m, 3.7 ft·lb)

- Connect the power tilt motor leads to the battery terminals to fully retract the tilt ram.



Ram	Power tilt motor lead	Battery terminal
Down	Green (G)	⊕
	Blue (L)	⊖

- Reverse the power tilt motor leads between the battery terminals to fully extend the tilt ram.



Ram	Power tilt motor lead	Battery terminal
Up	Blue (L)	⊕
	Green (G)	⊖

**NOTE:** \_\_\_\_\_

- Repeat steps 5–6 to fully extend and retract the tilt ram 4 to 5 times.
- If the tilt ram does not move up and down easily, push and pull on the ram to assist the operation.

- Fully extend the tilt ram.

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

**⚠ WARNING** \_\_\_\_\_

**Make sure that the tilt ram is 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, a small amount of fluid should overflow out of the filler hole when the cap is removed.
- If the fluid is below the correct level, add the recommended fluid.

	Recommended power tilt fluid: ATF Dexron II
---	--

- Install the reservoir cap, and then tighten it to the specified torque.

**NOTE:** \_\_\_\_\_

If the fluid is below the correct level in step 8, repeat steps 5–9 until the fluid remains at the correct level.

	Reservoir cap: 5 N·m (0.5 kgf·m, 3.7 ft·lb)
---	--

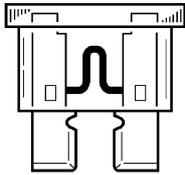
**Power tilt electrical system**

**(power tilt model)**

**Checking the fuse**

- Check the fuse for continuity. Replace if there is no continuity.

**Power tilt cylinder (power tilt model) / Power tilt electrical system (power tilt model)**



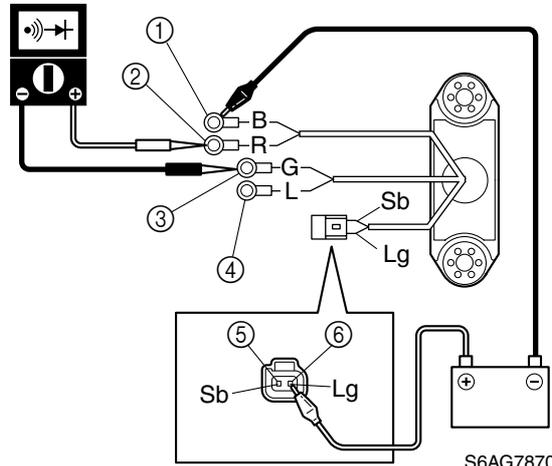
S6AG7851

**NOTE:**  
For the location of the fuse, see “Electrical component and wiring harness routing” (8-1).

**Checking the power tilt relay**

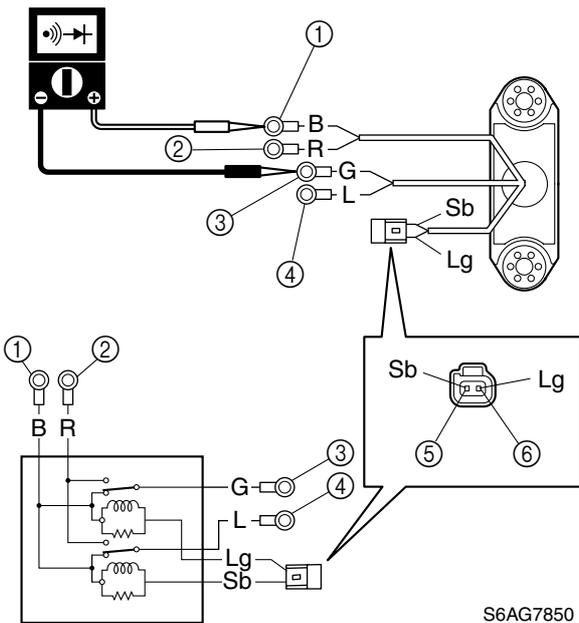
1. Check the power tilt relay for continuity. Replace the power tilt relay if out of specification.

2. Connect the positive battery lead to the light green (Lg) lead ⑥, and the negative battery lead to the terminal (B) ① as shown, and then check the power tilt relay for continuity. Replace the power tilt relay if out of specification.



S6AG7870

Power tilt relay continuity	
Terminal ② – Terminal ③	Continuity
Terminal ② – Terminal ④	No continuity
Terminal ③ – Terminal ④	No continuity

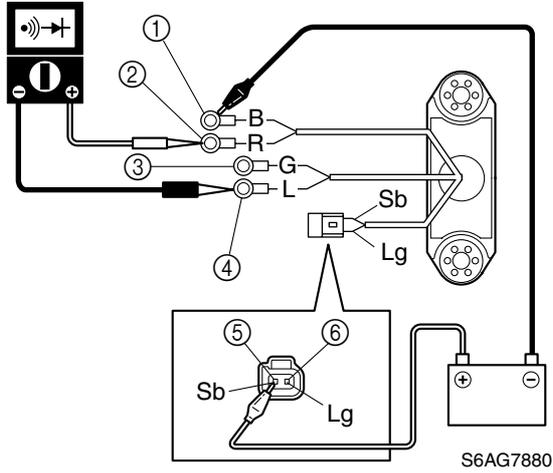


S6AG7850

Power tilt relay continuity	
Terminal ① – Terminal ③	Continuity
Terminal ① – Terminal ④	
Terminal ① – Terminal ⑤	
Terminal ① – Terminal ⑥	
Terminal ② – Terminal ③	No continuity
Terminal ② – Terminal ④	



- Connect the positive battery lead to the sky blue (Sb) lead ⑤, and the negative battery lead to the terminal (B) ① as shown, and then check the power tilt relay for continuity. Replace the power tilt relay if out of specification.

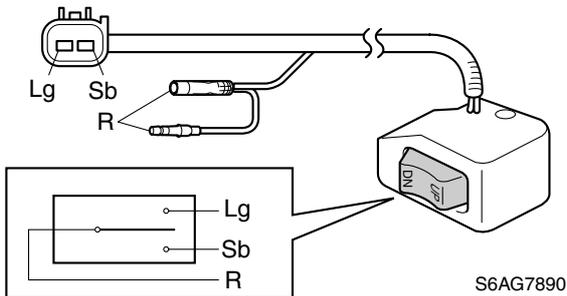


	Lead color		
Switch position	Skyblue (Sb)	Red (R)	Light green (Lg)
Free			
Up	○—○	○—○	
Down		○—○	○—○

	Power tilt relay continuity	
Terminal ② – Terminal ④	Continuity	
Terminal ② – Terminal ③	No continuity	
Terminal ③ – Terminal ④	No continuity	

**Checking the power tilt switch**

- Check the power tilt switch for continuity. Replace the power tilt switch if out of specification.





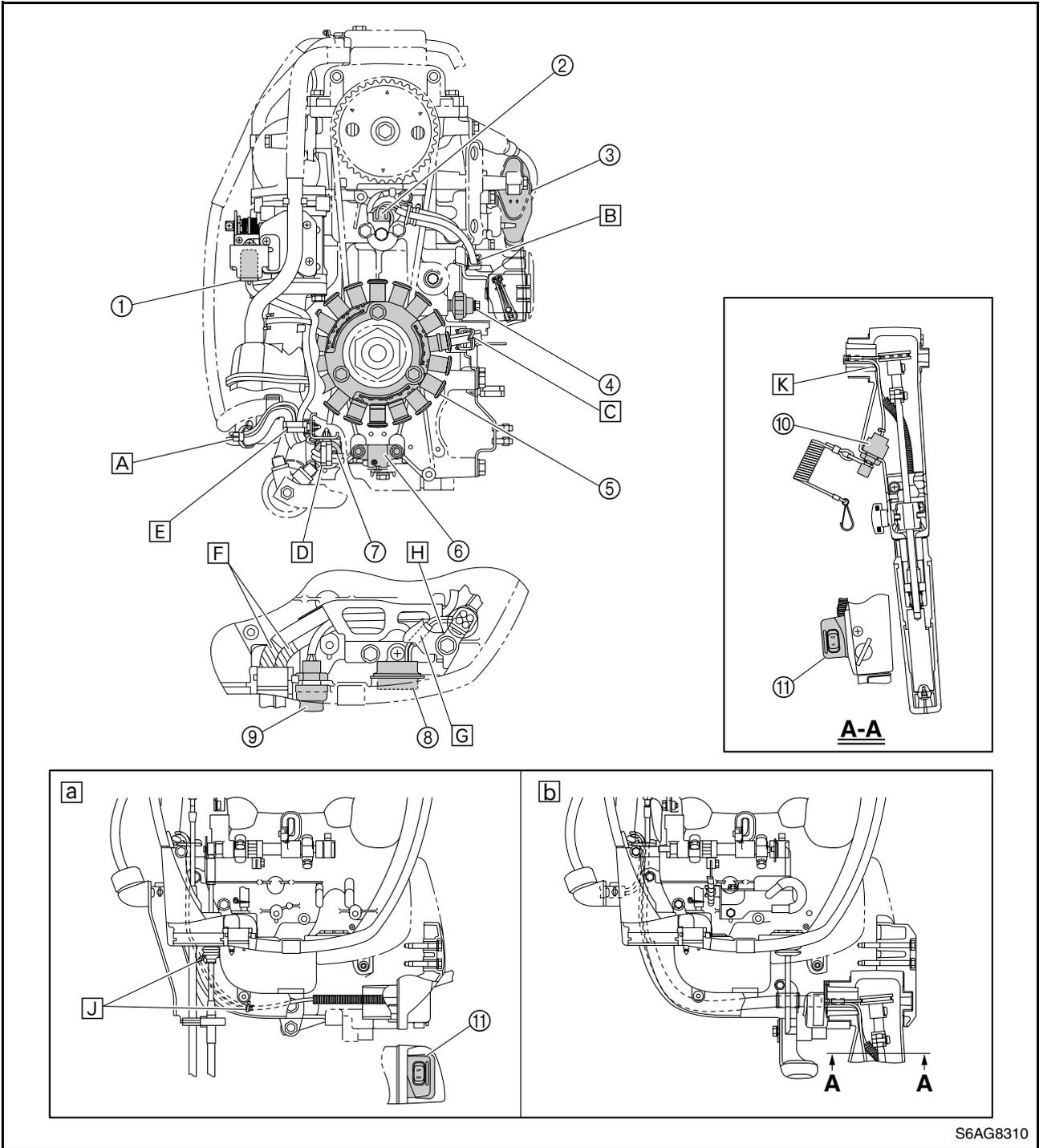
## Electrical system

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Electrical component and wiring harness routing

Top view



S6AG8310

- a** Remote control model
- b** Tiller handle model

- ① Prime Start
- ② Thermoswitch
- ③ Ignition coil
- ④ Oil pressure switch

- ⑤ Stator coil assembly (charge coil, lighting coil, and power bobbin)
- ⑥ Pulser coil
- ⑦ Neutral switch (tiller handle model with electric starter)
- ⑧ Warning indicator assembly
- ⑨ Engine start button (tiller handle model with electric starter)

## Electrical component and wiring harness routing

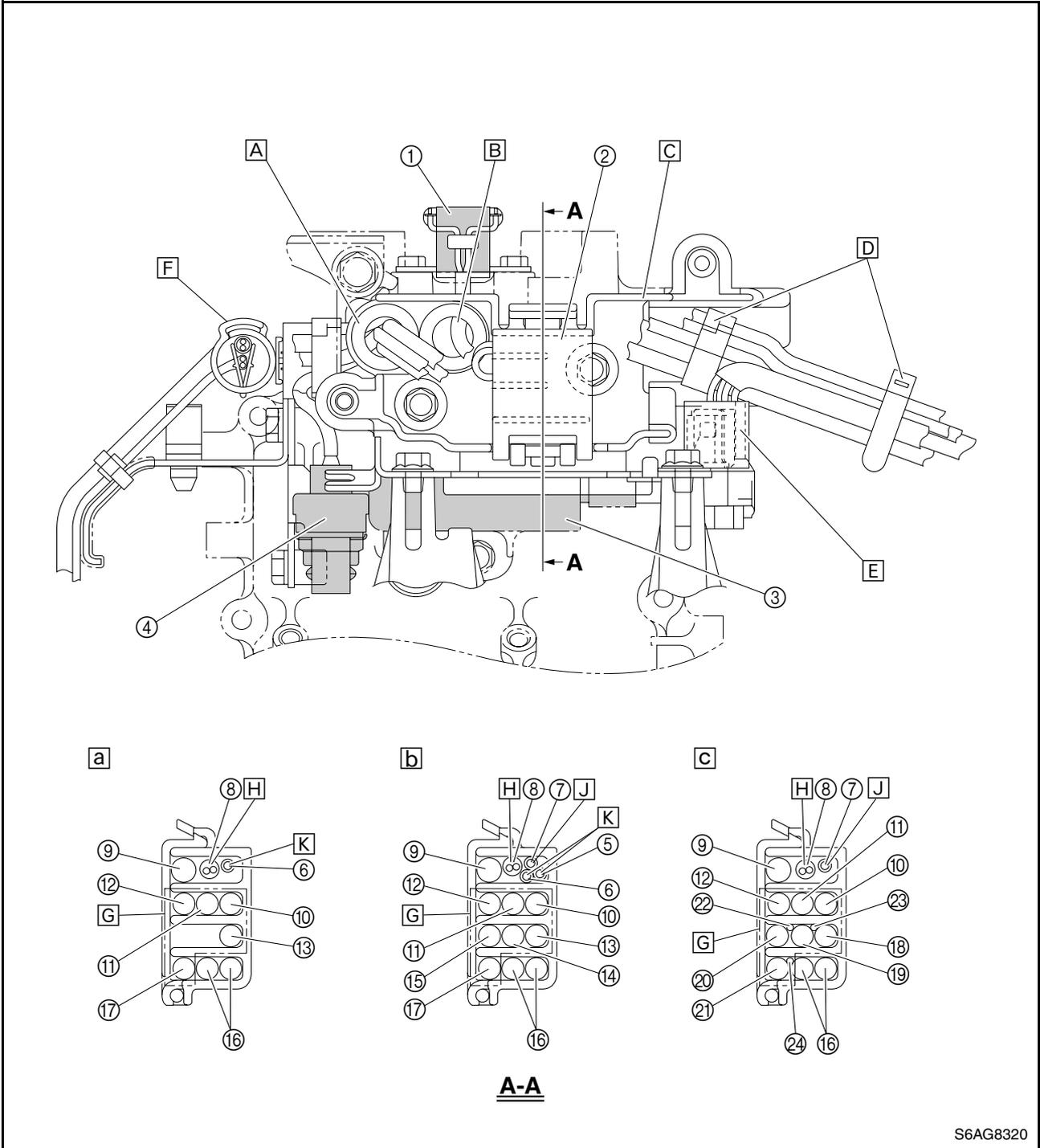
---

- ⑩ Engine stop lanyard switch (tiller handle model)
- ⑪ Power tilt switch (power tilt model)
  
- A Fasten the engine stop lanyard switch lead (tiller handle model), power tilt motor lead (power tilt model), and power tilt switch lead (power tilt model) with a plastic tie. Install the plastic tie as shown and cut off the excess end of the tie to 3 mm (0.12 in) or less.
- B Fasten the thermoswitch lead with the holder.
- C Fasten the stator coil assembly lead with the holder.
- D Fasten the engine stop lanyard switch lead (tiller handle model), power tilt motor lead (power tilt model), power tilt switch lead (power tilt model), neutral switch lead (tiller handle model with electric starter), and Prime Start lead with the holder.
- E Fasten the engine stop lanyard switch lead (tiller handle model), power tilt motor lead (power tilt model), power tilt switch lead (power tilt model), and Prime Start lead with the holder.
- F Be sure to position the battery cables and wiring harness so that the white tape is to the inside of the bottom bracket.
- G Route the warning indicator assembly lead between the plate and the stay (manual tilt model) or power tilt relay (power tilt model).
- H Install the plate, making sure that it contacts the boss on the bottom cowling.
- J Bundle the power tilt switch lead by folding it at the white tape (2 locations) on the lead, and then fasten the folded sections with plastic ties, making sure that the lead does not protrude past the edges of the steering bracket.
- K Be sure not to pinch the wiring harness in the area shown.



