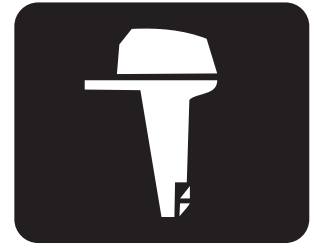




**YAMAHA**



**EK40G**  
**EK40J**

**SERVICE MANUAL**

**6H9-28197-5G-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.**

**EK40G/EK40J  
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.

- ① Parts are shown and detailed in an exploded diagram and are listed in the components list.
- ② Tightening torque specifications are provided in the exploded diagrams and after a numbered step with tightening instructions.
- ③ Symbols are used to indicate important aspects of a procedure, such as the grade of lubricant and lubrication point.
- ④ The components list consists of part names and quantities, as well as bolt and screw dimensions.
- ⑤ Service points regarding removal, checking, and installation are shown in individual illustrations to explain the relevant procedure.

**NOTE:**

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

**LOWR**

**Lower unit**

③      ②

Lower unit

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

6-5
62Y6A0K
62Y5A11

**LOWR**

**Lower unit**

①

**Removing the drive shaft**

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

Drive shaft holder 4 ①: 90890-06518  
Pinion nut holder ②: 90890-06505  
Socket adapter 2 ③: 90890-06507

**Disassembling the drive shaft**

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

**CAUTION:**

- Do not press the drive shaft threads ③ directly.
- Do not reuse the bearing, always replace it with a new one.

Bearing inner race attachment ②: 90890-06639

**CAUTION:**

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

Bearing separator ①: 90890-06534

- Remove the needle bearing from the forward gear.

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

6-19
62Y6750K
62Y5A11

④

⑤

## Symbols

The symbols below indicate the content of a chapter.

General information



Fuel system



Bracket unit



Specifications



Power unit



Electrical systems



Periodic checks and adjustments



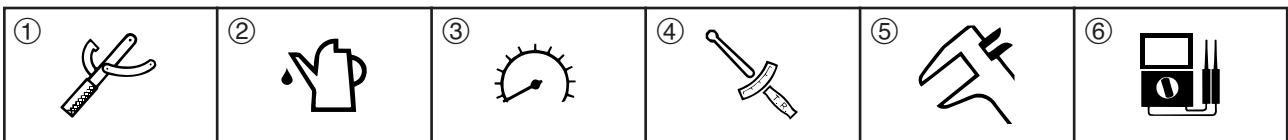
Lower unit



Troubleshooting

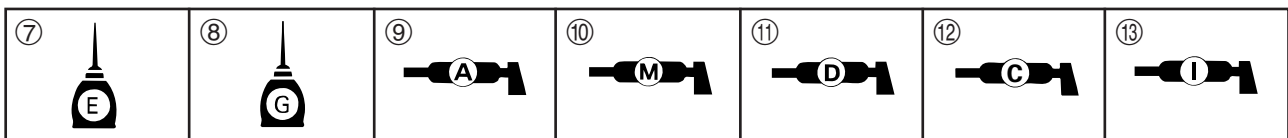


Symbols ① to ⑥ indicate specific data.



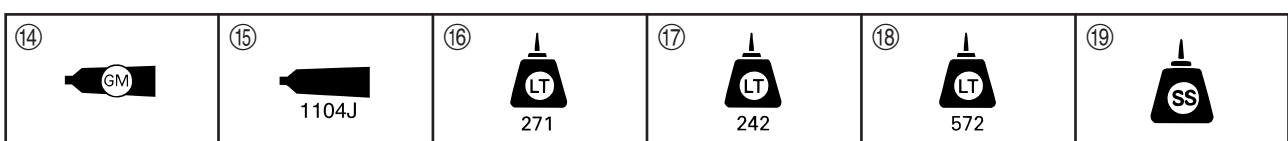
- ① Special tool
- ② Specified oil or fluid
- ③ Specified engine speed
- ④ Specified tightening torque
- ⑤ Specified measurement
- ⑥ Specified electrical value (resistance, voltage, electric current)

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



- ⑦ Apply Yamaha 2-stroke 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 Three bond 1104J
- ⑯ Apply LOCTITE 271 (red)
- ⑰ Apply LOCTITE 242 (blue)
- ⑱ Apply LOCTITE 572
- ⑲ Apply silicon sealant

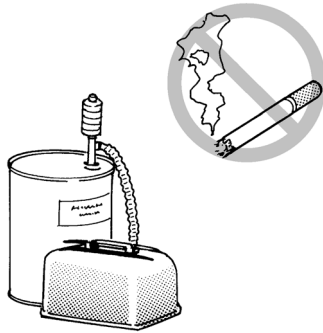


### Safety while working

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

#### Fire prevention

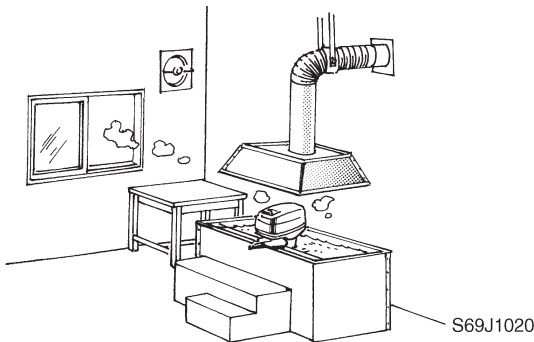
Gasoline is highly flammable. Keep gasoline and all flammable products away from heat, sparks, and open flames.



S69J1010

#### Ventilation

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

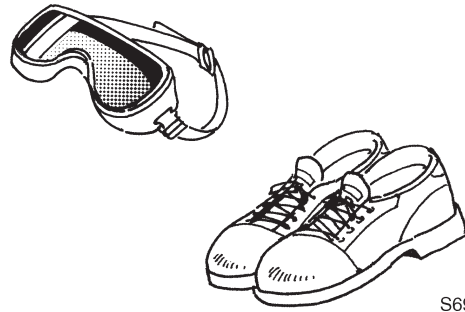


S69J1020

#### Self-protection

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

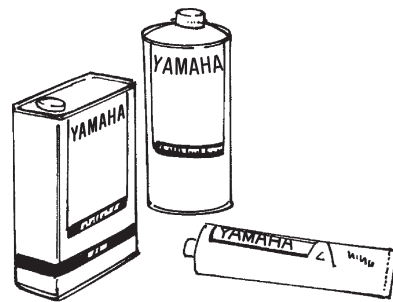
Protect your hands and feet by wearing protective gloves and safety shoes when necessary.



S69J1030

#### Parts, lubricants, and sealants

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



S69J1040

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

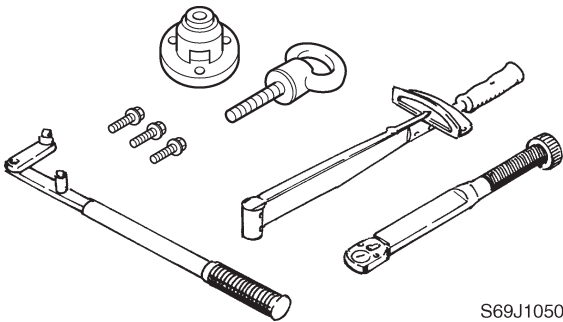
1. Maintain good standards of personal and industrial hygiene.
2. Change and wash clothing as soon as possible if soiled with lubricants.
3. Avoid contact with skin. Do not, for example, place a soiled rag in your pocket.
4. Wash hands and any other part of the body thoroughly with soap and hot water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

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

### Good working practices

#### Special service tools

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



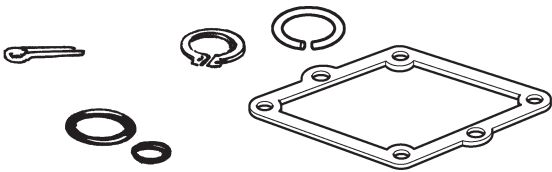
S69J1050

#### Tightening torques

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

#### Non-reusable parts

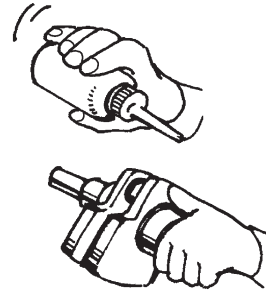
Always use new gaskets, seals, O-rings, cotter pins, circlips, etc., when installing or assembling parts.



S69J1060

### Disassembly and assembly

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



S69J1070

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



**Identification**

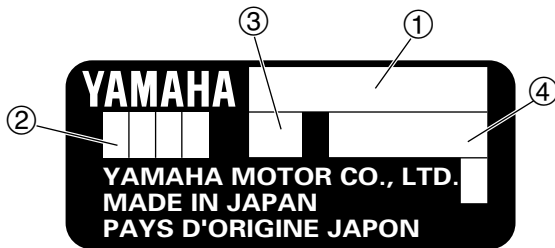
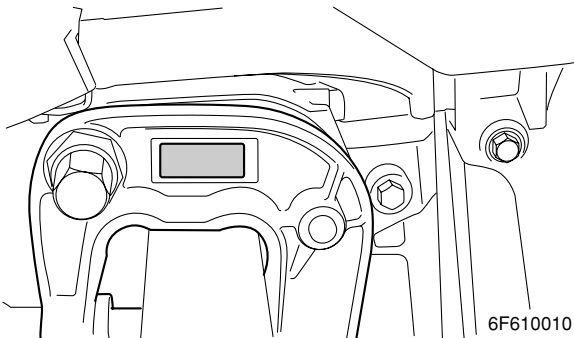
**Applicable model**

This manual covers the following models.

Applicable models
EK40GMH, EK40JMH, EK40JW

**Serial number**

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



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

Model name	Approved model code	Starting serial No.
EK40G	6F5K	1006117-
EK40J	6H9K	1001748-

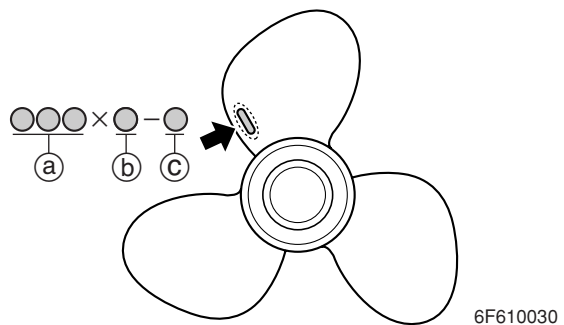
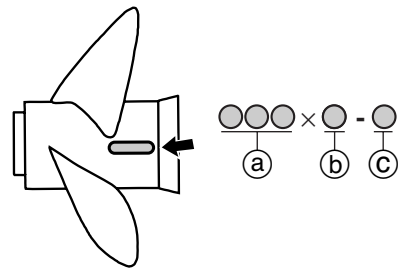
**Propeller selection**

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 the outside of the propeller boss or the propeller blade.