**Bow view**

**Manual starter model with manual tilt**



S6AG8320

- a** Tiller handle model with manual starter
- b** Tiller handle model with electric starter
- c** Remote control model
- ① Pulser coil
- ② Junction box
- ③ CDI unit
- ④ Neutral switch  
(tiller handle model with electric starter)

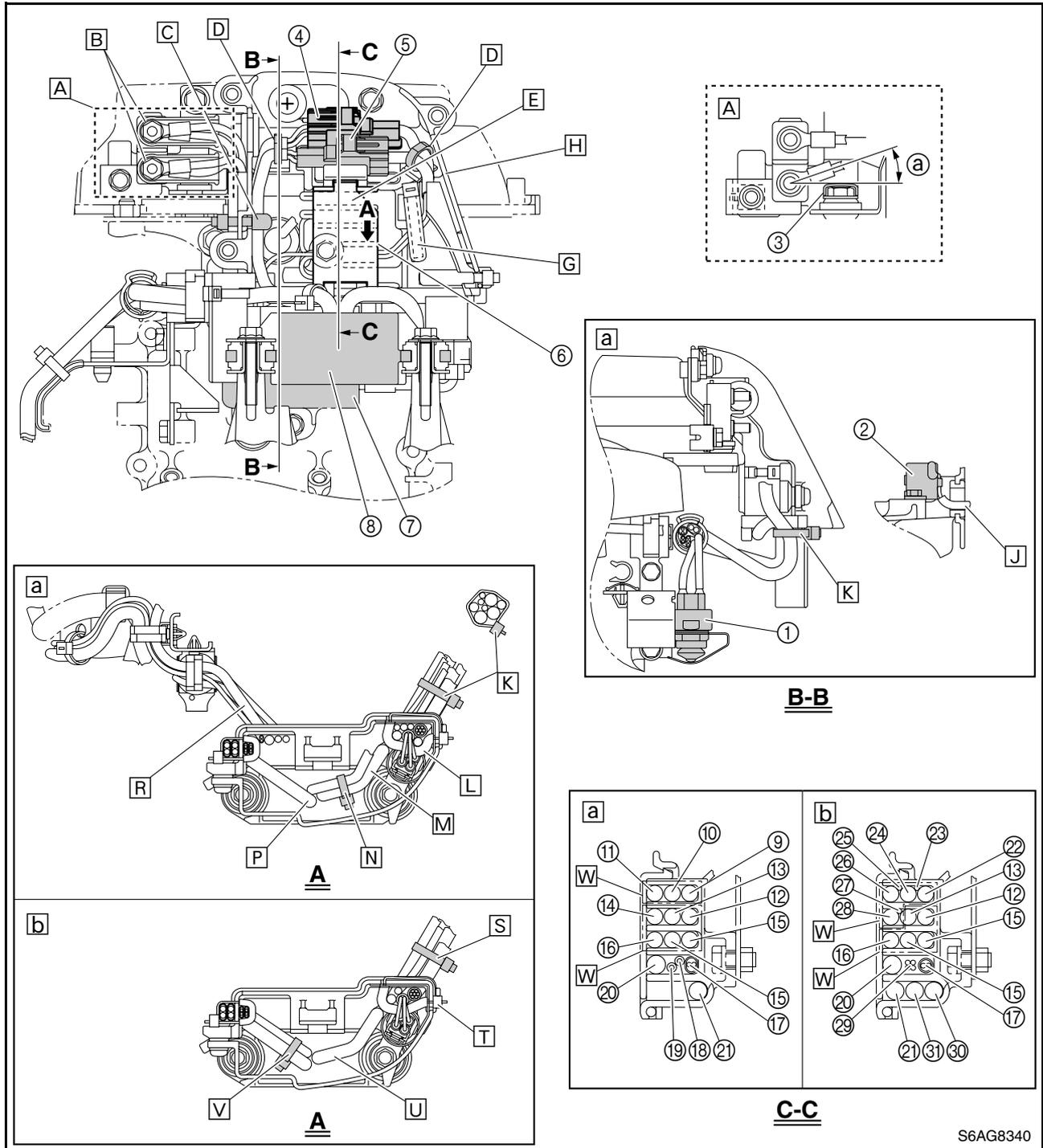
- ⑤ Neutral switch lead (tiller handle model with electric starter) (Br)
- ⑥ Engine stop lanyard switch lead (tiller handle model) (B)
- ⑦ Fuse lead (electric starter model) (R)
- ⑧ Charge coil lead (B/R, G/R)
- ⑨ Pulser coil connector (B)
- ⑩ Pulser coil connector (W/R)
- ⑪ Charge coil connector (B/R)

## Electrical component and wiring harness routing

- ⑫ Charge coil connector (G/R)
  - ⑬ Engine stop lanyard switch connector (tiller handle model) (W)
  - ⑭ Engine start button connector (tiller handle model with electric starter) (Br)
  - ⑮ Engine start button connector (tiller handle model with electric starter) (R)
  - ⑯ Prime Start connectors (L)
  - ⑰ Tachometer connector (G)
  - ⑱ Connector (10-pin main harness coupler to CDI unit) (remote control model) (W)
  - ⑲ Connector (10-pin main harness coupler to CDI unit) (remote control model) (P)
  - ⑳ Connector (10-pin main harness coupler to fuse) (remote control model) (R)
  - ㉑ Connector (10-pin main harness coupler to CDI unit) (remote control model) (G)
  - ㉒ Lead (10-pin main harness coupler to CDI unit) (remote control model) (P)
  - ㉓ Lead (10-pin main harness coupler to CDI unit) (remote control model) (W)
  - ㉔ Lead (10-pin main harness coupler to CDI unit) (remote control model) (G)
- 
- A Pass the engine stop lanyard switch lead (tiller handle model), neutral switch lead (tiller handle model with electric starter), and Prime Start lead through the grommet.
  - B Pass the pulser coil lead through the grommet.
  - C Be sure not to pinch the wiring harness and leads with the holder cover.
  - D Fasten the stator coil assembly lead, wiring harness, fuse lead (electric starter model), neutral switch lead, engine start button lead (tiller handle model with electric starter), and engine stop lanyard switch lead (tiller handle model) with the holder.
  - E Cover the edge of the coupler with the protective tube so that it does not contact the leads.
  - F Install the holder as shown.
  - G The connectors can be fastened in any position in the holder. However, do not fasten the pulser coil connector (W/R) and engine stop lanyard switch connector (W) in lowest opening in the holder.
  - H Fold the charge coil lead (B/R, G/R) back, connect it to the lead connectors (B/R, G/R), and then fasten it with the holder.
  - J Fold the fuse lead (R) back, and then connect it to the engine start button connector (R).
  - K Fasten the engine stop lanyard switch lead (B) and neutral switch lead (Br) (tiller handle model with electric starter) with the holder.



Electric starter model with power tilt



- a** Tiller handle model
- b** Remote control model

- ① Neutral switch (tiller handle model)
- ② Pulser coil
- ③ Cap
- ④ Coupler (power tilt relay leads) (Sb, Lg)
- ⑤ Coupler (power tilt relay leads) (Sb, Lg)
- ⑥ Junction box

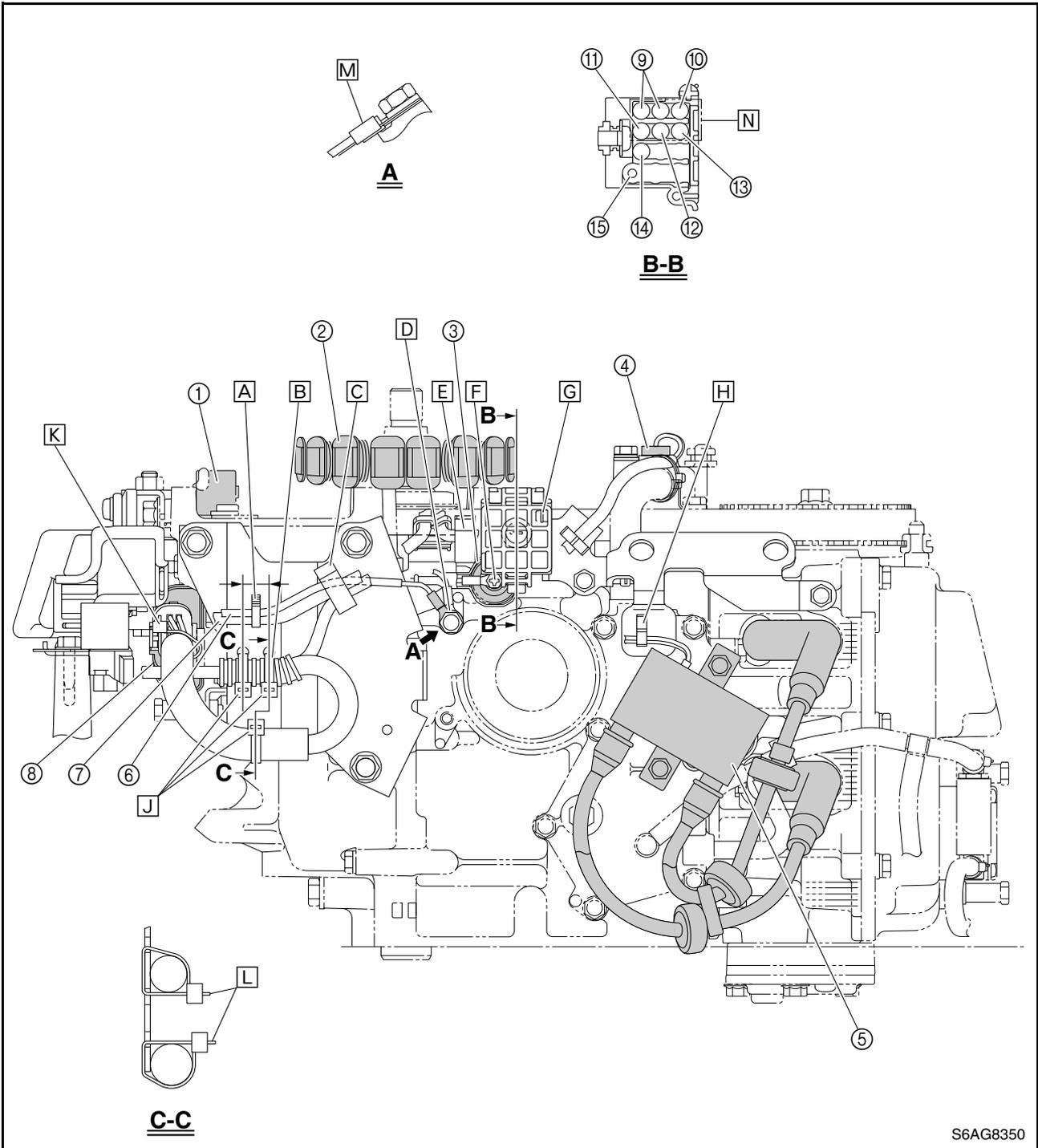
- ⑦ CDI unit
- ⑧ Power tilt relay
- ⑨ Engine start button connector (Br)
- ⑩ Connector (engine start button to fuse) (R)
- ⑪ Tachometer connector (G)
- ⑫ Charge coil connector (B/R)
- ⑬ Charge coil connector (G/R)
- ⑭ Engine stop lanyard switch connector (W)
- ⑮ Prime Start connector (L)

- ⑩ Pulser coil connector (W/R)
  - ⑪ Charge coil lead (B/R, G/R)
  - ⑫ Engine stop lanyard switch lead (B)
  - ⑬ Neutral switch lead (Br)
  - ⑭ Power tilt switch connector (R)
  - ⑮ Pulser coil connector (B)
  - ⑯ Connector (10-pin main harness coupler to CDI unit) (P)
  - ⑰ Lead (10-pin main harness coupler to CDI unit) (P)
  - ⑱ Connector (10-pin main harness coupler to fuse) (R)
  - ⑲ Lead (10-pin main harness coupler to CDI unit) (G)
  - ⑳ Connector (10-pin main harness coupler to CDI unit) (G)
  - ㉑ Lead (10-pin main harness coupler to CDI unit) (W)
  - ㉒ Connector (10-pin main harness coupler to CDI unit) (W)
  - ㉓ Lead (10-pin main harness coupler to power tilt switch and power tilt relay) (Sb, Lg)
  - ㉔ Connector (10-pin main harness coupler to power tilt switch and power tilt relay) (Sb)
  - ㉕ Connector (10-pin main harness coupler to power tilt switch and power tilt relay) (Lg)
- 
- A Install the power tilt motor leads (Sb, Lg) and power tilt relay leads (Sb, Lg) to the terminals, making sure to install the leads at angle  $\text{\textcircled{a}}$  of approximately 15–20°.
  - B Pass the power tilt motor leads (Sb, Lg) and power tilt switch leads (Sb, Lg) through the caps, and then connect the leads to the terminals. Apply Yamaha grease A to the connections, and then cover them with the caps. Be sure to pass leads of the same color through the caps and connect them to the same terminal.
  - C Fasten the power tilt motor lead, power tilt relay lead, and power tilt switch lead with a plastic tie.
  - D Fasten the power tilt relay lead (remote control model) and power tilt switch lead with the holder.
  - E Fold the charge coil lead (B/R, G/R) back, connect it to the lead connectors (B/R, G/R), and then fasten it with the holder.
  - F Be sure not to pinch the wiring harness when installing the junction box cover. Make sure that there is no slack in the wiring harness or leads in the junction box.
  - G Fasten the wiring harness (Sb, Lg) and the leads on the port side of the holder with a plastic tie. Install the plastic tie as shown.
  - H Pass the pulser coil lead through the grommet.
  - J Fasten the power tilt motor lead and power tilt switch lead on the starboard side of the damper with a plastic tie. Install the plastic tie as shown, making sure to fit it in the groove in the damper.
  - K Fasten the neutral switch lead, engine stop lanyard switch lead, stator coil assembly lead, wiring harness, fuse lead, and engine start button lead with a plastic tie as shown.
  - L Fasten the warning indicator assembly coupler, neutral switch lead, engine stop lanyard switch lead, stator coil assembly lead, wiring harness, fuse lead, and engine start button lead with a plastic tie. Install the plastic tie as shown.
  - M Make sure that the power tilt relay leads do not contact the junction box cover.
  - N Route the power tilt relay leads to the front of the holder, making sure that they are not pinched, and then fasten them with a plastic tie. Install the plastic tie as shown.
  - P Route the power tilt relay lead (Sb, Lg) to the front of the holder, making sure that it is not pinched.
  - R Route the Prime Start lead, engine stop lanyard switch lead, and neutral switch lead as shown.
  - S Fasten the stator coil assembly lead, wiring harness, and fuse lead with a plastic tie.
  - T Fasten the warning indicator assembly coupler, stator coil assembly lead, wiring harness, and fuse lead with a plastic tie. Install the plastic tie as shown.
  - U Route the power tilt relay lead (R, B) to the front of the holder, making sure that it is not pinched.
  - V Route the power tilt relay leads to the front of the holder, making sure that they are not pinched, and then fasten them with a plastic tie. Install the plastic tie as shown.
  - W The connectors can be fastened in any position in the holder.



**Port view**

**Manual starter model**



- ① Pulser coil
- ② Stator coil assembly  
(charge coil, lighting coil and power bobbin)
- ③ Oil pressure switch
- ④ Thermostat
- ⑤ Ignition coil
- ⑥ Engine stop lanyard switch lead
- ⑦ Charge coil lead
- ⑧ CDI unit

- ⑨ Lighting coil connectors (G)
- ⑩ Ignition coil connector (O)
- ⑪ Thermostat connector (Gy/B)
- ⑫ Thermostat connector (B)
- ⑬ Ignition coil connector (B)
- ⑭ Oil pressure switch connector (P)
- ⑮ Oil pressure switch lead (P)

S6AG8350

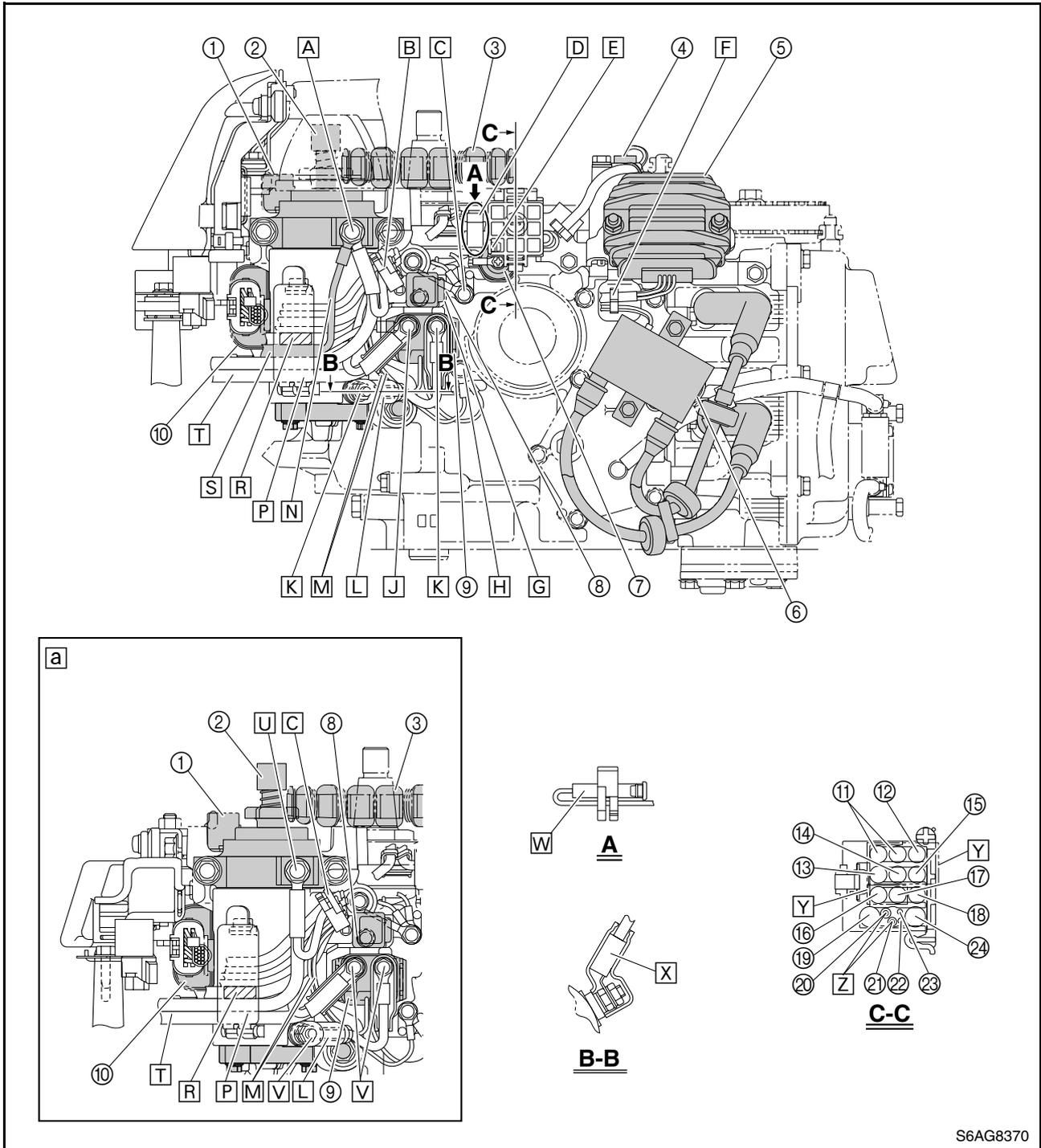
## Electrical component and wiring harness routing

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- A** Position the holder between the plastic ties.
- B** Fasten the wiring harness at the white tape with a plastic tie.
- C** Fasten the wiring harness, engine stop lanyard switch lead, and stator coil assembly lead with the holder.
- D** Install the terminals of the engine stop lanyard switch lead and wiring harness ground lead using the bolt, and then apply Yamaha grease A to the terminals and bolt.
- E** Fasten the lighting coil leads, wiring harness, and ground lead with the holder.
- F** Install the terminal of the oil pressure switch lead so that the lead is routed as shown. Apply Yamaha grease A to the terminal and bolt, and then install the cap.
- G** Insert the rubber plugs into the lighting coil connectors.
- H** Fasten the ignition coil lead with the holder.
- J** Fasten the wiring harness with plastic ties.
- K** Install the plastic tie as shown and cut off the excess end of the tie to 3 mm (0.12 in) or less.
- L** Install the plastic ties as shown.
- M** Install the terminal of the ground lead using the bolt, making sure that the crimped section of the terminal that secures the ground lead is facing outward as shown.
- N** The connectors can be fastened in any position in the holder.



Electric starter model



S6AG8370

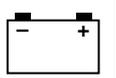
**a** Electric starter model without power tilt

- ① Pulser coil
- ② Starter motor
- ③ Stator coil assembly  
(charge coil, lighting coil and power bobbin)
- ④ Thermoswitch
- ⑤ Rectifier Regulator
- ⑥ Ignition coil

- ⑦ Oil pressure switch
- ⑧ Fuse (20 A)
- ⑨ Starter relay
- ⑩ CDI unit
- ⑪ Lighting coil connectors
- ⑫ Ignition coil connector (O)
- ⑬ Thermoswitch connector (Gy/B)
- ⑭ Thermoswitch connector (B)
- ⑮ Ignition coil connector (B)

## Electrical component and wiring harness routing

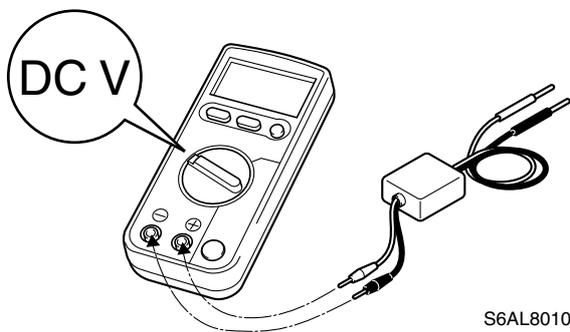
- ⑩ Positive battery lead connector (R)
  - ⑪ Starter relay connector (Br)
  - ⑫ Oil pressure switch connector (P)
  - ⑬ Rectifier Regulator connector (R)
  - ⑭ Lead (10-pin main harness coupler to starter relay) (Br) (remote control model) or neutral switch lead (Br) (tiller handle model)
  - ⑮ Fuse lead (R)
  - ⑯ Rectifier Regulator lead (B)
  - ⑰ Oil pressure switch lead (P)
  - ⑱ Rectifier Regulator connector (R)
- 
- A Install the terminals of the negative battery cable and power tilt relay lead (B) using the bolt, making sure to install the negative battery cable terminal under the power tilt relay lead (B) terminal, and then apply Yamaha grease A to the terminals and bolt.
  - B Fasten the wiring harness and leads in front of the starter motor with the holder.
  - C Install the terminals of the engine stop lanyard switch ground lead (tiller handle model), wiring harness ground lead, and negative battery cable using the bolt, and then apply Yamaha grease A to the terminals and bolt.
  - D Fasten the lighting coil leads, wiring harness, fuse leads, and neutral switch lead (tiller handle model) with the holder.
  - E Insert the rubber plug into the Rectifier Regulator connector (R).
  - F Fasten the ignition coil lead and Rectifier Regulator lead with the holder.
  - G Install the fuse bracket, making sure that the stopper on the bracket contacts the cylinder body.
  - H Install the terminals of the starter relay ground lead and Rectifier Regulator ground lead using the bolt, and then apply Yamaha grease A to the terminals and bolt.
  - J Install the terminals of the positive battery cable and power tilt relay lead (R) using the bolt, apply Yamaha grease A to the terminals and bolt, and then cover the terminals with the cap.
  - K Install the terminals of the starter motor lead using the bolt and nut, apply Yamaha grease A to the terminals, bolt, and nut, and then cover the terminals with the caps.
  - L Install the starter motor lead terminal as shown.
  - M Route the starter relay lead (Br) and Rectifier Regulator ground lead between the starter relay and the starter motor.
  - N Make sure that the power tilt relay lead (B) is not routed in front of the holder.
  - P Route the battery cables as shown and fasten them with the holder.
  - R Fasten the wiring harness at the white tape with the holder.
  - S Route the power tilt relay lead as shown.
  - T Make sure that there is no slack in the battery cables.
  - U Install the terminal of the negative battery cable using the bolt, and then apply Yamaha grease A to the terminal and bolt.
  - V Install the terminal of the positive battery cable using the bolt and the terminals of the starter motor lead using the bolt and nut, apply Yamaha grease A to the terminals, bolts, and nut, and then cover the terminals with the caps.
  - W Fold the lead (Y) (remote control model) back, and then fasten the connector and lead with the holder as shown.
  - X Install the bent terminal of the wiring harness to the starter motor.
  - Y The connectors can be fastened in any position in the holder.
  - Z Fold the neutral switch lead (Br) back, and then connect it to the starter relay connector (Br). Fold the fuse lead (R) back, and then connect it to the positive battery cable connector. Fasten the leads, which were folded back, with the holder. (Tiller handle model)  
Fold the lead (from 10-pin main harness coupler) (Br) back, and then connect it to the starter relay connector (Br). Fold the fuse lead (R) back, and then connect it to the positive battery cable connector. Fasten the leads, which were folded back, with the holder. (Remote control model)



## 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 component can be easily checked by measuring the peak voltage. The specified engine speed when measuring the peak voltage is affected 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.



S6AL8010

### **⚠ WARNING**

When checking the peak voltage, do not touch any of the connections of the digital tester leads.

### **CAUTION:**

When testing the voltage between the terminals of an electrical component with the digital tester, do not allow any of the leads to touch any metal parts. If touched, the electrical component can short and 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 B with the recommended digital circuit tester.
- Connect the positive pin of peak voltage adapter B 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**.

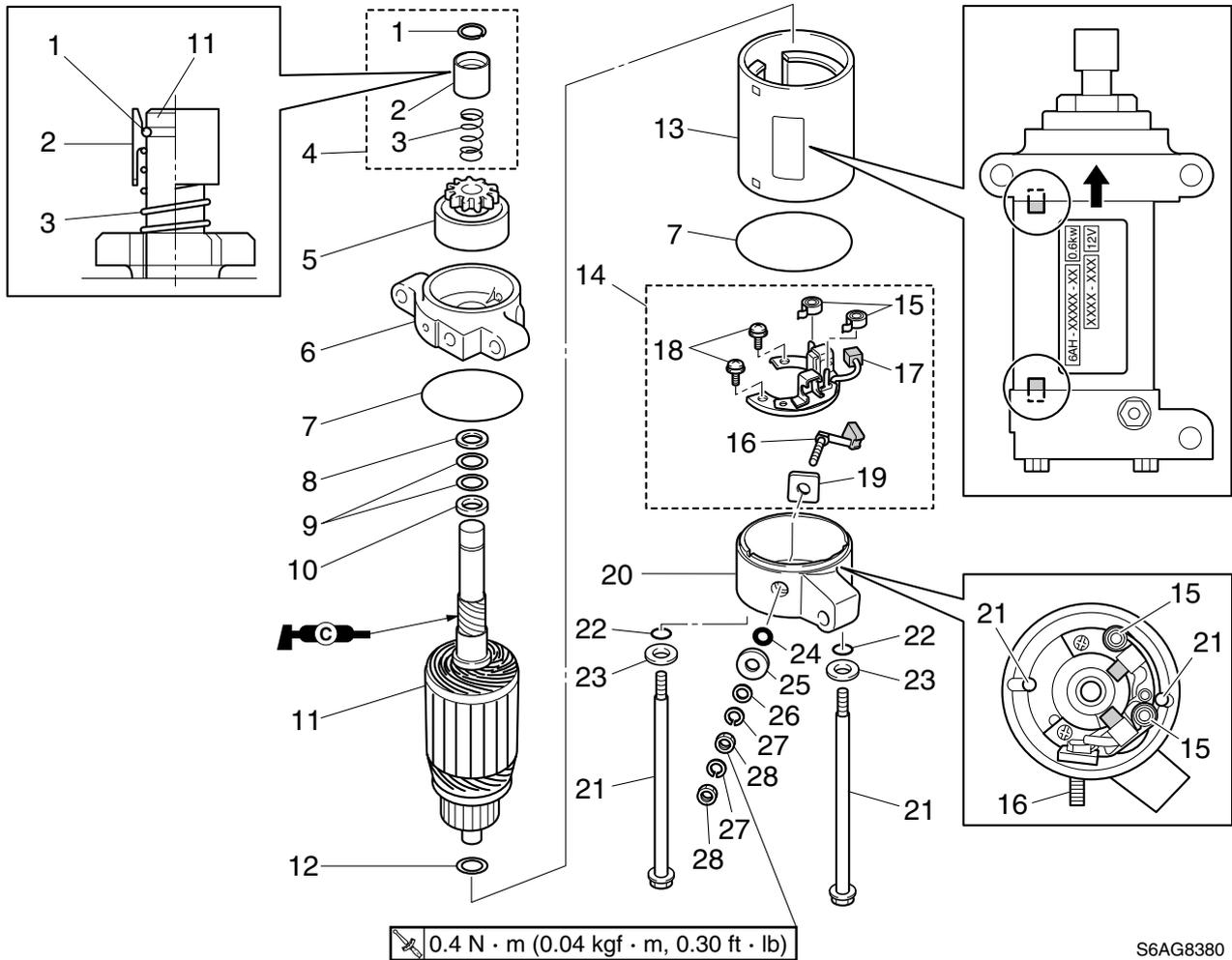


Digital circuit tester: 90890-03174

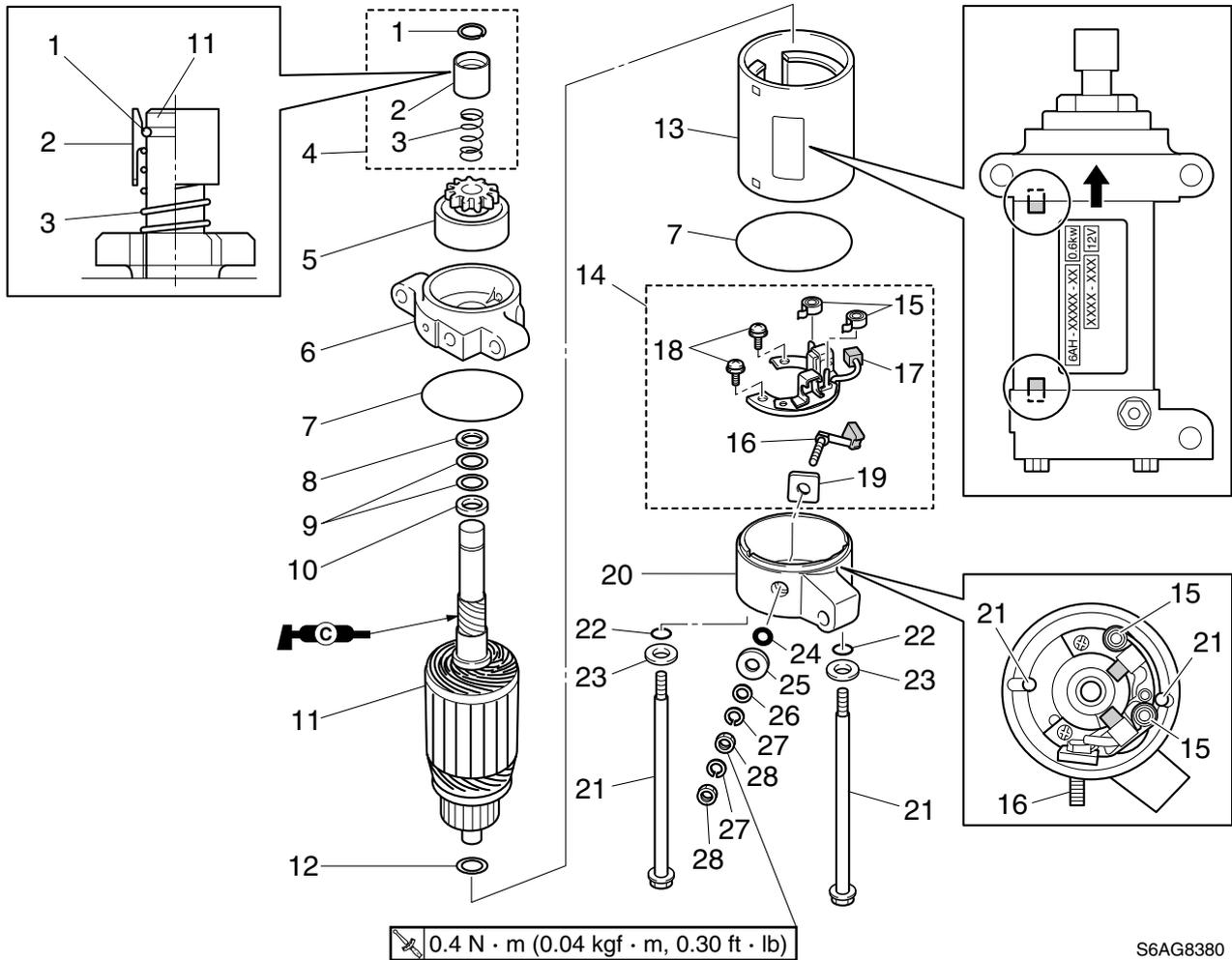
Peak voltage adapter B:  
90890-03172

Checking the electrical component / Starter motor (electric starter model)