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

**Selection**

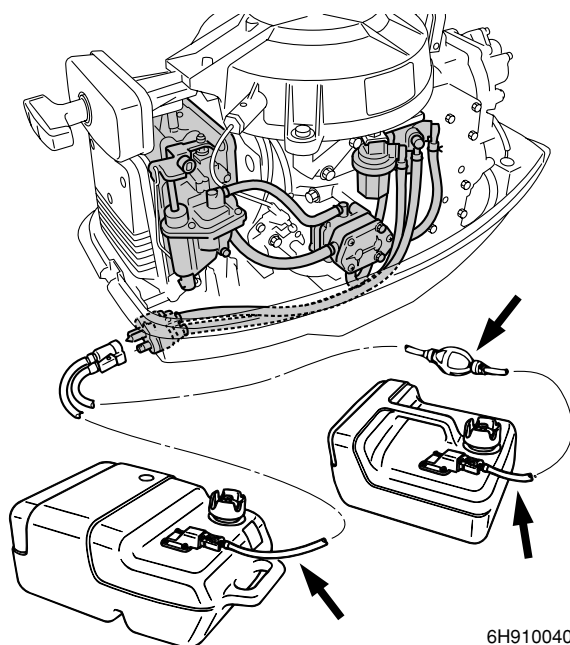
When the engine speed is at the full throttle operating range (4,500–5,500 r/min), the ideal propeller for the boat is one that provides maximum performance in relation to boat speed and fuel consumption.

**EK40G**

Propeller size (in)	Material
11 3/4 × 7 1/2 - H	Aluminum
11 3/4 × 8 3/4 - H	
11 3/4 × 10 - H	
11 1/2 × 11 - H	
11 1/2 × 12 - H	
11 1/2 × 13 - H	
11 1/2 × 13 1/2 - H	

**EK40J**

Propeller size (in)	Material
12 1/4 × 9 - G	Aluminum
11 3/4 × 10 - G	
11 5/8 × 11 - G	
12 × 11 - G	
11 3/8 × 12 - G	
11 3/4 × 12 - G	
11 1/8 × 13 - G	
11 1/2 × 13 - G	
10 1/4 × 14 - G	
11 1/4 × 14 - G	
10 1/4 × 15 - G	
11 × 15 - G	
10 1/4 × 16 - G	
10 3/4 × 16 - G	
10 3/4 × 17 - G	



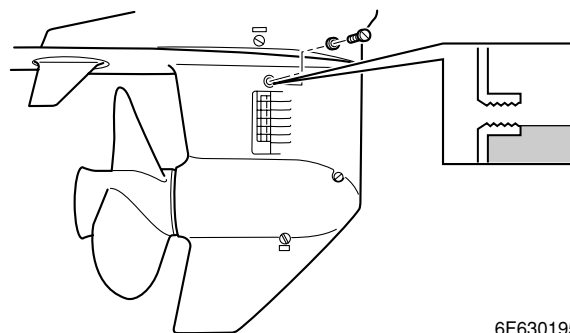
6H910040

**CAUTION:**

Use pre-mixed fuel only. Fuel and oil mixing ratio is 30:1. For break-in period, gasoline: 25:1, kerosene: 30:1 mixture shall be used.

**Checking the gear oil**

1. Check the gear oil level.



6F630195

**Checking the battery (W)**

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



Recommended battery capacity:  
 CCA/EN: 347 A  
 20HR/IEC: 40 Ah  
 Electrolyte specified gravity:  
 1.280 at 20°C (68°F)

**Predelivery checks**

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

**Checking the fuel system**

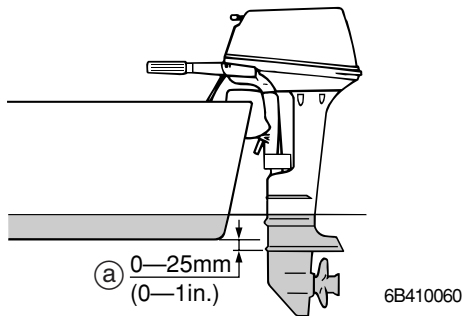
1. Check that the fuel hose is securely connected and that the fuel tank is filled with fuel.



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

**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.



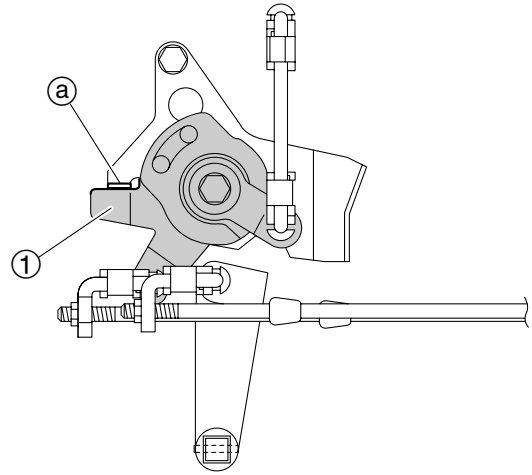
**NOTE:**

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

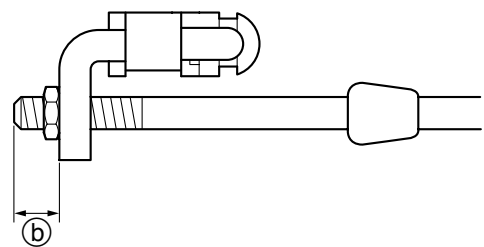
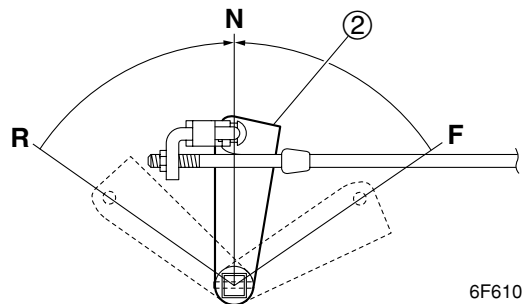
2. Check that the clamp brackets are secured with the clamp screws.

**Checking the remote control cables (remote control model)**

1. Set the remote control lever to the neutral position and fully close the throttle lever.
2. Check that the throttle pulley ① is in its fully closed position, and check the pulley is contact the fully stopper ② on the bracket.



3. Check that the shift lever ② is in the neutral position.



**WARNING**

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

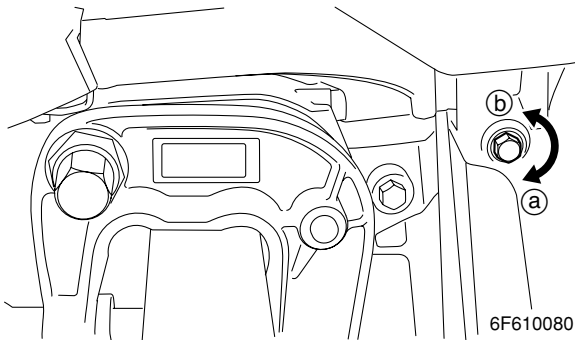
**NOTE:**

Check the throttle valve fully open, after setting the remote control cables.



### Checking the steering system

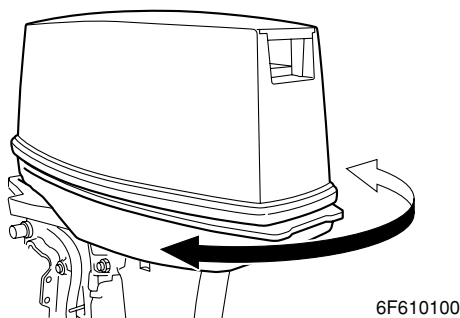
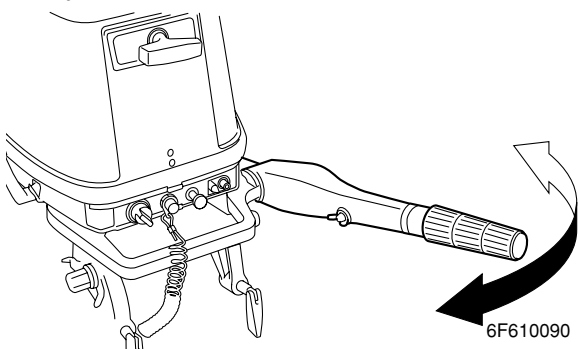
1. Check the steering friction for proper adjustment.



**NOTE:**

- To increase the friction, turn the friction adjusting bolt in direction (a).
- To decrease the friction, turn the friction adjusting bolt in direction (b).

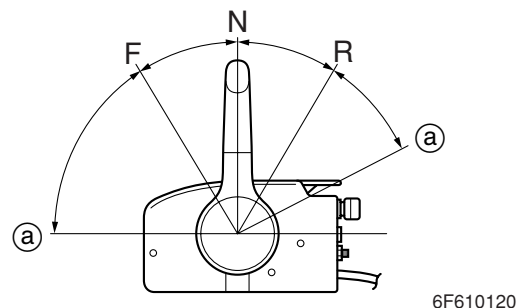
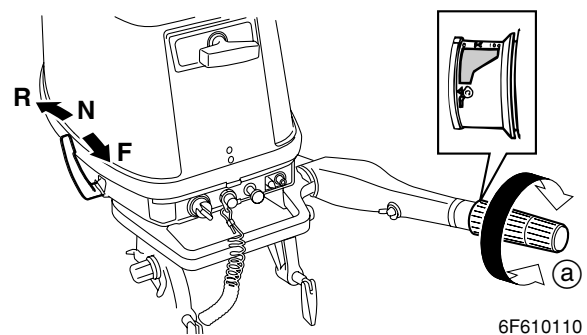
2. Check that the steering operates smoothly.