Starter motor (electric starter model)



No.	Part name	Q'ty	Remarks
1	Clip	1	<b>Not reusable</b>
2	Pinion stopper	1	
3	Spring	1	
4	Pinion stopper set	1	
5	Pinion	1	
6	Cover	1	
7	O-ring	2	<b>Not reusable</b>
8	Washer	1	t = 1.0 mm
9	Shim	—	
10	Washer	1	t = 2.0 mm
11	Armature	1	
12	Washer	1	t = 0.25 mm
13	Stator	1	
14	Brush holder assembly	1	
15	Brush spring	2	
16	Brush 1	1	
17	Brush 2 assembly	1	



S6AG8380

No.	Part name	Q'ty	Remarks
18	Screw	2	ø4 × 8 mm
19	Spacer	1	
20	Bracket	1	
21	Bolt	2	M5 × 120 mm
22	O-ring	2	
23	Washer	2	
24	O-ring	1	
25	Spacer	1	
26	Washer	1	
27	Spring washer	2	
28	Nut	2	

## Removing the starter motor

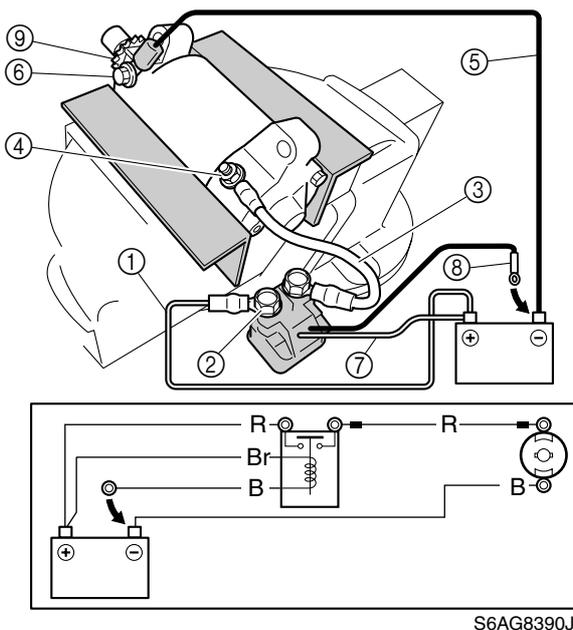
1. Remove the starter motor from the power unit.

### NOTE:

- Check the engine start switch or engine start button, neutral switch, starter relay, and fuse before removing the starter motor.
- To remove the starter motor, see “Bracket (electric starter model)” (5-24).

## Checking the starter motor operation

1. Hold the starter motor in a vise using aluminum plates on both sides.
2. Connect the positive battery cable ① to the starter relay terminal ②, connect the starter motor lead ③ to the starter motor positive terminal ④, and connect the negative battery cable ⑤ to the starter motor body ⑥.
3. Connect the starter relay lead (brown) ⑦ to the positive battery terminal. Connect the starter relay lead (black) ⑧ to the negative battery terminal to check the starter motor operation.



### ⚠ WARNING

Do not place any objects near the pinion or touch it. The pinion ⑨ moves slightly away from the starter motor body and rotates at high speed.

### NOTE:

- Check the starter motor operation for a few seconds.
- If the starter motor is disassembled for maintenance, be sure to check the operation again after assembling it.

4. Disconnect the negative battery cable and positive battery cable from the battery terminals.

## Checking the starter motor pinion

### CAUTION:

Be sure to disconnect the battery cables before checking the starter motor pinion.

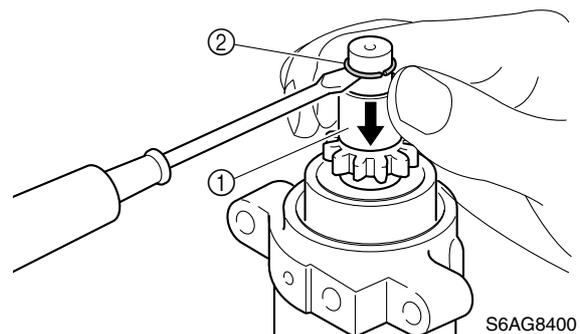
1. Check the pinion teeth. Replace the pinion if cracked or worn.
2. Check the pinion for smooth operation.

### NOTE:

Turn the pinion counterclockwise to check that it operates smoothly and turn it clockwise to check that it locks in place.

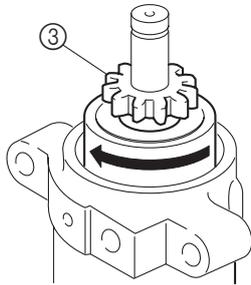
## Disassembling the starter motor

1. Slide the pinion stopper ① down as shown, and then remove the clip ②, pinion stopper, and spring.



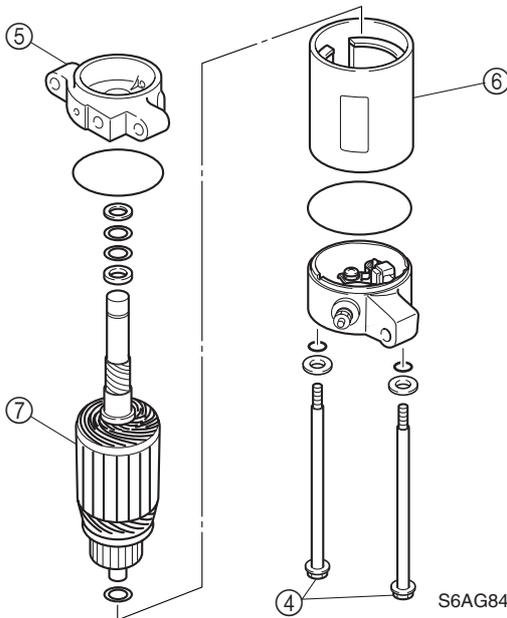


2. Turn the pinion ③ clockwise, and then remove the pinion.



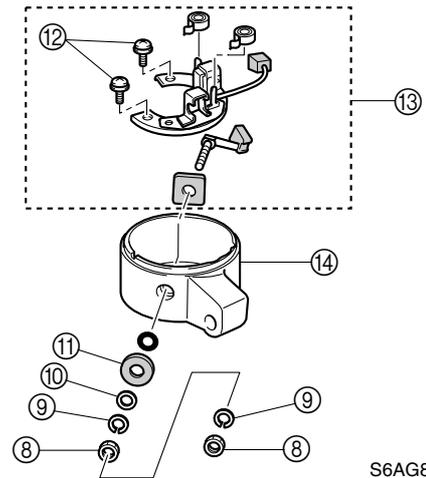
S6AG8410

3. Remove the bolts ④, and then remove the cover ⑤, stator ⑥, armature ⑦, and washer.



S6AG8420

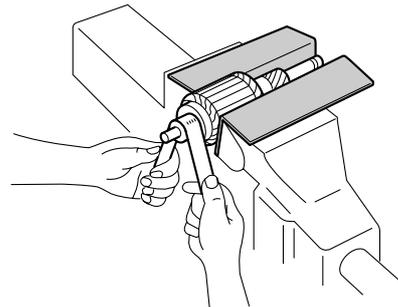
4. Remove the nuts ⑧, spring washers ⑨, washer ⑩, spacer ⑪, and screws ⑫, and then remove the brush holder assembly ⑬ from the bracket ⑭.



S6AG8430

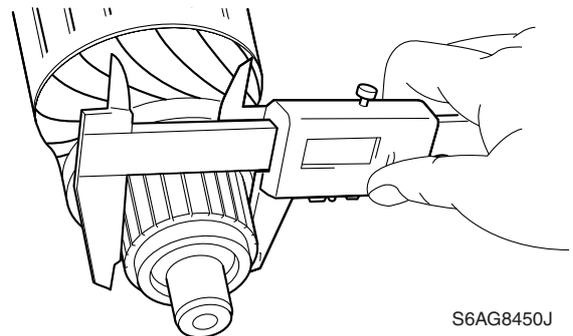
**Checking the starter motor**

1. Check the commutator. Clean with 600-grit sandpaper and compressed air if dirty.



S6AG8440

2. Measure the commutator diameter. Replace the armature if below specification.

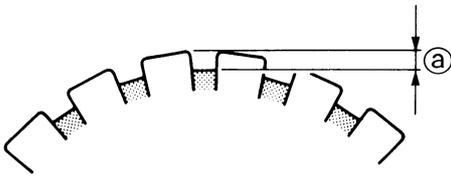


S6AG8450J

	Commutator standard diameter: 30.0 mm (1.18 in)
	Wear limit: 29.0 mm (1.14 in)

## Starter motor (electric starter model)

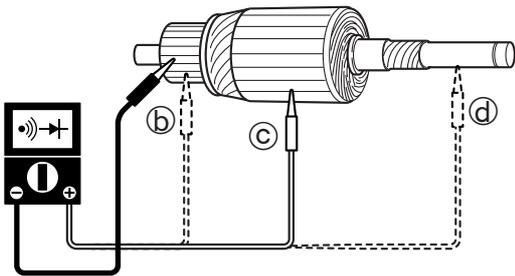
3. Measure the commutator undercut (a).  
Replace the armature if below specification.



S69J8410

	Commutator standard undercut (a): 0.8 mm (0.03 in) Wear limit: 0.2 mm (0.01 in)
--	---

4. Check the armature for continuity.  
Replace the armature if out of specification.

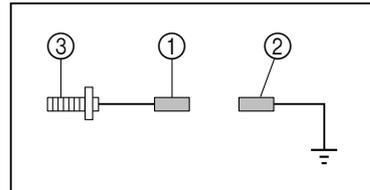
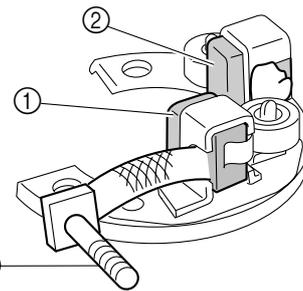


S6AG8460

	Armature continuity	
	Checking points	Continuity
	Commutator segments (b)	Yes
	Segment – Armature core (c)	No
	Segment – Armature shaft (d)	No

### Checking the brush holder and brush

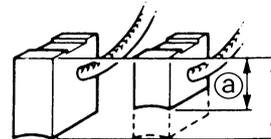
1. Check the brush holder assembly for continuity. Replace if out of specification.



S6AG8470

	Brush holder assembly continuity	
	Checking points	Continuity
	Brush ① – Terminal ③	Yes
	Brush ① – Brush ②	No
	Brush ② – Terminal ③	No

2. Measure the length of each brush.  
Replace if below specification.



S69J8430

	Brush standard length: 12.5 mm (0.49 in) Wear limit (a): 9.0 mm (0.35 in)
--	---

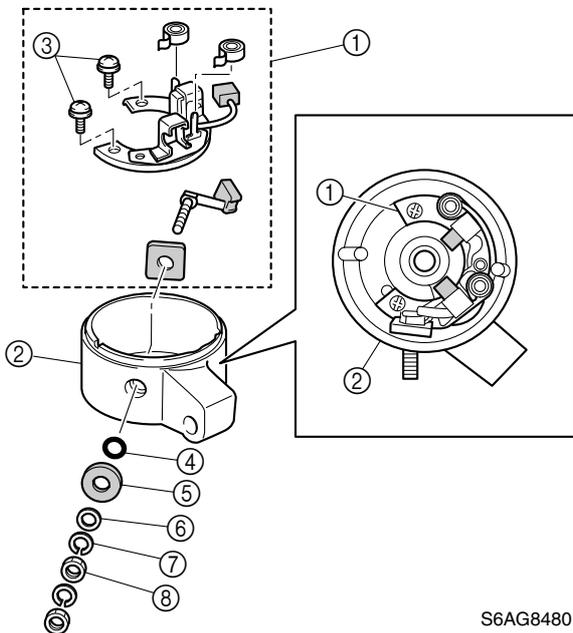


**Assembling the starter motor**

**CAUTION:**

**Do not allow grease or oil to contact the commutator of the armature.**

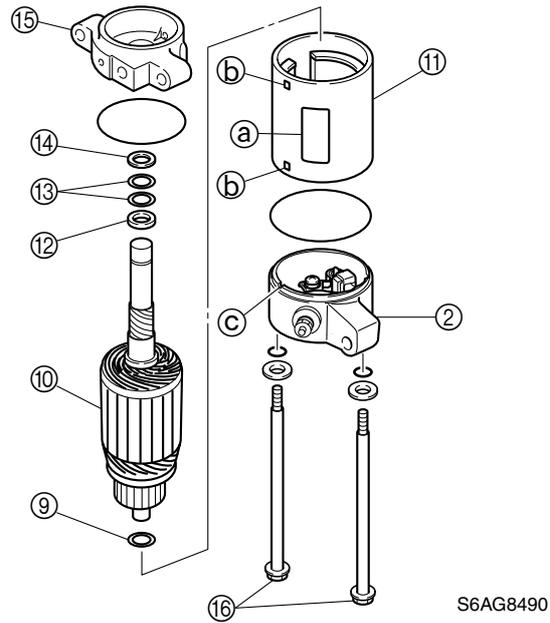
1. Install the brush holder assembly ① into the bracket ②, and then tighten the screws ③.
2. Install the O-ring ④, spacer ⑤, washer ⑥, and spring washer ⑦, and then tighten the nut ⑧ to the specified torque.



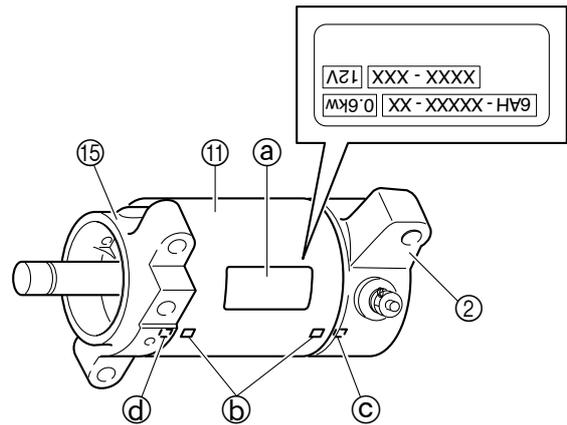
S6AG8480

**Starter motor terminal nut ⑧:**  
0.4 N·m (0.04 kgf·m, 0.30 ft·lb)

3. Install the washer ⑨ and armature ⑩ into the bracket ②.
4. Install the stator ⑪, washer ⑫, shim(s) ⑬, washer ⑭, and cover ⑮, and then tighten the bolts ⑯.