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

### Checking the gear shift and throttle operation

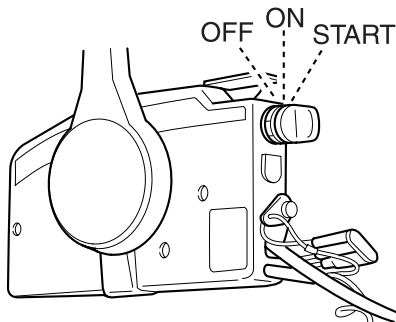
1. Check that the gear shift operates smoothly when the shift lever or remote control lever is shifted from neutral to forward or reverse.
2. Check that the throttle operates smoothly when the throttle grip (tiller handle model) is turned from the fully closed position to the fully open position (a).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





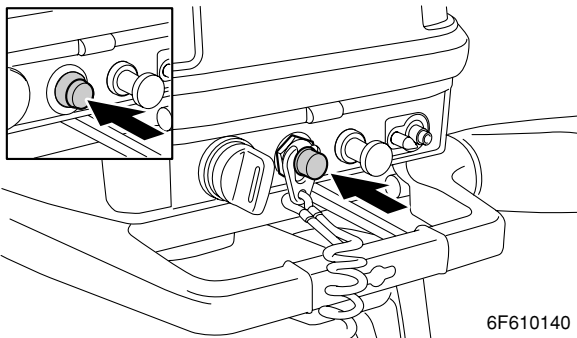
**Checking the engine start switch, engine stop lanyard switch and engine stop button**

1. Check that the engine starts when the engine start switch is turned to START. (remote control model)
2. Check that the engine turns off when the engine start switch is turned to OFF. (remote control model)

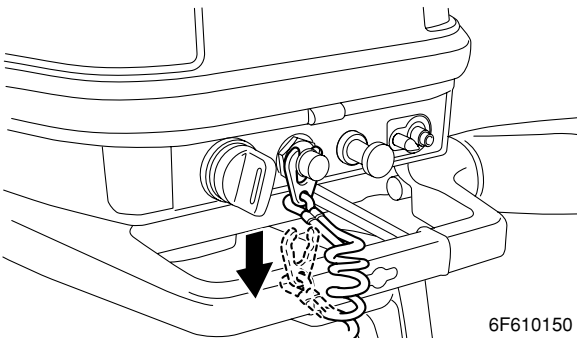


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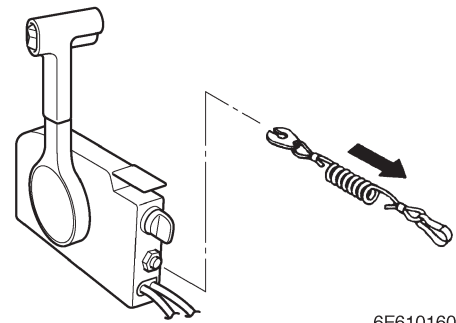
3. Check that the engine turns off when the engine stop lanyard switch (and or engine stop button) is pushed or the engine stop lanyard is pulled from the engine stop lanyard switch.



6F610140



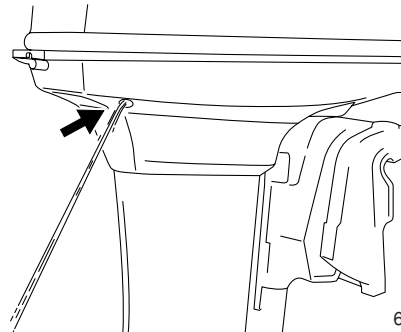
6F610150



6F610160

**Checking the cooling water pilot hole**

1. Check that cooling water is discharged from the cooling water pilot hole.



6F610170

**Test run**

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

**NOTE:** \_\_\_\_\_  
 \_\_\_\_\_  
 The test run is part of the break-in operation.

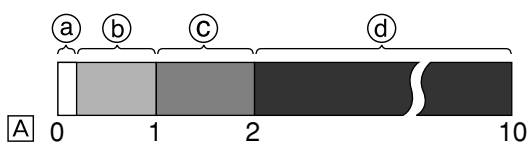
### Break-in

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

1. 10 minutes (a) at the lowest possible speed. A fast idle in neutral is best.
2. 50 minutes (b) at 1/2 throttle (approximately 3,000 r/min) or less. Vary engine speed occasionally. On an easy-planing boat, accelerate at full throttle onto plane, then immediately reduce the throttle to 3,000 r/min or less.
3. 1 hour (c) at 3/4 throttle (approximately 4,000 r/min). Vary engine speed occasionally. Run at full throttle for 1 minute, then allow about 10 minutes of operation at 3/4 throttle or less to let the engine cool.
4. 8 hours (d) at any speed, but avoid operating at full throttle for more than 5 minutes at a time. Let the engine cool between full-throttle runs. Vary engine speed occasionally.
5. After the first 10 hours. Use standard pre-mix ratio of fuel and oil. Refer to page 1-6.

### After test run

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



6F610180

[A] Hours

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— MEMO —

# Specifications

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- Maintenance specification ..... 2-3**
  - Power unit ..... 2-3
  - Lower unit ..... 2-5
  - Electrical ..... 2-5
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- Tightening torques ..... 2-9**
  - Specified torques ..... 2-9
  - General torques ..... 2-10

## General specification

Item	Unit	Model		
		EK40GMH	EK40JMH	EK40JW
<b>Dimensions</b>				
Overall length	mm (in)	997 (39.3)		692 (27.2)
Overall width	mm (in)	484 (19.1)		363 (14.3)
Overall height			1,208 (47.6)	
(S)	mm (in)	1,215 (47.8)		
(L)	mm (in)	1,342 (52.8)	1,335 (52.6)	–
Boat transom height		381 (15.0)		
(S)	mm (in)			
(L)	mm (in)	508 (20.2)		–
<b>Weight</b>				
(with aluminum propeller)			70.0 (154)	
(S)	kg (lb)	65.0 (143)		
(L)	kg (lb)	68.0 (150)	72.0 (159)	–
<b>Performance</b>				
Maximum output	kW (hp)	29.4 (40) at 5,000 r/min		
Full throttle operating range	r/min	4,500–5,500		
Maximum fuel consumption	L (US gal, Imp gal)/hr	19.5 (5.2, 4.3) at 5,500 r/min		
Engine idle speed	r/min	1,050–1,150		
<b>Power unit</b>				
Engine type		2-stroke, L		
Cylinder quantity		2		
Total displacement	cm <sup>3</sup> (cu. in)	669 (40.82)		
Bore x stroke	mm (in)	78.0 × 70.0 (3.07 × 2.76)		
Compression ratio		5.00		
Intake system		Reed valve		
Scavenging system		Loop charge		
Control system		Tiller handle		Remote control
Starting system		Manual		Manual and electric
Fuel system		Carburetor		
Ignition control system		CDI		
Maximum generator output	(W) V, A	(80)	(80)	12, 6
Starting enrichment		Choke valve		
Spark plug	(NGK)	B7HS (NGK)		
Cooling system		Water		
Exhaust system		Under water	Propeller boss	
Lubrication system		Pre-mixed fuel		

## General specification

Item	Unit	Model		
		EK40GMH	EK40JMH	EK40JW
<b>Fuel and oil</b> Fuel type Engine oil Engine oil grade Gear oil type Gear oil grade (*1) Gear oil quantity	NMMA-certified  API SAE cm <sup>3</sup> (US oz, Imp oz)	Regular gasoline and kerosene 2-stroke outboard motor oil TC-W3 Hypoid gear oil GL-4 90 315 (10.65, 11.11)		
<b>Bracket unit</b> Trim angle (at 12° boat transom) Tilt-up angle Steering angle	Degree  Degree Degree	8, 12, 16, 20, 24  67 45 + 45		
<b>Drive unit</b> Gear shift positions Gear ratio Reduction gear type Clutch type Propeller shaft type Propeller direction (rear view) Propeller ID mark		F-N-R 1.85 (24/13)      2.00 (26/13) Spiral bevel gear Dog clutch Share pin      Spline Clockwise H      G		
<b>Electrical</b> Battery minimum capacity (*2) CCA/EN 20HR/IEC		—      —      347 —      —      40		

(\*1) Meeting both API and SAE requirements

(\*2) CCA: Cold Cranking Ampere

EN: European Norm (European standard)

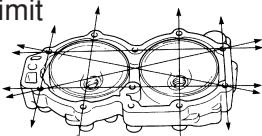

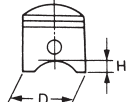
IEC: International Electrotechnical Commission





## Maintenance specification

### Power unit

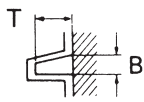
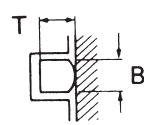
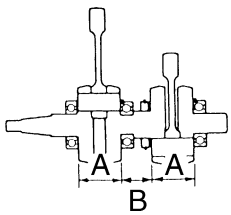
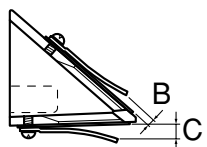
Item	Unit	Model		
		EK40GMH	EK40JMH	EK40JW
<b>Power unit</b> Minimum compression pressure (*1)	kPa (kgf/cm <sup>2</sup> , psi)	400 (4.0, 58)		
<b>Cylinder head</b> Warpage limit  (lines indicate straightedge position)	mm (in)	0.1 (0.0039)		
<b>Cylinders</b> Bore size Wear limit Taper limit Out-of-round limit 	mm (in) mm (in) mm (in) mm (in)	78.000–78.020 (3.0709–3.0716) 78.100 (3.0700) 0.08 (0.0032) 0.05 (0.0020)		
<b>Pistons</b> Piston diameter (D) Measuring point (H) Piston-to-cylinder clearance (limit) Piston pin boss bore Oversize piston 1st 2nd Oversize piston diameter 1st 2nd 	mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in)	77.940–77.965 (3.0685–3.0695) 10.0 (0.39) 0.055–0.060 (0.0022–0.0024) 0.110 (0.0043) 19.904–19.915 (0.7836–0.7841)  0.25 (0.010) 0.50 (0.020)  78.190–78.215 (3.0783–3.0793) 78.440–78.465 (3.0882–3.0892)		
<b>Piston pins</b> Outside diameter	mm (in)	19.895–19.900 (0.7833–0.7835)		

(\*1) Measuring conditions:

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

The figures are for reference only.



Item	Unit	Model		
		EK40GMH	EK40JMH	EK40JW
<b>Piston rings</b>				
Top ring				
Dimension B 	mm (in)	1.970–1.990 (0.0776–0.0783)		
Dimension T	mm (in)	2.500–2.700 (0.0984–0.1063)		
End gap	mm (in)	0.30–0.50 (0.0118–0.0197)		
Side clearance	mm (in)	0.02–0.06 (0.0008–0.0024)		
Oversize diameter				
1st	mm (in)	78.25 (3.0807)		
2nd	mm (in)	78.50 (3.0906)		
2nd piston ring 				
Dimension B	mm (in)	1.970–1.990 (0.0776–0.0783)		
Dimension T	mm (in)	2.500–2.700 (0.0984–0.1063)		
End gap	mm (in)	0.30–0.50 (0.0118–0.0197)		
Side clearance	mm (in)	0.03–0.07 (0.0012–0.0028)		
Oversize diameter				
1st	mm (in)	78.25 (3.0807)		
2nd	mm (in)	78.50 (3.0906)		
<b>Connecting rods</b>				
Small-end inside diameter	mm (in)	24.900–24.912 (0.9803–0.9808)		
Big-end side clearance	mm (in)	0.200–0.700 (0.0079–0.0276)		
Small-end axial play limit	mm (in)	2.0 (0.08)		
<b>Crankshaft</b>				
Crankshaft width A	mm (in)	61.40–61.45 (2.4173–2.4193)		
Crankshaft width B	mm (in)	41.38–41.60 (1.6291–1.6378)		
Crankpin diameter	mm (in)	26.995–27.000 (1.0627–1.0629)		
Runout limit	mm (in)	0.03 (0.0012)		
				
<b>Thermostat</b>				
Opening temperature	°C (°F)	58–62 (136–144)		
Fully open temperature	°C (°F)	70 (158)		
Valve open lower limit	mm (in)	3.0 (0.12)		
<b>Reed valves</b>				
Valve bending limit	mm (in)	0.2 (0.0079)		
Valve stopper height B	mm (in)	2.2–2.6 (0.087–0.102)		
Valve stopper height C	mm (in)	4.0–4.4 (0.157–0.173)		
				

Item	Unit	Model			
		EK40GMH		EK40JMH	EK40JW
<b>Carburetor</b>		6F542		6H903	
ID mark		Kerosene	Gasoline	Kerosene	Gasoline
Main jet (M.J.)	#	145	—	140	—
Main air jet (M.A.J.)		ø1.70	—	ø1.70	—
Main nozzle (M.N.)	mm (in)	3.2 (0.13)	—	3.2 (0.13)	—
Pilot jet (P.J.)	#	90	60	90	60
Pilot air jet (P.A.J.)		ø1.00	ø1.20	ø1.00	ø1.20
Pilot screw (P.S.)	turns out	3/4 – 1 1/4		3/4 – 1 1/4	
Valve seat size	mm (in)	2.0 (0.08)	1.2 (0.05)	2.0 (0.08)	1.2 (0.05)
Float height	mm (in)	12.0–13.0 (0.47–0.51)	4.0–5.0 (0.16–0.20)	12.0–13.0 (0.47–0.51)	4.0–5.0 (0.16–0.20)

### Lower unit

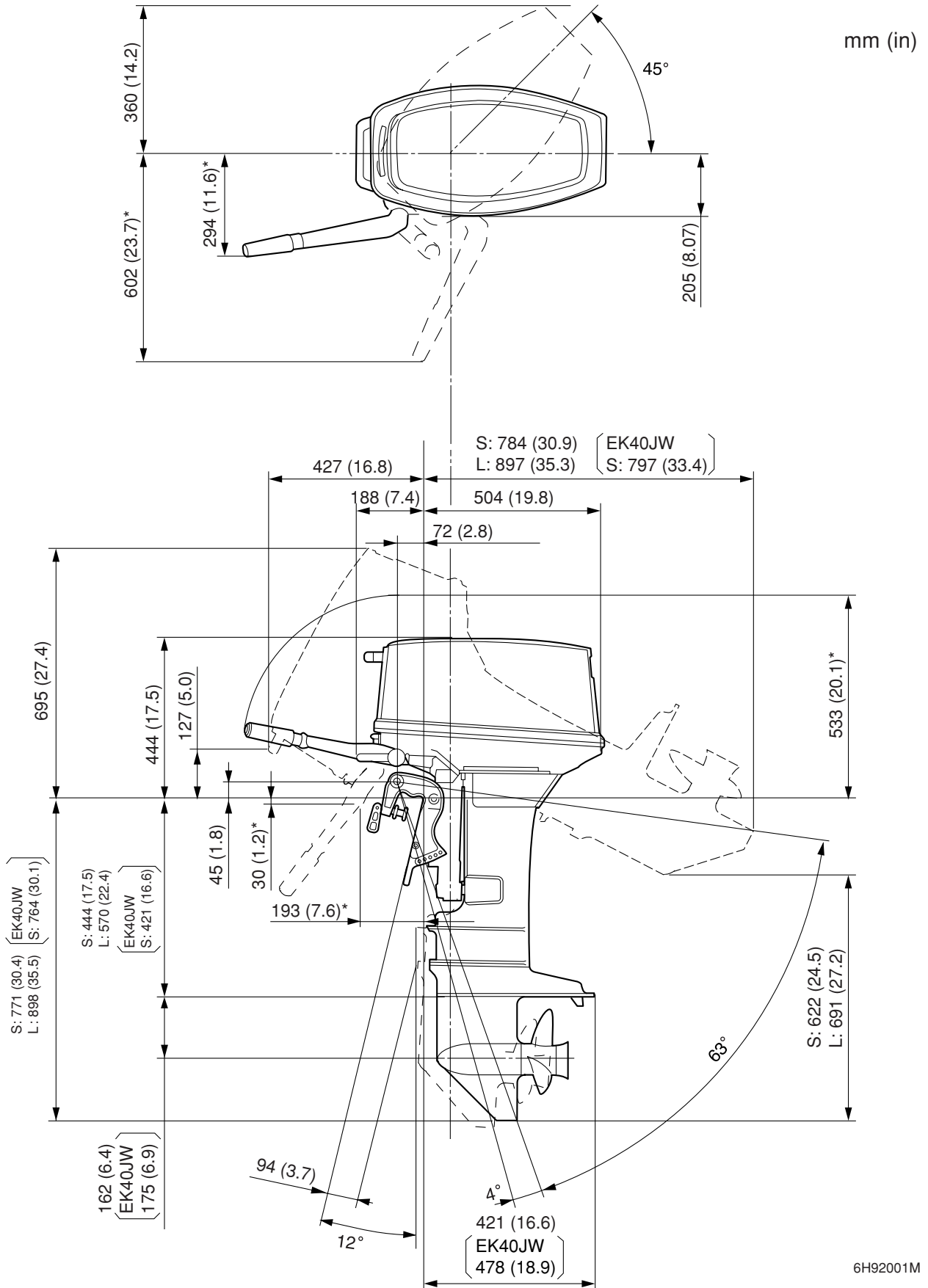
Item	Unit	Model		
		EK40GMH	EK40JMH	EK40JW
<b>Gear backlash</b>				
Pinion-to-forward	mm (in)	0.05–0.24 (0.0020–0.0094)	0.19–0.47 (0.0075–0.0185)	
Pinion-to-reverse	mm (in)	0.40–0.59 (0.0157–0.0232)	0.76–1.04 (0.0299–0.0409)	
Pinion gear shims	mm	0.70, 0.75, 0.80, 0.85	0.05, 0.08, 0.12, 0.30, 0.50	
Forward gear shims	mm	0.70, 0.80, 0.90,	0.05, 0.08, 0.12, 0.30, 0.50	
Reverse gear shims	mm	1.00, 1.10, 1.20 1.80, 1.90, 2.00, 2.10, 2.20, 2.30, 2.40, 2.50	0.05, 0.08, 0.12, 0.30, 0.50	

### Electrical

Item	Unit	Model		
		EK40GMH	EK40JMH	EK40JW
<b>Ignition and ignition control system</b>				
Ignition timing (full retard)	Degree	BTDC 9 at engine idle speed		
Ignition timing (full advanced)	Degree	BTDC 23		
Ignition spark gap	mm (in)	0.6–0.7 (0.024–0.028)		
Ignition coil resistance				
Primary coil (O–B) at 20°C (68°F)	Ω	0.26–0.35		

Item	Unit	Model		
		EK40GMH	EK40JMH	EK40JW
Secondary coil (spark plug wire–spark plug wire) at 20°C (68°F)	kΩ	6.8–10.2		
CDI unit output peak voltage (O–B)				
at Cranking (loaded)	V		160	
at 1,500 r/min (loaded)	V		185	
at 3,500 r/min (loaded)	V		170	
Pulser coil output peak voltage (W/R–B, W/B–B)				
at Cranking (unloaded)	V		10.0	
at Cranking (loaded)	V		10.0	
at 1,500 r/min (loaded)	V		30.0	
at 3,500 r/min (loaded)	V		66.0	
Pulser coil resistance (W/R–B)	Ω		16.2–19.8	
Pulser coil resistance (W/B–B)	Ω		16.2–19.8	
Charge coil output peak voltage (Positive side: Br– Negative side: L)				
at Cranking (unloaded)	V		150	
at Cranking (loaded)	V		140	
at 1,500 r/min (loaded)	V		190	
at 3,500 r/min (loaded)	V		180	
Charge coil resistance (Br–L)	Ω		243–297	
<b>Starter motor</b>				
Type				
Brushes		—	—	Bendix
Length limit	mm (in)	—	—	9.0 (0.35)
Armature				
Commutator undercut limit	mm (in)	—	—	0.2 (0.01)
<b>Charging system</b>				
Fuse	A	—	—	20
Lighting coil output peak voltage (G–G)				
at Cranking (unloaded)	V		6.0	
at 1,500 r/min (unloaded)	V		17.0	
at 3,500 r/min (unloaded)	V		38.0	
Lighting coil resistance (G–G)	Ω		0.32–0.39	
Rectifier output peak voltage (R–B)				
at 1,500 r/min (unloaded)	V		13	
at 3,500 r/min (unloaded)	V		13	