S6AG8490

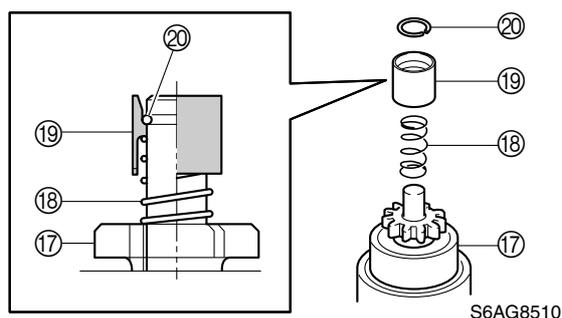


S6AG8500

**NOTE:**

- Align the projections (b) on the stator ⑪ with groove (c) on the bracket ② and groove (d) on the cover ⑮.
- Install the stator so that the label (a) is read from bottom to top as shown.

5. Install the pinion ⑰, spring ⑱, and pinion stopper ⑲.
6. Slide the pinion stopper down, and then install a new clip ⑳.



S6AG8510

**NOTE:**

- Install the pinion stopper ⑱ in the direction shown.
- Check the starter motor operation again after assembling it.

**Installing the starter motor**

1. Install the starter motor to the power unit.
2. Install the wiring harness to the starter motor, and then fasten the wiring harness.

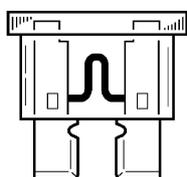
**NOTE:**

To wire the starter motor, see “Electrical component and wiring harness routing” (8-1).

**Starting system**

**Checking the fuse (electric starter model)**

1. Check the fuse for continuity. Replace if there is no continuity.



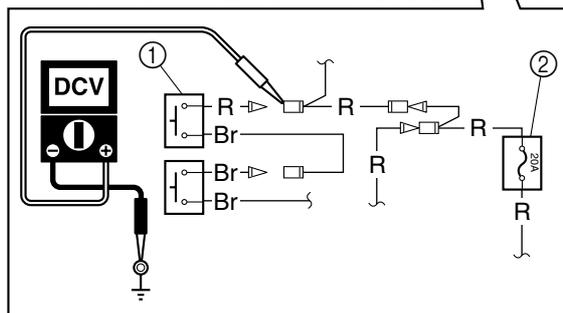
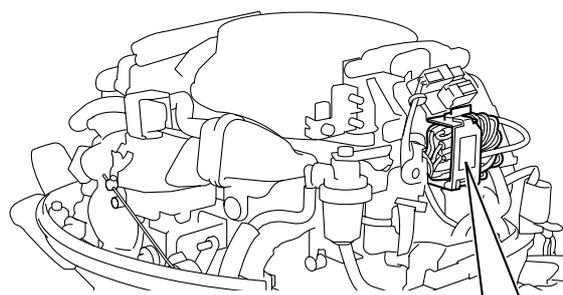
S6AG7851

**NOTE:**

For the location of the fuse, see “Electrical component and wiring harness routing” (8-1).

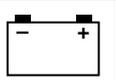
**Checking the engine start button (tiller handle model with electric starter)**

1. Disconnect the engine start button ① connectors.
2. Measure the input voltage between the connector (wiring harness end) of the engine start button ① and the ground. Check the fuse ② and wiring harness if below specification.

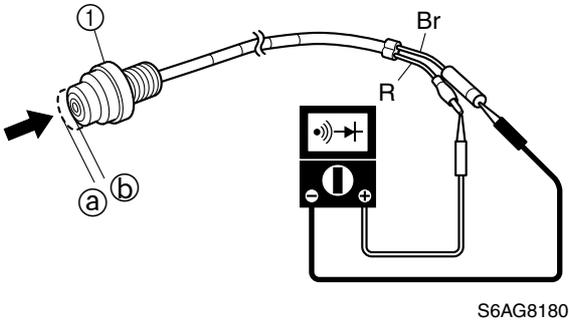


S6AG8170

	Engine start button input voltage (reference data):
	Red (R) – Ground
	12 V (battery voltage)



3. Check the engine start button ① for continuity between the engine start button connectors (engine start button end). Replace if out of specification.

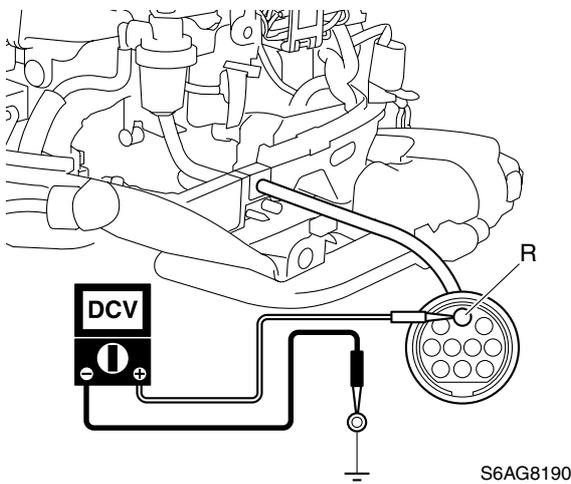


Engine start button continuity: Red (R) – Brown (Br)	
Button position	Continuity
Free ①	No
Pushed ②	Yes

4. Connect the connectors of the engine start button ①.

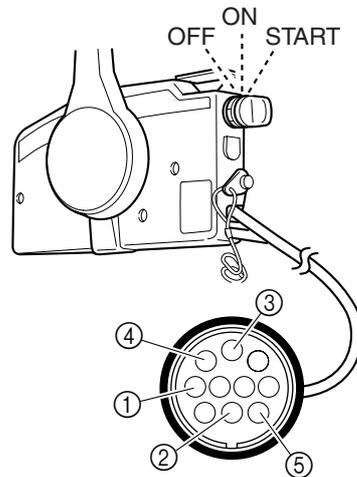
**Checking the engine start switch (remote control model)**

1. Disconnect the 10-pin main harness coupler.
2. Measure the input voltage between the 10-pin main harness coupler (outboard motor end) and the ground. Check the fuse and wiring harness if below specification.



Engine start switch input voltage (reference data):	
Red (R) – Ground	12 V (battery voltage)

3. Set the remote control lever to the neutral position.
4. Check the engine start switch for continuity at the 10-pin main harness coupler (remote control box end). Check the wiring harness and neutral switch, or replace the engine start switch if out of specification.



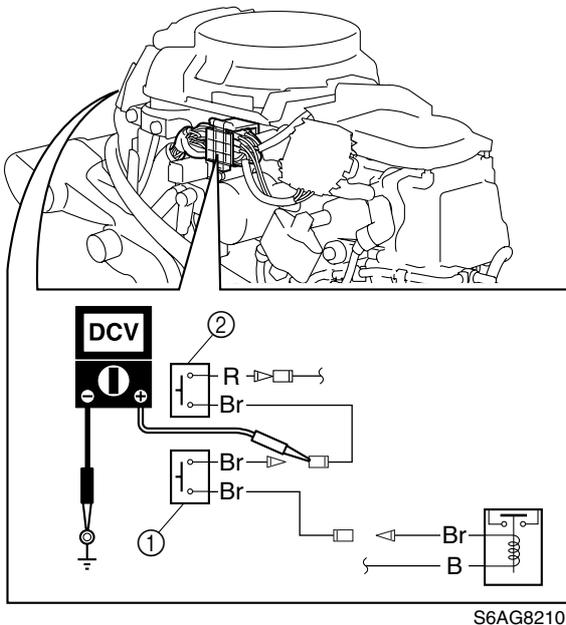
	Lead color				
	White (W) ①	Black (B) ②	Red (R) ③	Yellow (Y) ④	Brown (Br) ⑤
Switch position	①	②	③	④	⑤
OFF	○—○				
ON			○—○		
START			○—○	○—○	

5. Connect the 10-pin main harness coupler.

**Checking the neutral switch (tiller handle model with electric starter)**

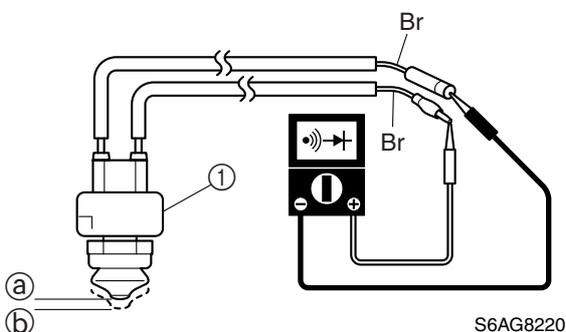
1. Disconnect the neutral switch ① connectors.

- Push the engine start button, and then measure the input voltage between the neutral switch connector (engine start button end) and the ground. Check the engine start button ② and wiring harness if below specification.



	<p>Neutral switch input voltage (reference data): Brown (Br) – Ground 12 V (battery voltage)</p>
---	--

- Check the neutral switch ① for continuity between the neutral switch connectors (neutral switch end). Replace if out of specification.

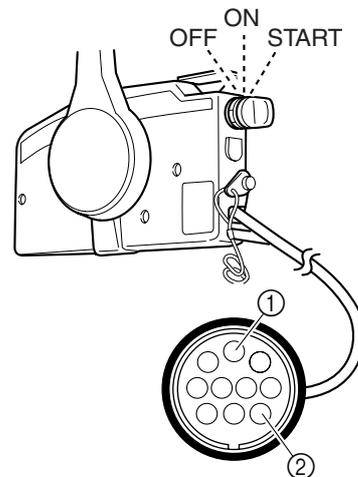


	<p>Neutral switch continuity: Brown (Br) – Brown (Br)</p>	
	Switch position	Continuity
	Pushed ③ (neutral)	Yes
	Free ④ (forward or reverse)	No

- Connect the connectors of the neutral switch ①.

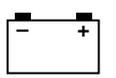
**Checking the neutral switch (remote control model)**

- Set the remote control lever to the neutral, forward or reverse position.
- Turn the engine start switch to “START,” and then check the neutral switch for continuity at the 10-pin main harness coupler (remote control box end). Check the wiring harness or replace the neutral switch if out of specification.



- NOTE:**
- Be sure to check the engine start switch for continuity before checking the neutral switch.
  - Check for continuity when the engine start switch is turned to “START.”

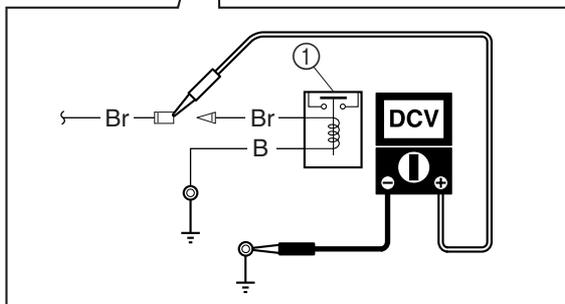
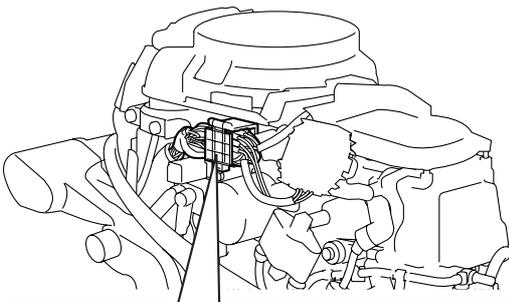
	Lead color	
Remote control lever position	Red (R) ①	Brown (Br) ②
Neutral	○	○
Forward or reverse		



3. Turn the engine start switch to "OFF."
4. Connect the 10-pin main harness coupler.

### Checking the starter relay (electric starter model)

1. Disconnect the starter relay ① connector.
2. Set the shift lever or remote control lever to the neutral position.
3. Push the engine start button, and then measure the input voltage between the starter relay connector (neutral switch end) and the ground. Check the engine start button, neutral switch, wiring harness and ground lead if below specification. (Tiller handle model)  
Turn the engine start switch to "START," and then measure the input voltage between the starter relay connector (neutral switch end) and the ground. Check the engine start switch, neutral switch (in the remote control box), wiring harness, and ground lead if below specification. (Remote control model)



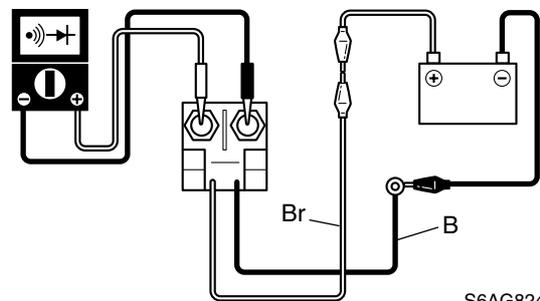
S6AG8230



Starter relay input voltage  
(reference data):

Brown (Br) – Ground  
12 V (battery voltage)

4. Disconnect the battery cables, and then remove the starter relay.
5. Connect the digital circuit tester leads to the starter relay terminals.
6. Connect the brown (Br) lead of the starter relay to the positive battery terminal and connect the black (B) lead to the negative battery terminal. Check for continuity between the starter relay terminals. Replace if there is no continuity.
7. Disconnect the brown (Br) or black (B) lead of the starter relay from a battery terminal. Check that there is no continuity between the starter relay terminals. Replace if there is continuity.



S6AG8240

8. Install the starter relay, and then connect the battery cables, starter relay connector, and starter relay lead.

## Ignition and ignition control system

### Checking the ignition spark

1. Disconnect the spark plug caps from the spark plugs.

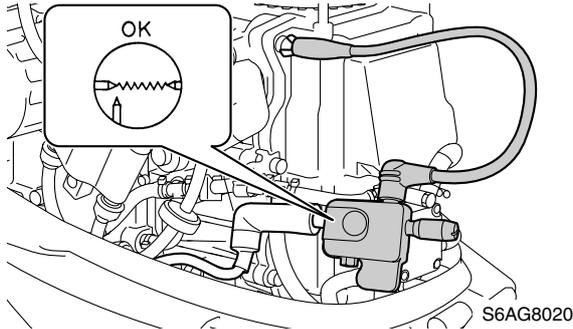
**NOTE:** \_\_\_\_\_  
To prevent the engine from starting when cranking it, be sure to disconnect both spark plug caps.

2. Connect the spark plug cap to the special service tool.



Ignition tester: 90890-06754

3. Crank the engine and check for a spark. If there is no spark, check the ignition system.



S6AG8020

### ⚠ WARNING

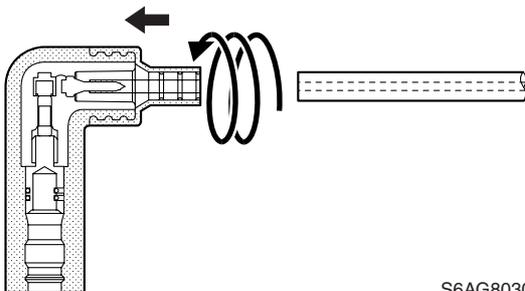
- Do not touch any of the connections of the special service tool.
- Be sure to install the special service tool to the spark plug cap so that sparks do not leak out.
- Keep flammable gas or liquids away, since this test can produce sparks.

### NOTE:

Repeat steps 2–3 for each spark plug cap.

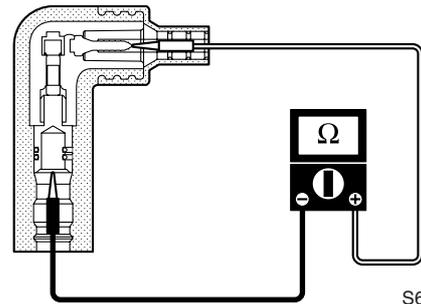
### Checking the spark plug cap

1. Remove the spark plug caps from the spark plug wires by turning the caps counterclockwise.



S6AG8030

2. Measure the spark plug cap resistance. Replace if out of specification.



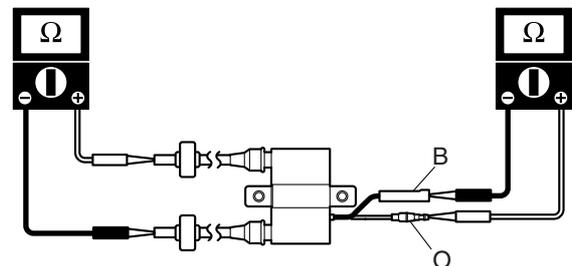
S6AG8040



Spark plug cap resistance:  
3.75–6.25 kΩ

### Checking the ignition coil

1. Disconnect the ignition coil connectors.
2. Remove the spark plug caps from the spark plug wires by turning the caps counterclockwise.
3. Measure the ignition coil resistance. Replace if out of specification.



S6AG8050



Ignition coil resistance:

Primary coil:

Orange (O) – Black (B)  
0.26–0.35 Ω at 20 °C (68 °F)

Secondary coil:

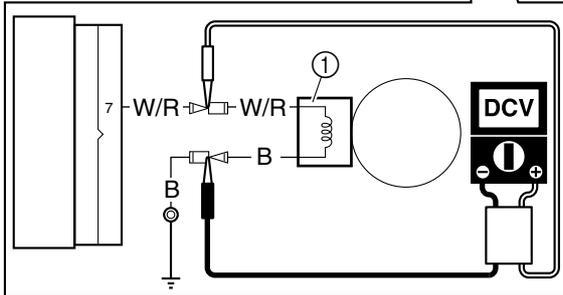
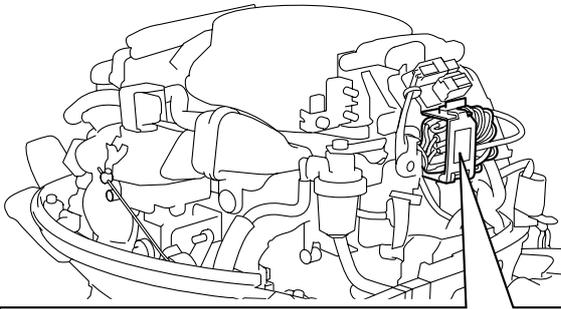
Spark plug wire – Spark plug wire  
6.8–10.2 kΩ at 20 °C (68 °F)

4. Install the spark plug caps to the spark plug wires by turning the caps clockwise, and then connect the ignition coil connectors.



**Checking the pulser coil**

1. Measure the pulser coil ① output peak voltage. Replace if below specification.



S6AG8060

**NOTE:**

- To prevent the engine from starting when cranking it, be sure to disconnect both spark plug caps.
- Do not remove the clip from the engine stop lanyard switch.
- If measuring the output peak voltage under the unloaded conditions, disconnect the connectors.
- When using the manual starter to crank the engine, the voltage values may vary depending on the speed at which the starter handle is pulled.

	Pulser coil output peak voltage: White/red (W/R) – Black (B)			
	r/min	Unloaded	Loaded	
		Cranking	1,500	3,500
DC V	5.1	2.6	5.3	8.4

2. Disconnect the pulser coil connectors.
3. Measure the pulser coil resistance. Replace if out of specification.



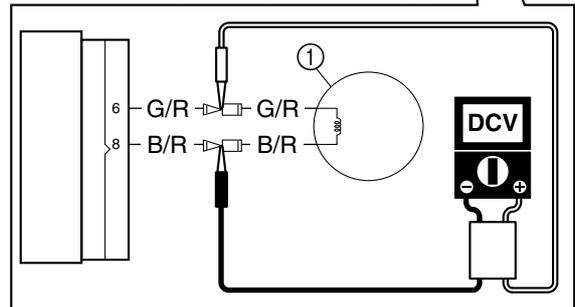
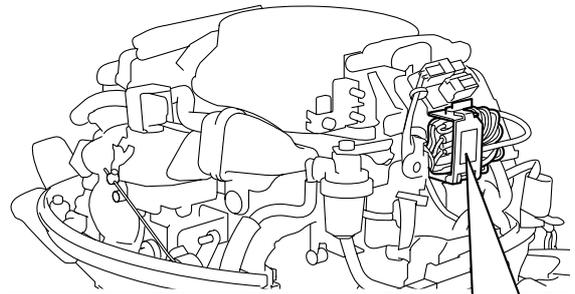
Pulser coil resistance  
(reference data):

White/red (W/R) – Black (B)  
152–228 Ω at 20 °C (68 °F)

4. Connect the pulser coil connectors.

**Checking the charge coil**

1. Measure the charge coil ① output peak voltage. Replace the stator coil assembly if below specification.



S6AG8070

**NOTE:**

- To prevent the engine from starting when cranking it, be sure to disconnect both spark plug caps.
- Do not remove the clip from the engine stop lanyard switch.
- If measuring the output peak voltage under the unloaded conditions, disconnect the connectors.
- When using the manual starter to crank the engine, the voltage values may vary depending on the speed at which the starter handle is pulled.

	Charge coil output peak voltage: Black/red (B/R) – Green/red (G/R)			
r/min	Unloaded	Loaded		
	Cranking	1,500	3,500	
DC V	60	140	150	150

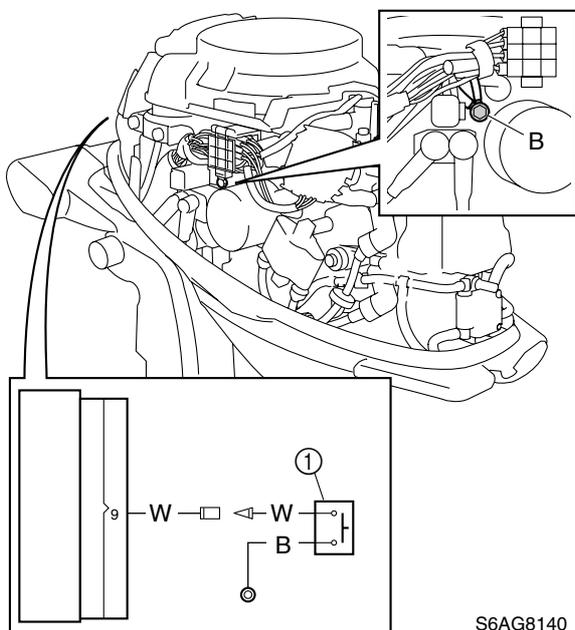
2. Disconnect the charge coil connectors.
3. Measure the charge coil resistance. Replace the stator coil assembly if out of specification.

	Charge coil resistance (reference data): Black/red (B/R) – Green/red (G/R) 25.5–34.5 Ω at 20 °C (68 °F)
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4. Connect the charge coil connectors.

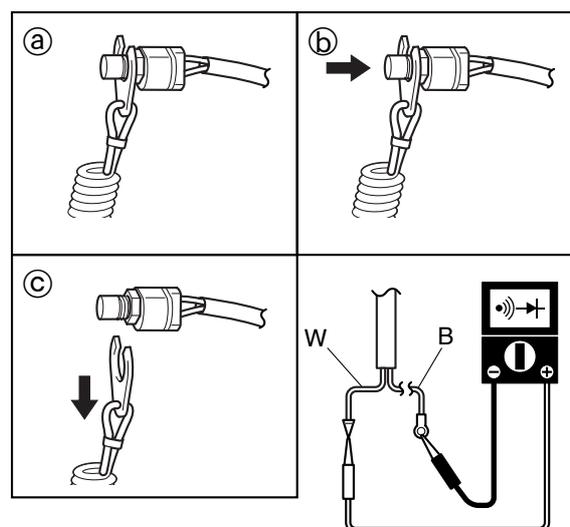
### Checking the engine stop lanyard switch (tiller handle model)

1. Disconnect the engine stop lanyard switch ① connector and terminal.



S6AG8140

2. Check the engine stop lanyard switch ① for continuity between the engine stop lanyard switch connector and terminal (engine stop lanyard switch end). Replace if out of specification.



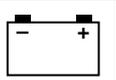
S6AG8150

	Engine stop lanyard switch continuity: White (W) – Black (B)
Switch position	Continuity
Clip installed ①	No
Engine stop button pushed ②	Yes
Clip removed ③	Yes

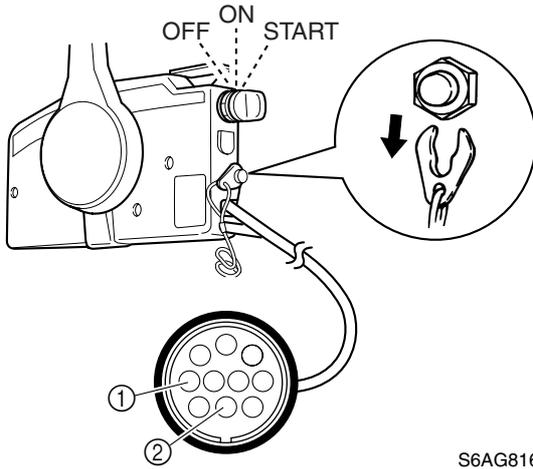
3. Connect the engine stop lanyard switch connector and terminal.

### Checking the engine stop lanyard switch (remote control model)

1. Disconnect the 10-pin main harness coupler.



- Turn the engine start switch to “ON,” and then check the engine stop lanyard switch for continuity at the 10-pin main harness coupler (remote control box end). Check the wiring harness or replace the engine stop lanyard switch if out of specification.



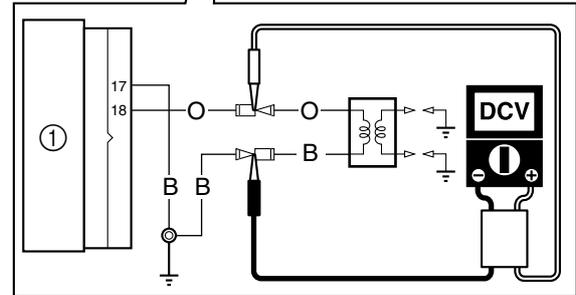
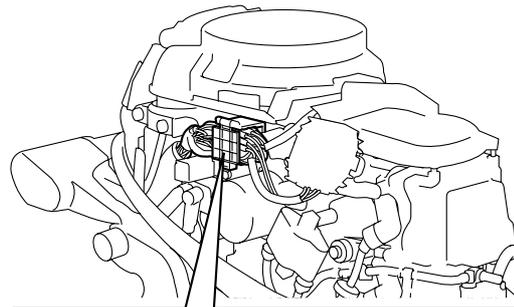
S6AG8160

	Engine stop lanyard switch continuity: White (W) ① – Black (B) ②
Switch position	Continuity
Clip installed	No
Clip removed	Yes

- Turn the engine start switch to “OFF.”
- Connect the 10-pin main harness coupler.

**Engine electric control system**  
**Checking the CDI unit**

- Measure the CDI unit ① output peak voltage. Replace if below specification.



S6AG8080

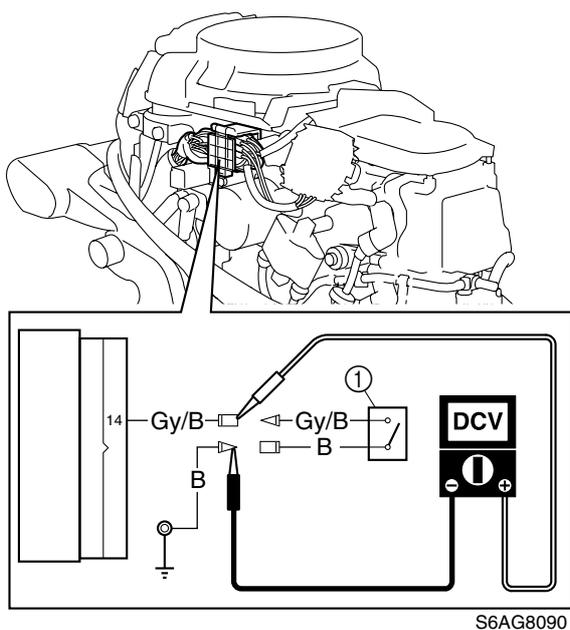
**NOTE:**

- To prevent the engine from starting when cranking it, be sure to disconnect both spark plug caps.
- Do not remove the clip from the engine stop lanyard switch.
- When using the manual starter to crank the engine, the voltage values may vary depending on the speed at which the starter handle is pulled.
- Be sure to check the charge coil and pulser coil before measuring the CDI unit output peak voltage.

	CDI unit output peak voltage: Orange (O) – Black (B)		
r/min	Loaded		
	Cranking	1,500	3,500
DC V	140	150	150

**Checking the thermoswitch**

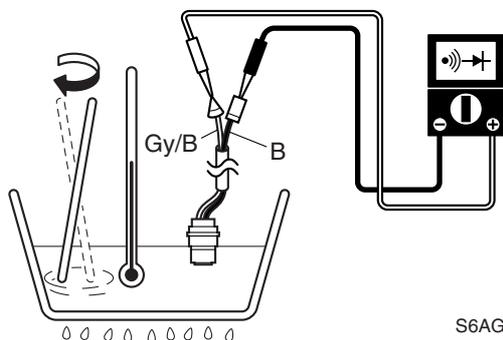
- Disconnect the thermoswitch ① connectors.
- Start the engine, and then measure the input voltage at the thermoswitch connectors (wiring harness end). Check the wiring harness if out of specification.



S6AG8090

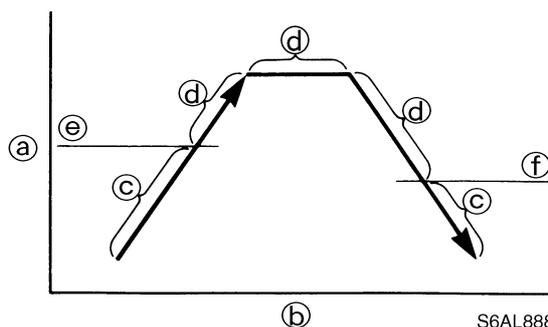
 Thermoswitch input voltage (reference data):  
Gray/black (Gy/B) – Black (B)  
7.5 V at engine idle speed

3. Push the engine stop button. (Tiller handle model)  
Turn the engine start switch to “OFF.” (Remote control model)
4. Remove the thermoswitch.
5. Place the thermoswitch in a container of water and slowly heat the water.



S6AG8100

6. Check the thermoswitch for continuity at the specified temperatures. Replace if out of specification.



S6AL8880

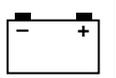
- Ⓐ Temperature
- Ⓑ Time
- Ⓒ No continuity
- Ⓓ Continuity

 Thermoswitch continuity temperature:  
Gray/black (Gy/B) – Black (B)  
Ⓔ: 76–84 °C (169–183 °F)  
Ⓕ: 63–77 °C (145–171 °F)

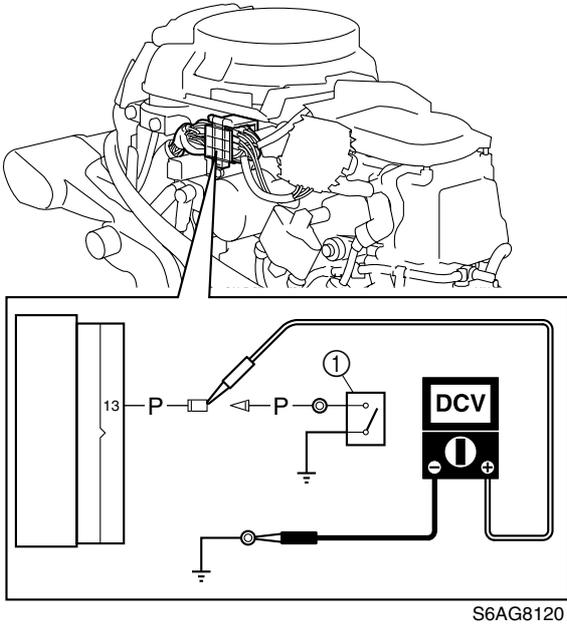
7. Install the thermoswitch, and then connect the thermoswitch connectors.