**Dimensions  
Exterior**

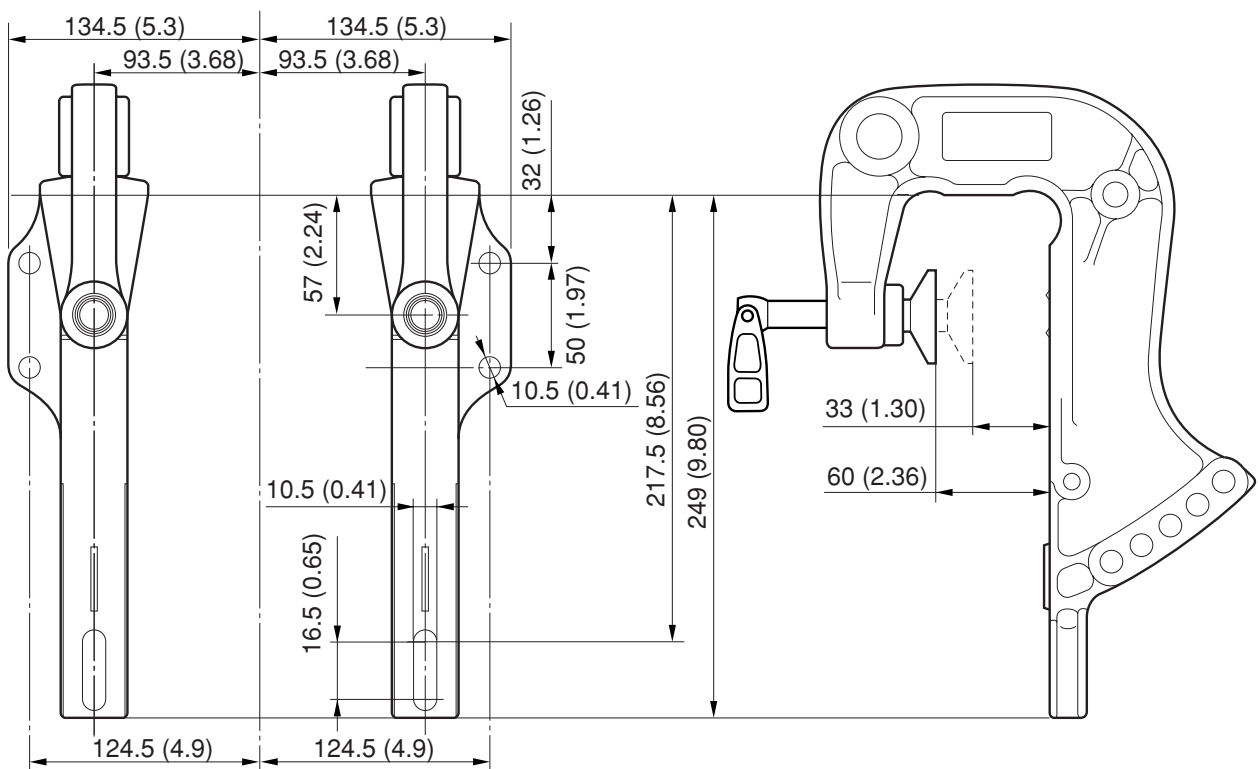


6H92001M

Clamp bracket

mm (in)

2



6F62002M

## Tightening torques

### Specified torques

Part to be tightened		Thread size	Tightening torques		
			N·m	kgf·m	ft·lb
<b>Fuel system</b>					
Main jet		—	4	0.4	3.0
<b>Power unit</b>					
Power unit mounting bolt		M8	21	2.1	15.5
Flywheel nut		M20	160	16	115
Manual starter nut		M6	10	1.0	7.2
Manual starter bolt		M6	15	1.5	11.1
Starter motor bolt		M8	29	2.9	21
Starter relay terminal nut		M6	4	0.4	3.0
Cylinder head bolt	1st	M8	15	1.5	11.1
	2nd		30	3.0	22
Cylinder head cover bolt		M6	12	1.2	8.7
Exhaust outer cover bolt		M6	8	0.8	5.8
Crankcase bolt	1st	M8	20	2.0	15
	2nd		40	4.0	29.5
Spark plug		M14	25	2.5	18
<b>Lower unit</b>					
Check screw		—	9	0.9	6.6
Drain screw		—	9	0.9	6.6
Lower case mounting bolt		M8	21	2.1	15.5
Lower case cap bolt (EK40G)	1st	M6	4	0.4	3.0
	2nd		8	0.8	5.8
Cooling water inlet cover (EK40J)		M5	4	0.4	3.0
Propeller nut (EK40J)		M16	35	3.5	25.3
Propeller shaft housing ring nut (EK40J)		—	90	9.0	65
Pinion nut (EK40J)		M12	74	7.4	54.6
<b>Bracket unit</b>					
Throttle grip screw		M5	3	0.3	2.2
Engine stop lanyard switch nut		—	5	0.5	3.6
Upper mount nut		M8	28	2.8	20
Lower mount nut		M12	55	5.5	40
Clamp bolt	1st	M8	14	1.4	10
	2nd		24	2.4	17.7
Self locking nut		M22	45	4.5	33
Bracket nut		M6	24	2.4	17.7
Clamp pad bolt		M6	10	1.0	7.2
Tilt lever bolt		M5	4	0.4	3.0
Grease nipple		—	3	0.3	2.2

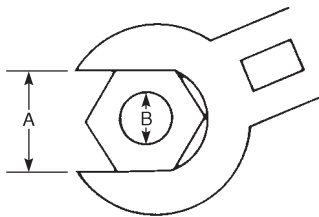
## General torques

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	3.6
10 mm	M6	8	0.8	5.8
12 mm	M8	18	1.8	13
14 mm	M10	36	3.6	26
17 mm	M12	43	4.3	31



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— MEMO —

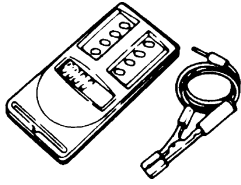


## Periodic checks and adjustments

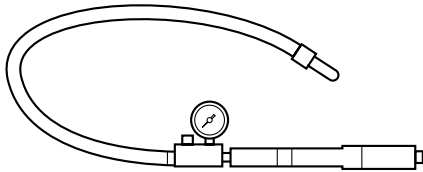
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## Special service tools



**Digital tachometer**  
**90890-06760**



**Leakage tester**  
**90890-06840**

### Maintenance interval chart

Use the following chart as a guideline for general maintenance.

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

Item	Actions	Initial		Every		Refer to page
		10 hours (Break-in)	50 hours (3 months)	100 hours (6 months)	200 hours (1 year)	
Anode (s) (external)	Check / replace		○	○		3-9
Anode (s) (internal)	Check / replace				○	5-30
Battery	Check / charge	○				3-9
Cooling water passages	Clean		○	○		3-4
Cowling clamp	Check				○	3-3
Fuel filter (can be dis-assembled)	Check / clean	○	○	○		3-3
Fuel system	Check	○	○	○		3-3
Fuel tank (Yamaha portable tank)	Check / clean				○	—
Gear oil	Change	○		○		3-8
Lubrication points	Lubricate			○		3-10
Idling speed (carburetor model)	Check / adjust	○		○		3-7
Propeller and cotter pin	Check / replace		○	○		3-9
Shift link / shift cable	Check / adjust				○	3-7
Thermostat	Check				○	3-4
Throttle link / throttle cable / throttle pick-up timing	Check / adjust				○	3-5, 3-6
Water pump	Check				○	6-10, 6-32
Spark plug	Clean / adjust / replace	○	○	○		3-3

**NOTE:**

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

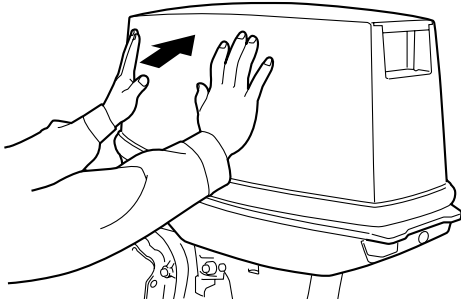




## Top cowling

### Checking the top cowling

1. Check the fitting by pushing the cowling with both hands.

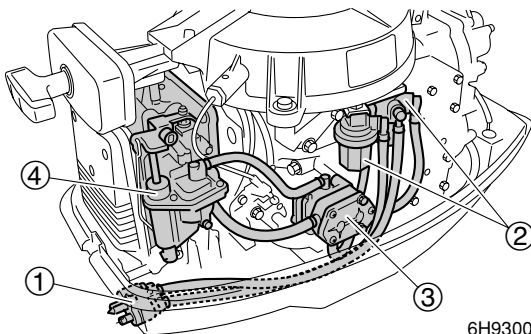


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## Fuel system

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

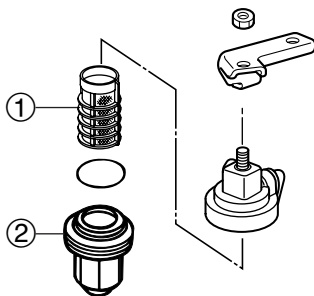
1. Check the fuel hose connections and fuel joint ① for leaks. Replace if necessary. Also, check the fuel filter ②, fuel pump ③, and carburetor ④ for leaks or deterioration. Replace if necessary.



6H930020

### Checking the fuel filters

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



6B430020

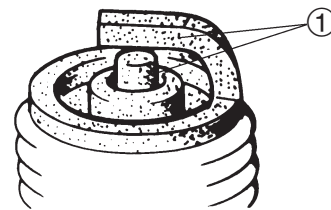
### NOTE:

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

## Power unit

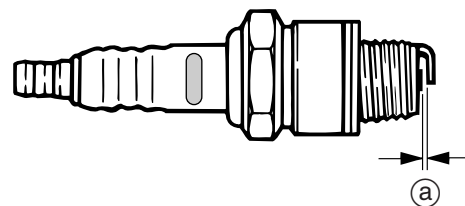
### Checking the spark plugs

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



6B430025

3. Check the electrodes for erosion and excessive carbon or other deposits, and the gasket for damage. Replace the spark plug if necessary.
4. Check the spark plug gap ①. Adjust if out of specification.



6B430030



Specified spark plug:

B7HS (NGK)

Spark plug gap ①:

0.6—0.7 mm (0.024—0.028 in)

5. Install the spark plug, tighten it finger tight, then to the specified torque with a spark plug wrench.

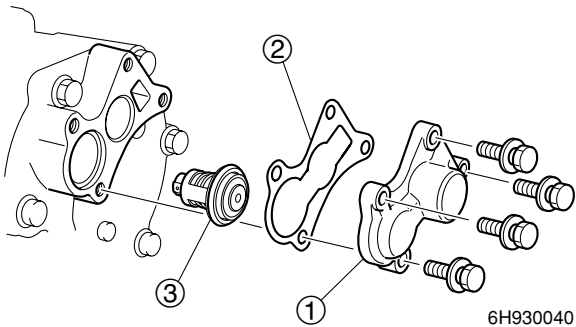


Spark plug:

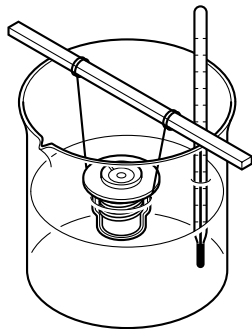
25 N·m (2.5 kgf·m, 18 ft·lb)

### Checking the thermostat

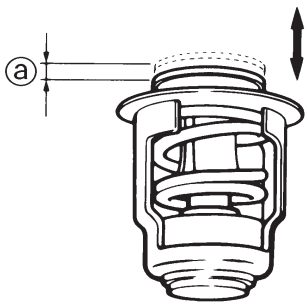
1. Remove the thermostat cover (1), gasket (2), and thermostat (3).




2. Suspend the thermostat in a container of water.
3. Place a thermometer in the water and slowly heat the water.



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

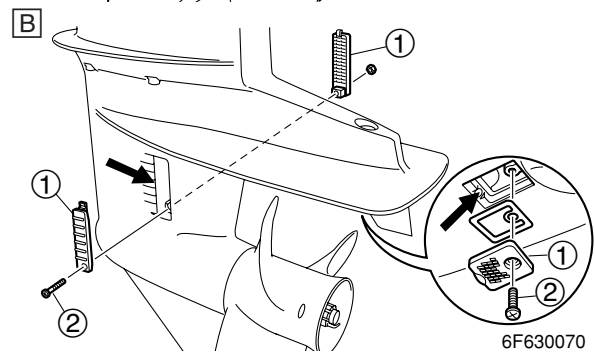
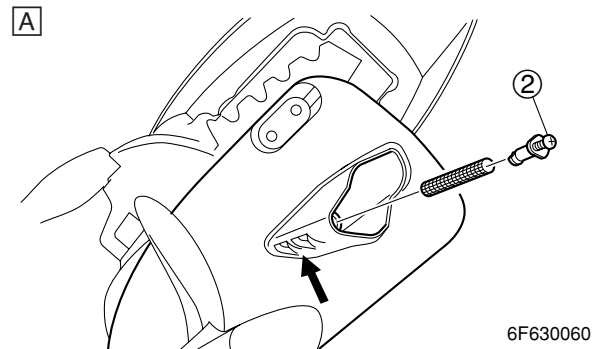


 Water temperature	Valve lift (a)
58–62°C (136–147°F)	0 mm (0 in) (valve begins to tilt)
above 70°C (158°F)	more than 3.0 mm (0.12 in)

5. Install the thermostat and thermostat cover, and then tighten the cover bolts.

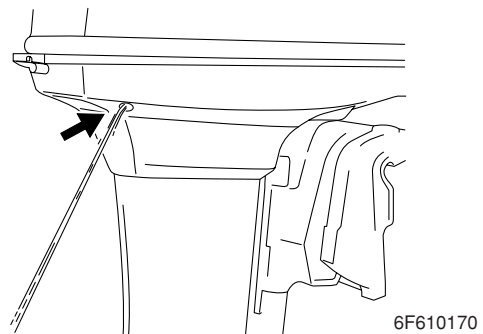
### Checking the cooling water passages

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



- A EK40G
- B EK40J

2. Place the lower unit in water, 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 passage inside the out-board motor.

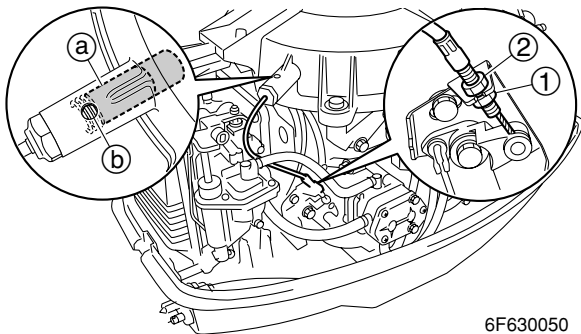




## Control system

### Adjusting the start-in-gear protection

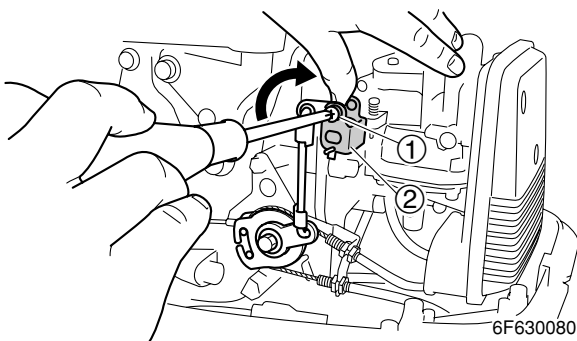
1. Set the gear shift to the neutral position.
2. Loosen the lock nut ①, and then adjust the start-in-gear protection adjusting nut ② until the top of the plunger a aligns with the centre of the hole in the starter case b.



6F630050

### Adjusting the throttle link position

1. Check that the throttle link and throttle pulley for smooth operation. Adjust if necessary.
2. Loosen the throttle arm adjusting screw ①.
3. Turn the throttle grip or remote control lever in the fully opened position and adjust the throttle arm ② until its contacts with the stopper.
4. Tighten the throttle arm adjusting screw ①.



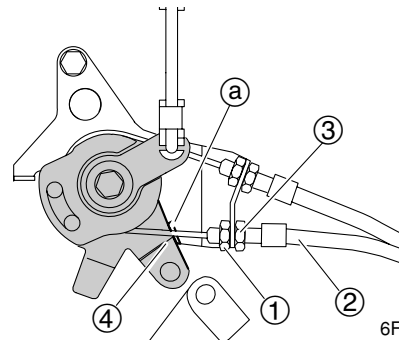
6F630080

### Adjusting the throttle cable (MH)

#### NOTE:

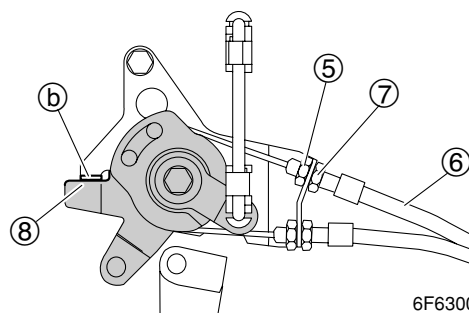
Before adjusting the throttle cables, the throttle stop screw should be properly adjusted.

1. Check the throttle cables for smooth operation, looseness, fraying or damage. Replace if necessary.
2. With the throttle grip in the fully opened position, check that the stopper on the pulley contact with the stopper on the bracket. Adjust if necessary.
3. Loosen the locknut ① and adjust the throttle cable (open-side) ② with the adjusting nut ③ until the stopper ④ on the pulley contact the stopper plate a on the bracket, then tighten the locknut.



6F630085

4. Turn the throttle grip to the fully closed position.
5. Loosen the locknut ⑤ and adjust the length of the throttle cable (close-side) ⑥ with the adjusting nut ⑦ until the stopper ⑧ on the pulley contact the stopper plate b on the bracket, then tighten the locknut.

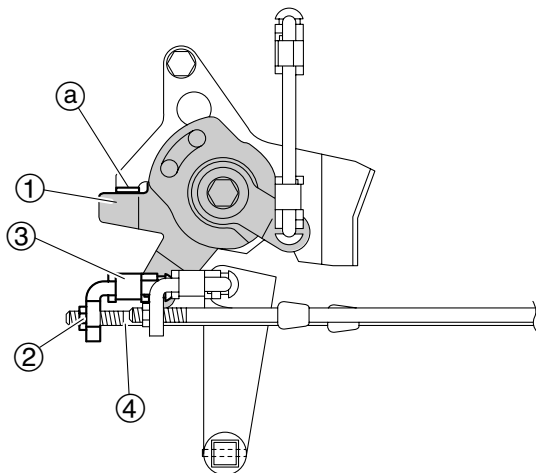


6F630090

- Fully open and close the throttle grip and make sure the stopper on the pulley contacts the stopper on the bracket (at the fully opened position) and stopper on the bracket contacts the stopper on the pulley (at the fully closed position). If proper contacts are not made, repeat the procedure.

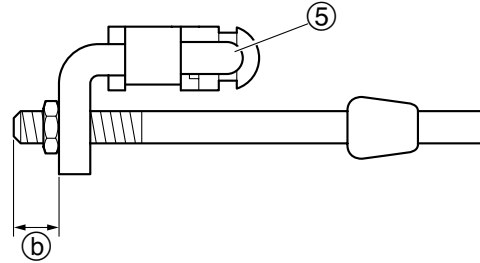
### Adjusting the throttle cable (W)

- Check that the throttle cable for smooth operation, looseness, fraying or damage. Replace if necessary.
- Check that the stopper ① on the pulley is contact the stopper plate ② on the bracket when the remote control lever is in neutral and the throttle lever is fully closed position. Adjust the throttle cable length if necessary.
- Loosen the adjusting nut ②, remove the cable joint ③, and then remove the throttle cable ④.



6F630100

- Adjust the position of the cable end ⑤ until it is aligned with the hole on the pulley.



6F610075

### ⚠ WARNING

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

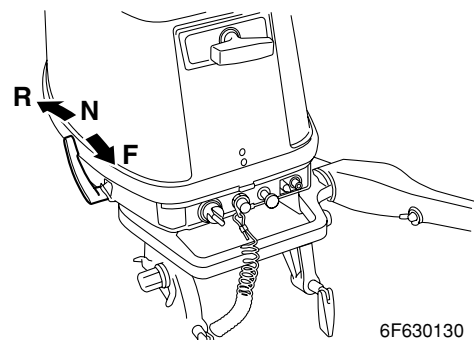
- Install the cable joint ③ and tighten the adjusting nut.
- Check the throttle cable for smooth operation.

### NOTE:

If the remote control cables cannot be properly adjusted at the engine side, make adjustments at the remote control side.

### Checking the gear shift operation (MH)

- Check that the gear shift operates smoothly when shifting from neutral to forward or reverse. Adjust the shift rod if necessary.



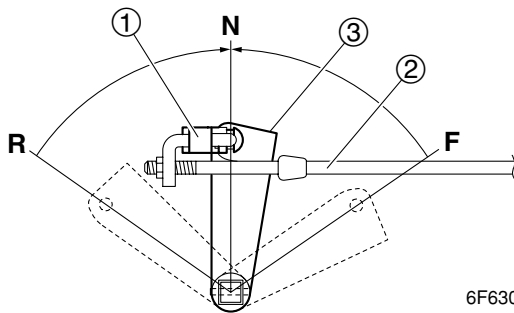
6F630130

- Set the gear shift to the neutral position.



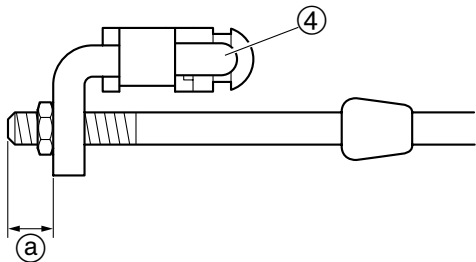
**Checking the gear shift operation  
(W)**

1. Check that the gear shift operates smoothly when shifting it from neutral to forward or reverse. Adjust the shift cable length if necessary.
2. Set the gear shift to the neutral position.
3. Remove the cable joint ①, and then disconnect the shift cable ②.
4. Set the shift lever ③ to the neutral position.