### Checking the oil pressure switch

1. Disconnect the oil pressure switch connector.

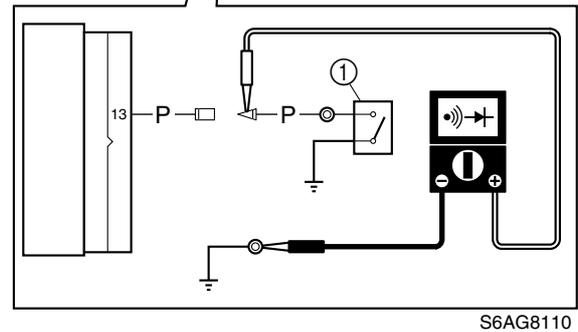
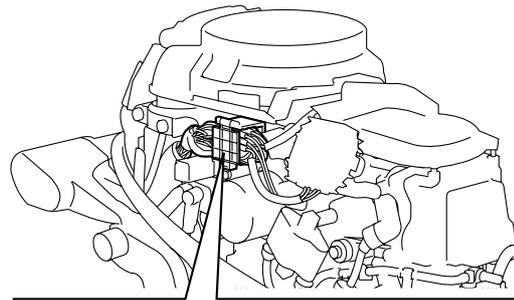


2. Start the engine, and then measure the input voltage between the oil pressure switch connector (wiring harness end) and the ground. Check the wiring harness if below specification.



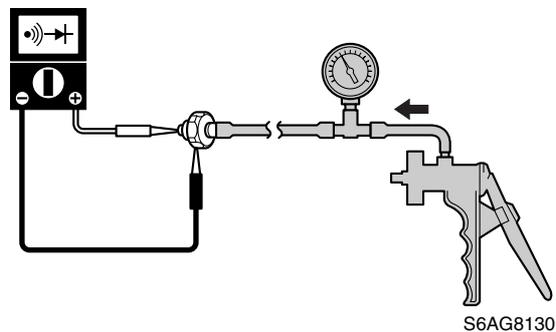
**Oil pressure switch input voltage (reference data):**  
 Pink (P) – Ground  
 12 V (battery voltage) at engine idle speed

3. Push the engine stop button. (Tiller handle model)  
Turn the engine start switch to “OFF.” (Remote control model)
4. Check the oil pressure switch ① for continuity when the engine is stopped and when it is running. Check the oil pressure and oil pressure switch if out of specification.



<b>Oil pressure switch continuity:</b> Oil pressure switch – Ground	
Engine condition	Continuity
Stopped	Yes
Running	No

5. Remove the oil pressure switch.
6. Connect the special service tool to the oil pressure switch.
7. Check the oil pressure switch for continuity at the specified pressure. Replace if out of specification.



**NOTE:** \_\_\_\_\_  
 Slowly operate the special service tool.

**Vacuum/pressure pump gauge set:**  
 90890-06756

 Oil pressure switch continuity: Oil pressure switch – Ground	
Oil pressure	Continuity
49.0 kPa (0.490 kgf/cm <sup>2</sup> , 7.105 psi) below	Yes
49.0 kPa (0.490 kgf/cm <sup>2</sup> , 7.105 psi) above	No

8. Install the oil pressure switch, and then connect the oil pressure switch connector.

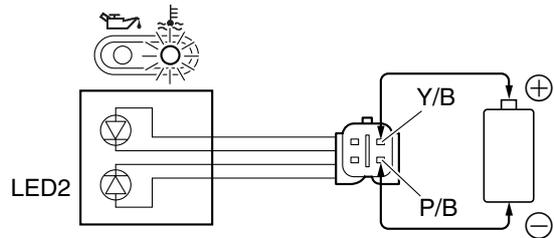
**NOTE:** \_\_\_\_\_

To check the oil pressure, see “Checking the oil pressure” (5-1).

**Checking the warning indicator assembly**

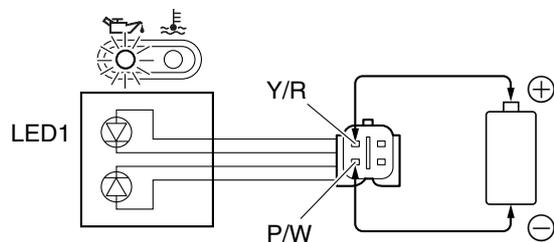
1. Disconnect the thermosthwitch connectors, and then ground the gray/black (Gy/B) lead (wiring harness end).
2. Start the engine and operate it at engine idle speed for at least 120 seconds, and then check that the overheat warning indicator comes on.
3. Disconnect the oil pressure switch connector, and then ground the pink (P) lead (wiring harness end).
4. Start the engine, increase the engine speed to approximately 2,000 r/min, and check that the oil pressure warning indicator comes on after 10 seconds.
5. Push the engine stop button. (Tiller handle model)  
Turn the engine start switch to “OFF.” (Remote control model)
6. Connect the thermosthwitch connectors and oil pressure switch lead terminal.
7. Disconnect the warning indicator assembly coupler.

8. Connect the yellow/black (Y/B) lead to the positive penlight battery terminal (1.5 V) and connect the pink/black (P/B) lead to the negative terminal, and then check that the warning indicator comes on. Replace the warning indicator assembly if it does not come on.



S6AG8300

9. Connect the yellow/red (Y/R) lead to the positive penlight battery terminal (1.5 V) and connect the pink/white (P/W) lead to the negative terminal, and then check that the warning indicator comes on. Replace the warning indicator assembly if it does not come on.



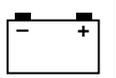
S6AG8290

**CAUTION:** \_\_\_\_\_

- Only use a penlight battery (1.5 V) when checking the LEDs. Other batteries (e.g., alkaline batteries or high-voltage batteries) will damage the diodes.
- Do not apply more than 1.7 V to the leads when checking the LEDs.

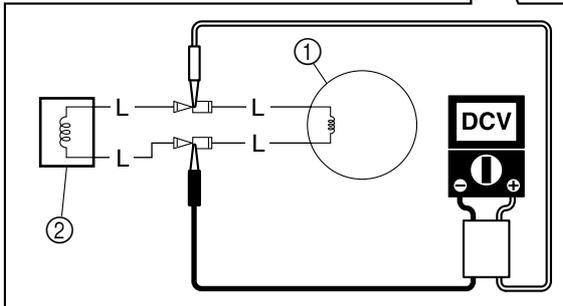
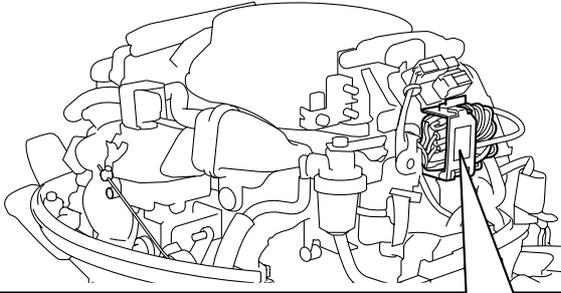
**NOTE:** \_\_\_\_\_

A feature of LEDs is that they only allow current to flow in one direction.



## Checking the power bobbin (for Prime Start)

1. Measure the power bobbin ① output peak voltage. Replace the stator coil assembly if below specification.



S6AG8250

### NOTE:

- To prevent the engine from starting when cranking it, be sure to disconnect both spark plug caps.
- Do not remove the clip from the engine stop lanyard switch.
- If measuring the output peak voltage under the unloaded conditions, disconnect the connectors.
- When using the manual starter to crank the engine, the voltage values may vary depending on the speed at which the starter handle is pulled.
- Measurements under the unloaded condition or when the Prime Start ② is malfunctioning may not be possible at 1,500 r/min because the engine speed may be too high.

 Power bobbin output peak voltage: Blue (L) – Blue (L)			
r/min	Unloaded		
	Cranking	1,500	3,500
DC V	10.3	27.8	63.2
r/min	Loaded		
	Cranking	1,500	3,500
DC V	9.5	27.5	61.6

2. Disconnect the power bobbin connectors.
3. Measure the power bobbin resistance. Replace the stator coil assembly if out of specification.

 Power bobbin resistance (reference data): Blue (L) – Blue (L) 0.77–1.04 $\Omega$ at 20 °C (68 °F)	
--	--

4. Connect the power bobbin connectors.

## Charging system (electric starter model)

### Checking the lighting coil

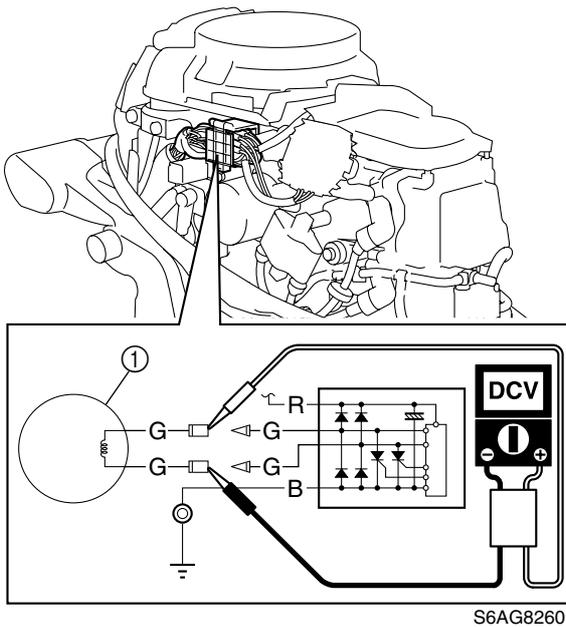
1. Disconnect the lighting coil connectors.
2. Measure the lighting coil ① output peak voltage. Replace the stator coil assembly if below specification.

### Checking the Rectifier Regulator

**CAUTION:**

If the battery cables are connected in reverse, the Rectifier Regulator can be damaged.

1. Measure the Rectifier Regulator ① output peak voltage. Check the Rectifier Regulator for continuity if the output peak voltage is below specification.



**NOTE:**

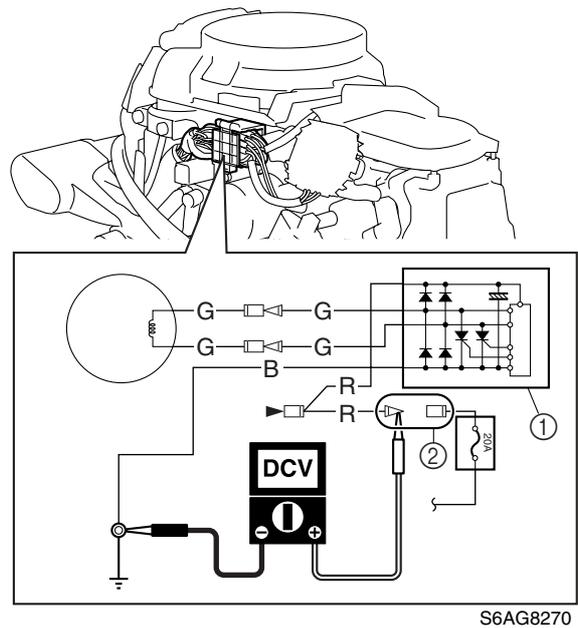
- To prevent the engine from starting when cranking it, be sure to disconnect both spark plug caps.
- Do not remove the clip from the engine stop lanyard switch.

	Lighting coil output peak voltage: Green (G) – Green (G)		
r/min	Unloaded		
	Cranking	1,500	3,500
DC V	13.4	33.2	75.4

3. Measure the lighting coil resistance. Replace the stator coil assembly if out of specification.

	Lighting coil resistance (reference data): Green (G) – Green (G) 0.31–0.43 Ω at 20 °C (68 °F)	
--	--	--

4. Connect the lighting coil connectors.

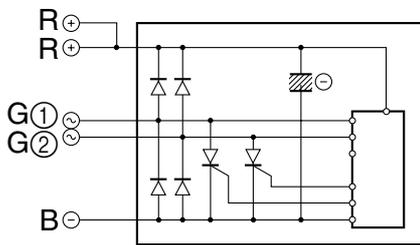
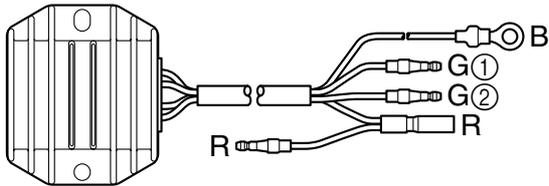


**NOTE:**

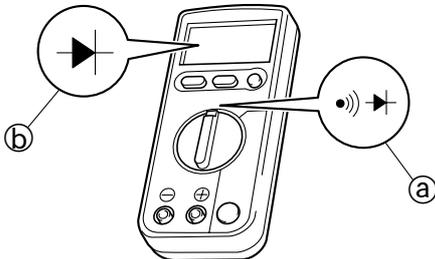
- Measure the Rectifier Regulator output peak voltage with the connector (R) ② disconnected.
- Do not use peak voltage adapter B when measuring the Rectifier Regulator output peak voltage.
- Be sure to check the lighting coil before measuring the Rectifier Regulator output peak voltage.

	Rectifier Regulator output peak voltage: Red (R) – Black (B)	
r/min	Unloaded	
	1,500	3,500
DC V	13	13

2. Disconnect the Rectifier Regulator connector and terminal.
3. Check the Rectifier Regulator for continuity. Replace if out of specification.



S6AG8280



S6S18360

**NOTE:** Be sure to set the measurement range (a), and display the mark (b) by pushing the "SHIFT" switch when checking the Rectifier Regulator continuity.

Rectifier Regulator continuity (testing diode)		
Tester lead		Display value (V) (reference data)
⊕	⊖	
G ①	R	0.434
G ①	B	OL
G ①	G ②	OL
G ②	R	0.454
G ②	B	OL
G ②	G ①	OL
B	R	0.838
B	G ①	0.458
B	G ②	0.460
R	B	OL
R	G ①	OL
R	G ②	OL

OL: Indicates an overload

---

## Troubleshooting

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Troubleshooting the lower unit .....	9-9

## Troubleshooting the outboard motor

**NOTE:**

Before troubleshooting the outboard motor:

- Make sure that fresh fuel of the specified type has been used.
- Make sure that the battery is fully charged.
- Be sure to check that the couplers, connectors, and battery terminals are securely connected.
- When checking the input voltage of a part, the coupler or connector must be disconnected. However, be careful not to short-circuit the wiring harness.
- Perform the troubleshooting as described in the following tables.

### Troubleshooting table format

Troubleshooting 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 causes of symptom 2.

Cause 2: The content considered as the trouble causes of cause 1.

### Troubleshooting the power unit

#### Symptom 1: Engine does not crank (manual starter model)

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Starter rope does not operate	Shift lever not in the neutral position	—	Set the shift lever to the neutral position.	3-9
	Start-in-gear protection cable not adjusted correctly	—	Adjust the start-in-gear protection cable.	3-11
	Manual starter malfunction	—	Disassemble and check the manual starter.	5-9
	Stuck piston	—	Disassemble and check the power unit.	5-1
	Piston lock due to water in the combustion chamber			
	Stuck drive shaft	Buildup of foreign material on the drive shaft and bushing	Disassemble and check the upper case. (L-transom model only)	7-15
Malfunction of the lower unit internal parts		Disassemble and check the lower unit.	6-12	
Starter rope operates, but the engine does not crank	Manual starter malfunction	—	Disassemble and check the manual starter.	5-9

**Symptom 1: Engine does not crank (electric starter model)**

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Starter motor does not operate	Shift lever or remote control lever not in the neutral position	—	Set the shift lever or remote control lever to the neutral position.	3-9 3-10
	Blown fuse	—	Check the fuse.	8-18
	Engine start button or engine start switch malfunction	—	Check the engine start button or engine start switch.	8-18
	Neutral switch malfunction	—	Check the neutral switch.	8-19 8-20
	Starter relay malfunction	—	Check the starter relay.	8-21
	Short, open, or loose connection in starter motor circuit	—	Check the wiring harness continuity.	WD
	Starter motor malfunction	—	Disassemble and check the starter motor.	8-14
Starter motor operates, but the engine does not crank	Stuck piston	—	Disassemble and check the power unit.	5-1
	Piston lock due to water in the combustion chamber			
	Stuck drive shaft	Buildup of foreign material on the drive shaft and bushing	Disassemble and check the upper case. (L-transom model only)	7-15
		Malfunction of the lower unit internal parts	Disassemble and check the lower unit.	6-12
Starter motor malfunction	—	Disassemble and check the starter motor.	8-14	

WD: See the wiring diagram.