6F630135

5. Adjust the position of the cable end ④ until it is aligned with the hole of the shift lever.



6F610077

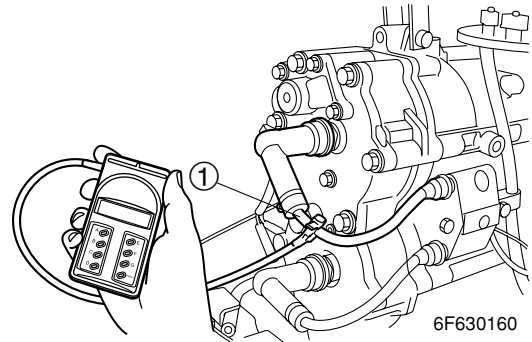
**⚠ WARNING**

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

6. Install the cable joint ① and tighten the adjusting nut.
7. Check the gear shift for smooth operation and, if necessary, repeat steps 2—6.

**Checking the engine idle speed**

1. Start the engine and warm it up for 5 minutes.
2. Attach the special service tool to spark plug wire #1 ①, and then check the engine idle speed. Adjust if out of specification.



6F630160

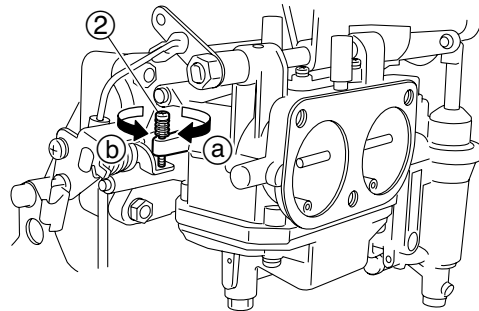


Digital tachometer: 90890-06760



Engine idle speed:  
1,050—1,150 r/min

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



6H930170

**NOTE:**

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

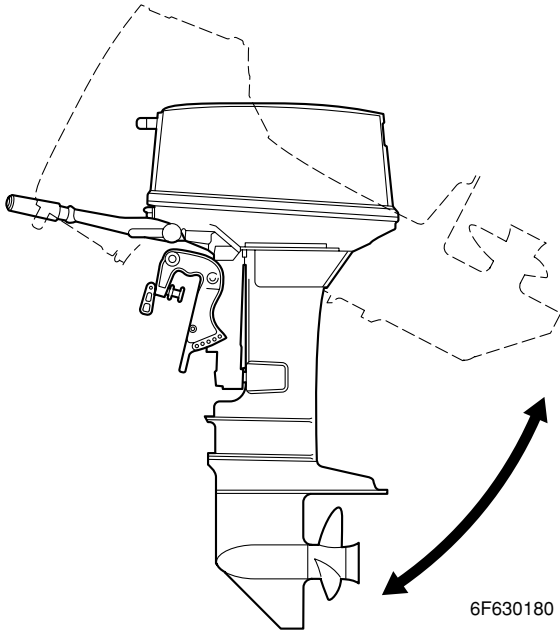
4. If the specified engine idle speed cannot be obtained, adjust the throttle cable(s).



## Bracket

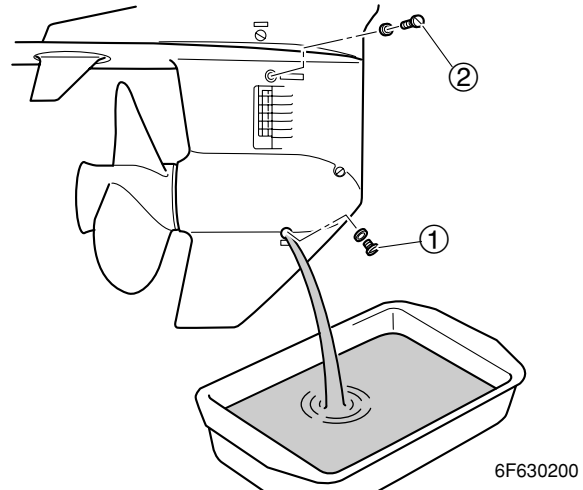
### Checking the tilt operation

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



## Changing the gear oil

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

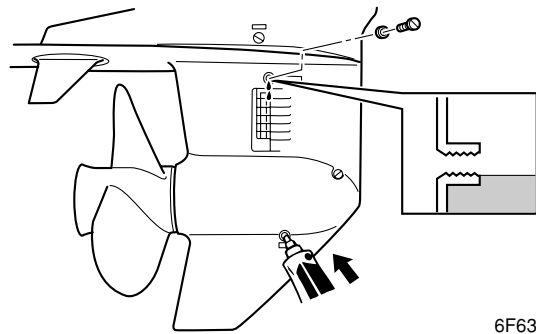
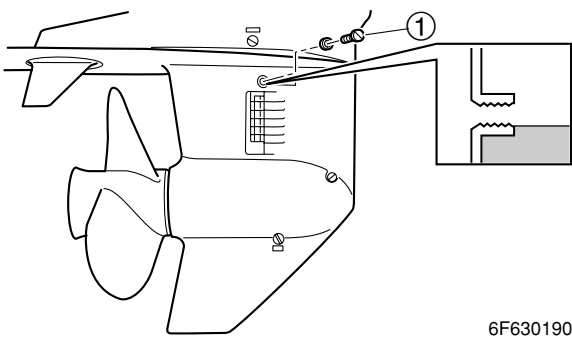


3. Check the oil for metal and discoloration, and its viscosity. Check the internal parts of the lower case if necessary.
4. Insert a gear oil tube or gear oil pump into the drain hole and slowly fill the gear oil until oil flows out of the check hole and no air bubbles are visible.

## Lower unit

### Checking the gear oil level

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



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



Recommended gear oil:  
Hypoid gear oil  
API: GL-4  
SAE: 90  
Oil quantity:  
315 cm<sup>3</sup>  
(10.65 US oz, 11.11 Imp oz)



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

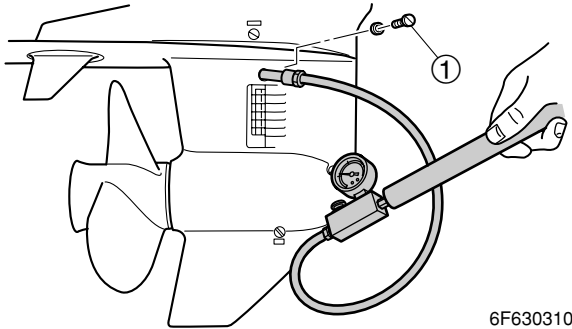


### Checking the lower unit for air leakage

**CAUTION:**

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

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



6F630310



Leakage tester: 90890-06840

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

**NOTE:**

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



Lower unit holding pressure:  
100 kPa (1.0 kgf/cm<sup>2</sup>, 14 psi)

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

### Checking the propeller

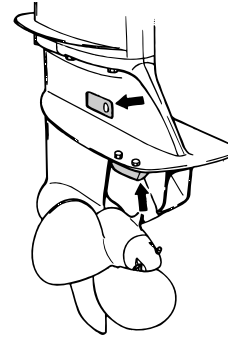
1. Check the propeller blades and splines for cracks, damage, or wear. Replace if necessary.

### General

#### Checking the anodes

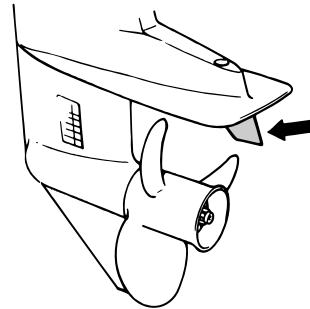
1. Check the anodes and trim tab for scales, grease, and oil. Clean if necessary.

A



6F630220

B



6F630230

A EK40G

B EK40J

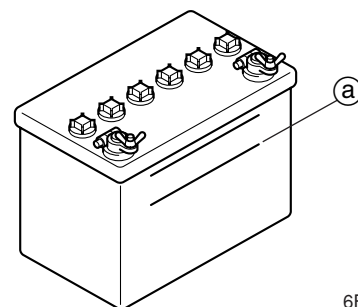
**CAUTION:**

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

2. Replace the anodes or trim tab if excessively eroded.

### Checking the battery (W)

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



6F630240

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

**⚠ WARNING**

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

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

Antidote (EXTERNAL):

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

Antidote (INTERNAL):

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

**KEEP BATTERIES AND ELECTROLYTE OUT OF REACH OF CHILDREN.**

**NOTE:**

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



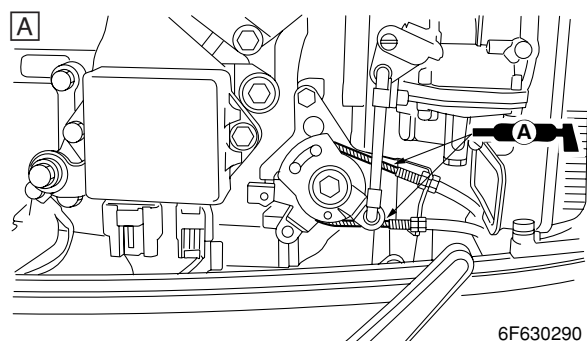
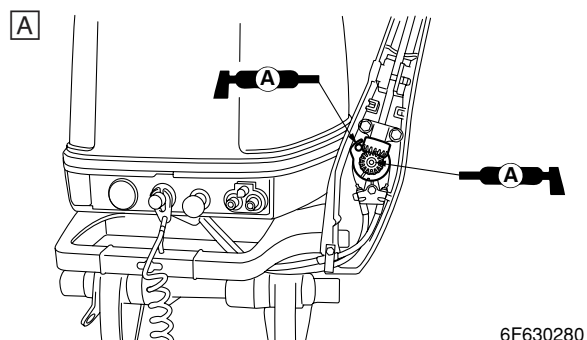
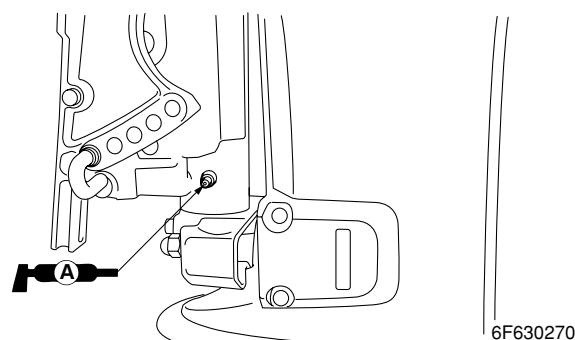
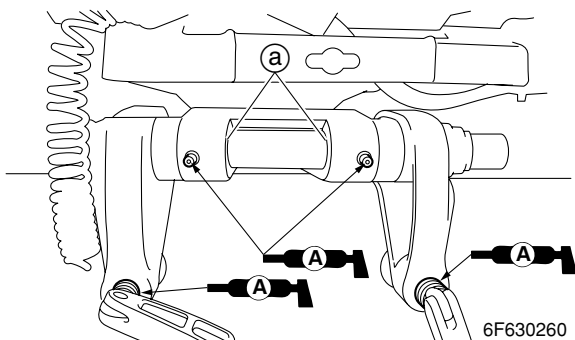
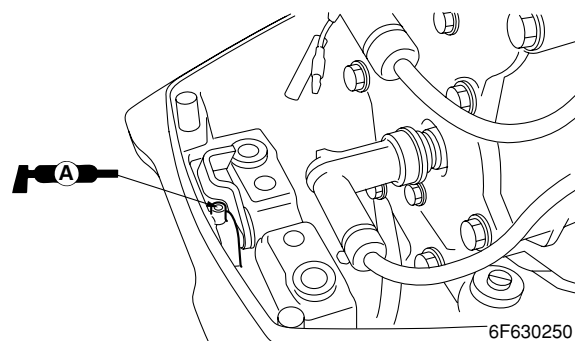
Electrolyte specific gravity:  
1.280 at 20° C (68° F)