**Symptom 1: Engine does not start (engine cranks)**

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Spark plug does not spark	Spark plug malfunction	—	Check the spark plug.	3-5
	Spark plug cap malfunction	—	Check the spark plug cap.	8-22
	Ignition coil malfunction	—	Check the ignition coil.	8-22
	Engine stop lanyard switch malfunction	—	Check the engine stop lanyard switch.	8-24
	Charge coil malfunction	—	Check the charge coil.	8-23
	Pulser coil malfunction	—	Check the pulser coil.	8-23
	CDI unit malfunction	—	Check the CDI unit.	8-25
Fuel not supplied	Pinched or kinked fuel hose	—	Check the fuel hoses and fuel hose joint.	3-2
	Clogged fuel filter	—	Clean or replace the fuel filter.	3-3
	Fuel pump malfunction	—	Disassemble and check the fuel pump.	4-6
	Carburetor malfunction	Malfunction of the carburetor internal parts	Disassemble and check the carburetor.	4-12
	Prime Start malfunction	—	Check the Prime Start.	4-13
Low compression pressure	Valve clearance not adjusted correctly	—	Adjust the valve clearance.	5-2
	Damaged cylinder head gasket	—	Disassemble and check the cylinder head and power unit.	5-37 5-51
	Damaged valve			
	Valve stuck to valve guide			
	Scratched piston and piston ring(s)			

**Symptom 1: Unstable engine idle speed, poor acceleration, poor performance, limited engine speed, or engine stalls**

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page	
Intermittent spark	Spark plug malfunction	—	Check the spark plug.	3-5	
	Spark plug cap malfunction	—	Check the spark plug cap.	8-22	
	Ignition coil malfunction	—	Check the ignition coil.	8-22	
	Engine stop lanyard switch malfunction	—	Check the engine stop lanyard switch.	8-24	
	Charge coil malfunction	—	Check the charge coil.	8-23	
	Pulser coil malfunction	—	Check the pulser coil.	8-23	
	CDI unit malfunction	—	Check the CDI unit.	8-25	
Incorrect fuel and air amount supplied	Pinched or kinked fuel hose	—	Check the fuel hoses and fuel hose joint.	3-2	
	Clogged fuel filter	—	Clean or replace the fuel filter.	3-3	
	Fuel pump malfunction	—	Disassemble and check the fuel pump.	4-6	
	Carburetor malfunction	Throttle stop screw not adjusted correctly	—	Adjust the throttle stop screw.	3-11
		Pilot screw not adjusted correctly	—	Adjust the pilot screw.	4-15
		Malfunction of the carburetor internal parts	—	Disassemble and check the carburetor.	4-12
Prime Start system malfunction	Prime Start malfunction	—	Check the Prime Start.	4-13	
	Power bobbin malfunction	—	Check the power bobbin.	8-29	

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Low compression pressure	Valve clearance not adjusted correctly	—	Adjust the valve clearance.	5-2
	Automatic decompression actuator malfunction	—	Disassemble and check the cylinder head and power unit.	5-37 5-43 5-51
	Damaged cylinder head gasket			
	Damaged valve			
	Scratched piston and piston ring(s)			
Throttle valve does not fully open	Throttle control system malfunction	Throttle cable(s) not adjusted correctly	Check and adjust the throttle cable(s).	3-7 3-8
—	Air leakage (carburetor to cylinder head)	Damaged gaskets, spacer, and intake manifold (carburetor to cylinder head)	Check the gaskets, spacer, and intake manifold (carburetor to cylinder head).	4-12 5-34

**Symptom 1: High engine idle speed**

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Prime Start system malfunction	Prime Start malfunction	—	Check the Prime Start.	4-13
	Power bobbin malfunction	—	Check the power bobbin.	8-29
Engine speed does not decrease when throttle control lever is in fully closed position	Carburetor malfunction	Throttle stop screw not adjusted correctly	Adjust the throttle stop screw.	3-11
		Pilot screw not adjusted correctly	Adjust the pilot screw.	4-15
		Malfunction of the carburetor internal parts	Disassemble and check the carburetor.	4-12
Throttle control lever does not return to fully closed position	Throttle control system malfunction	Throttle cable(s) not adjusted correctly	Check and adjust the throttle cable(s).	3-7 3-8
		Throttle cam not installed correctly	Check the throttle cam.	5-61

**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"> <li>• Buzzer comes on (remote control model)</li> <li>• Overheat warning indicator comes on</li> <li>• Cooling water does not discharge from the cooling water pilot hole</li> </ul>	Clogged cooling water inlet	—	Check the cooling water inlets.	3-7	
	Clogged cooling water passages	—	Check the cooling water passages.	3-7	
	Cooling water leakage				
	Damaged water pipe or incorrect installation	—	Check the water pipe and its installation.	7-15	
	Water pump malfunction	Damaged water pump impeller	Check the impeller.	6-5	
			Check the Woodruff key.	6-5	
			Water leakage from water pump housing	Check the water pump housing.	6-5
				Check the insert cartridge.	6-5
				Check the outer plate cartridge.	6-5
	Thermostat malfunction	—	Check the thermostat.	3-6	
Thermoswitch malfunction	—	Check the thermoswitch.	8-25		
<ul style="list-style-type: none"> <li>• Buzzer comes on (remote control model)</li> <li>• Oil pressure warning indicator comes on</li> </ul>	Insufficient engine oil	—	Add sufficient oil.	3-3	
	Engine oil pressure decrease	—	Check the oil pressure.	5-1	
		Oil pump malfunction	Check the oil pump.	5-47	
		Clogged oil strainer	Check the oil strainer.	7-16	
		Clogged oil passages	Check the engine oil passages (power unit and oil pump).	5-37	
		Clogged oil filter	Replace the oil filter.	3-4	
	Oil pressure switch malfunction	—	Check the oil pressure switch.	8-26	

**Troubleshooting the power tilt unit (Power tilt model)**
**Symptom 1: Power tilt unit does not operate**

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Power tilt relay does not operate	Blown fuse	—	Check the fuse.	7-47
	Power tilt switch malfunction	—	Check the power tilt switch.	7-49
	Short, open, or loose connection of the wiring harness	—	Check the wiring harness continuity.	WD
	Power tilt relay malfunction	—	Check the power tilt relay.	7-48
Power tilt motor does not operate	Short, open, or loose connection in power tilt motor circuit	—	Check the wiring harness continuity.	WD
	Power tilt motor malfunction	—	Disassemble and check the power tilt motor.	7-31
Power tilt motor operates, but the tilt ram does not extend	Manual valve left open	Manual valve malfunction	Check the manual valve.	7-38
	Insufficient power tilt fluid	—	Add sufficient fluid.	3-13
	Power tilt fluid leakage	—	Check the power tilt unit for leakage.	7-43
	Clogged filter	—	Disassemble and check the power tilt unit.	7-38
	Clogged fluid passages			
	Malfunction of the power tilt unit internal parts			

WD: See the wiring diagram.

**Symptom 1: Power tilt unit does not hold the outboard motor up**

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
—	Manual valve left open	Manual valve malfunction	Check the manual valve.	7-38
	Insufficient power tilt fluid	—	Add sufficient fluid.	3-13
	Power tilt fluid leakage	—	Check the power tilt unit for leakage.	7-43
	Clogged fluid passages	—	Disassemble and check the power tilt unit.	7-38
	Malfunction of the power tilt unit internal parts			

**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
—	Throttle open (tiller handle model)	—	Turn the throttle cam to the fully closed position. (Tiller handle model)	3-7
	Shift cable and shift cable joint malfunction (remote control model)	—	Check and adjust the shift cable and shift cable joint. (Remote control model)	3-10
	Remote control box malfunction (remote control model)	—	Check the remote control box. (Remote control model)	3-10
	Shift rod cam malfunction	—	Check the shift link rod.	3-9 3-10
		Detent malfunction	Check the shift rod cam.	5-13 5-15
	Shift rod operation malfunction	Shift rod not connected correctly	Check the connection of the shift rod.	6-17
		Shift rod not adjusted correctly	Adjust the shift rod.	6-17
	Shift mechanism malfunction (in lower unit)	—	Disassemble and check the lower unit.	6-7

**A.**

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— MEMO —

## Wiring diagram

### F15CMH, F20BMH

- ① CDI unit
- ② Stator coil assembly (charge coil)
- ③ Stator coil assembly (power bobbin)
- ④ Stator coil assembly (lighting coil)
- ⑤ Pulser coil
- ⑥ Primary Start
- ⑦ Ignition coil
- ⑧ Spark plug
- ⑨ Thermoswitch
- ⑩ Oil pressure switch
- ⑪ Engine stop lanyard switch
- ⑫ Warning indicator

Ⓐ To tachometer

#### Color code

B : Black  
G : Green  
L : Blue  
O : Orange  
P : Pink  
W : White  
B/R : Black/red  
G/R : Green/red  
Gy/B : Gray/black  
P/B : Pink/black  
P/W : Pink/white  
W/R : White/red  
Y/B : Yellow/black  
Y/R : Yellow/red

## Wiring diagram

### F15CEH, F20BEHP

- ① CDI unit
- ② Stator coil assembly (charge coil)
- ③ Stator coil assembly (power bobbin)
- ④ Stator coil assembly (lighting coil)
- ⑤ Pulser coil
- ⑥ Primary Start
- ⑦ Rectifier Regulator
- ⑧ Fuse (20A)
- ⑨ Starter motor
- ⑩ Starter relay
- ⑪ Battery
- ⑫ Ignition coil
- ⑬ Spark plug
- ⑭ Thermostat
- ⑮ Oil pressure switch
- ⑯ Neutral switch
- ⑰ Engine start button
- ⑱ Engine stop lanyard switch
- ⑲ Warning indicator
- ⑳ Power tilt motor (power tilt model)
- ㉑ Terminal (power tilt model)
- ㉒ Power tilt relay (power tilt model)
- ㉓ Power tilt switch (power tilt model)

- Ⓐ Power tilt model
- Ⓑ To tachometer

### Color code

B	: Black
Br	: Brown
G	: Green
L	: Blue
Lg	: Light green
O	: Orange
P	: Pink
R	: Red
Sb	: Sky blue
W	: White
B/R	: Black/red
G/R	: Green/red
Gy/B	: Gray/black
P/B	: Pink/black
P/W	: Pink/white
W/R	: White/red
Y/B	: Yellow/black
Y/R	: Yellow/red

## Wiring diagram

### F15CE, F15CEP, F20BE, F20BEP

- ① CDI unit
- ② Stator coil assembly (charge coil)
- ③ Stator coil assembly (power bobbin)
- ④ Stator coil assembly (lighting coil)
- ⑤ Pulser coil
- ⑥ Primary Start
- ⑦ Rectifier Regulator
- ⑧ Fuse (20A)
- ⑨ Starter motor
- ⑩ Starter relay
- ⑪ Battery
- ⑫ Ignition coil
- ⑬ Spark plug
- ⑭ Thermoswitch
- ⑮ Oil pressure switch
- ⑯ Warning indicator
- ⑰ Power tilt motor (power tilt model)
- ⑱ Terminal (power tilt model)
- ⑲ Power tilt relay (power tilt model)
- ⑳ Power tilt switch (power tilt model)

- Ⓐ Power tilt model
- Ⓑ To remote control

#### Color code

B	: Black
Br	: Brown
G	: Green
L	: Blue
Lg	: Light green
O	: Orange
P	: Pink
R	: Red
Sb	: Sky blue
W	: White
Y	: Yellow
B/R	: Black/red
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P/B	: Pink/black
P/W	: Pink/white
W/R	: White/red
Y/B	: Yellow/black
Y/R	: Yellow/red



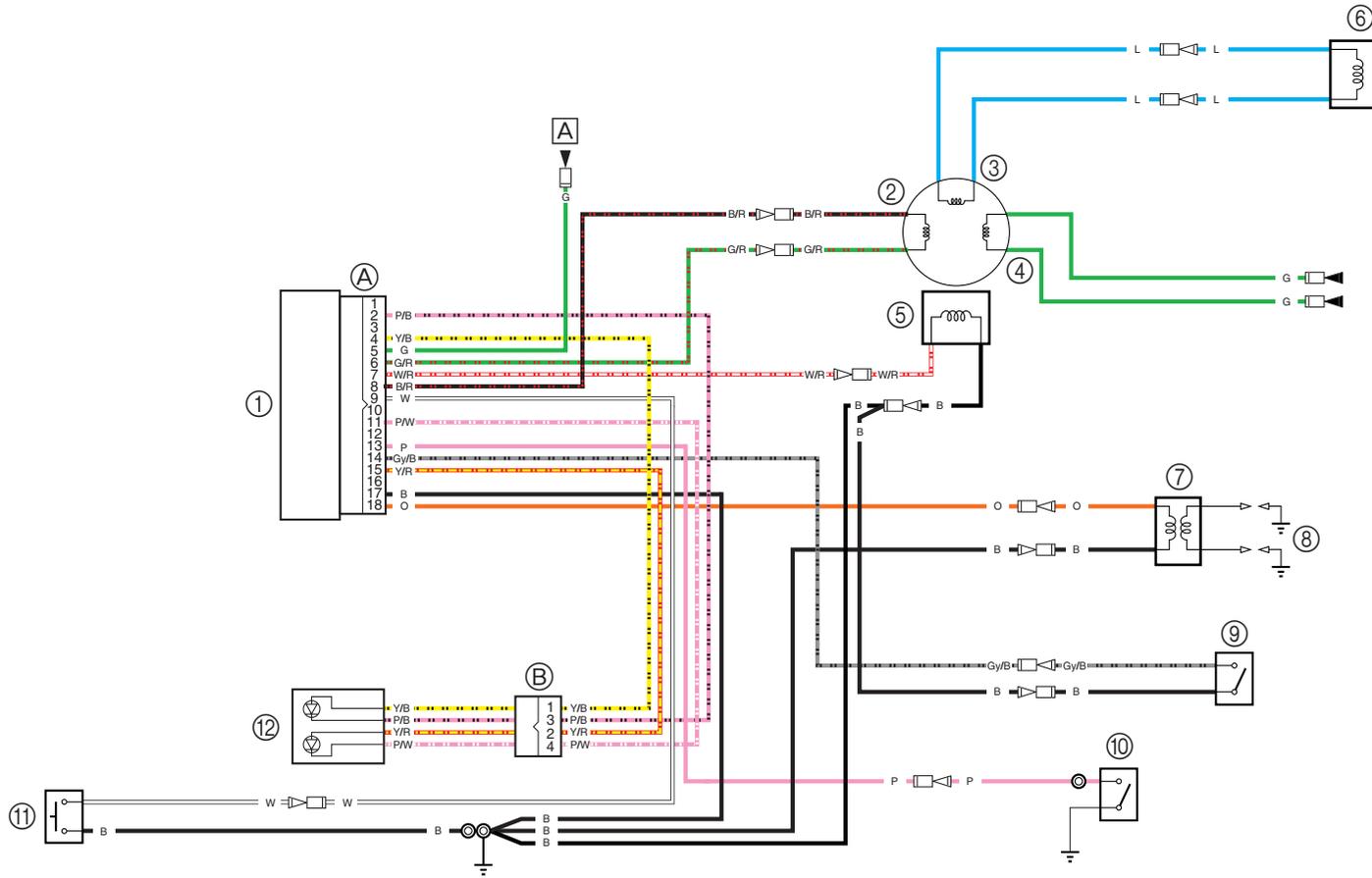


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# F15CMH, F20BMH

	A	B



# F15CEH, F20BEHP