**Lubricating the outboard motor**

1. Apply water resistant grease to the areas shown.

**NOTE:**

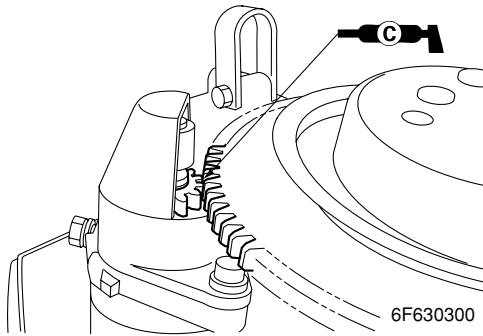
Apply grease to the grease nipple until it flows from the bushings (a).



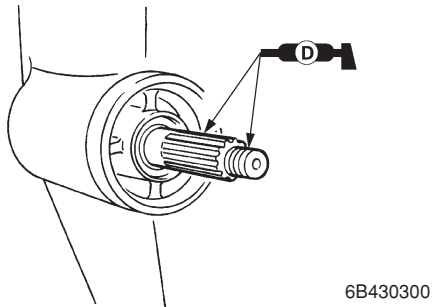
[A] Tiller handle model



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



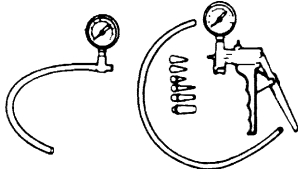
3. Apply corrosion resistant grease to the area shown.



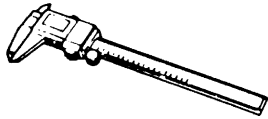
## Fuel system

<b>Special service tools .....</b>	<b>4-1</b>
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<b>Fuel line .....</b>	<b>4-3</b>
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Checking the fuel pump .....	4-14
Disassembling the fuel pump .....	4-15
Assembling the fuel pump .....	4-15
Checking the fuel joint .....	4-15

## Special service tools

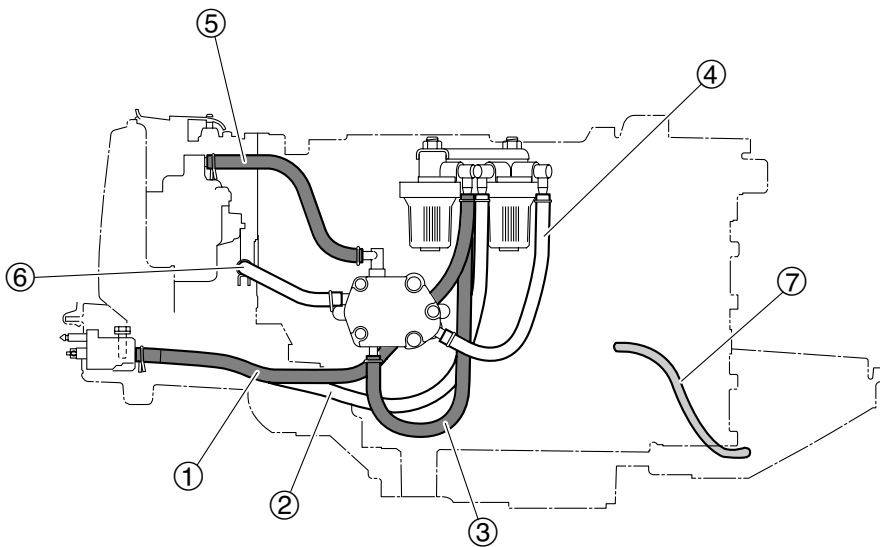
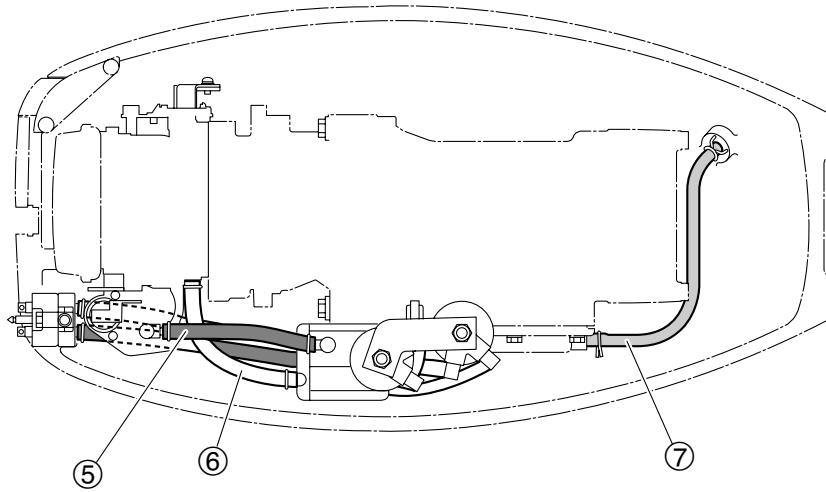


**Vacuum/pressure pump gauge set**  
90890-06756



**Digital caliper**  
90890-06704

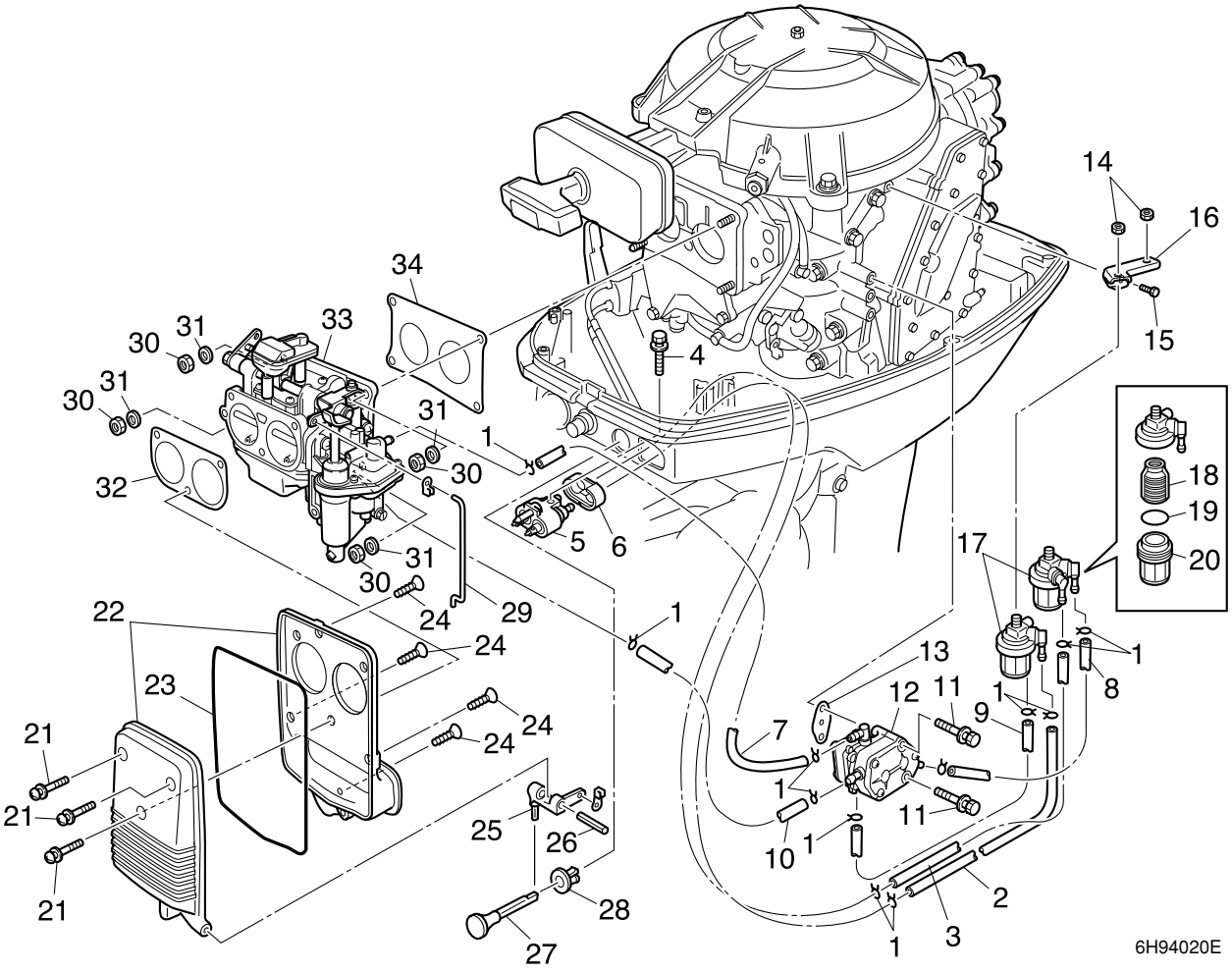
## Hose routing



- ① Fuel hose (Fuel joint-to-fuel filter: For Gasoline)
- ② Fuel hose (Fuel joint-to-fuel filter: For Kerosene)
- ③ Fuel hose (Fuel filter-to-fuel pump: For Gasoline)
- ④ Fuel hose (Fuel filter-to-fuel pump: For Kerosene)
- ⑤ Fuel hose (Fuel pump-to-carburetor: For Gasoline)
- ⑥ Fuel hose (Fuel pump-to-carburetor: For Kerosene)
- ⑦ Pilot water hose

6H94010E

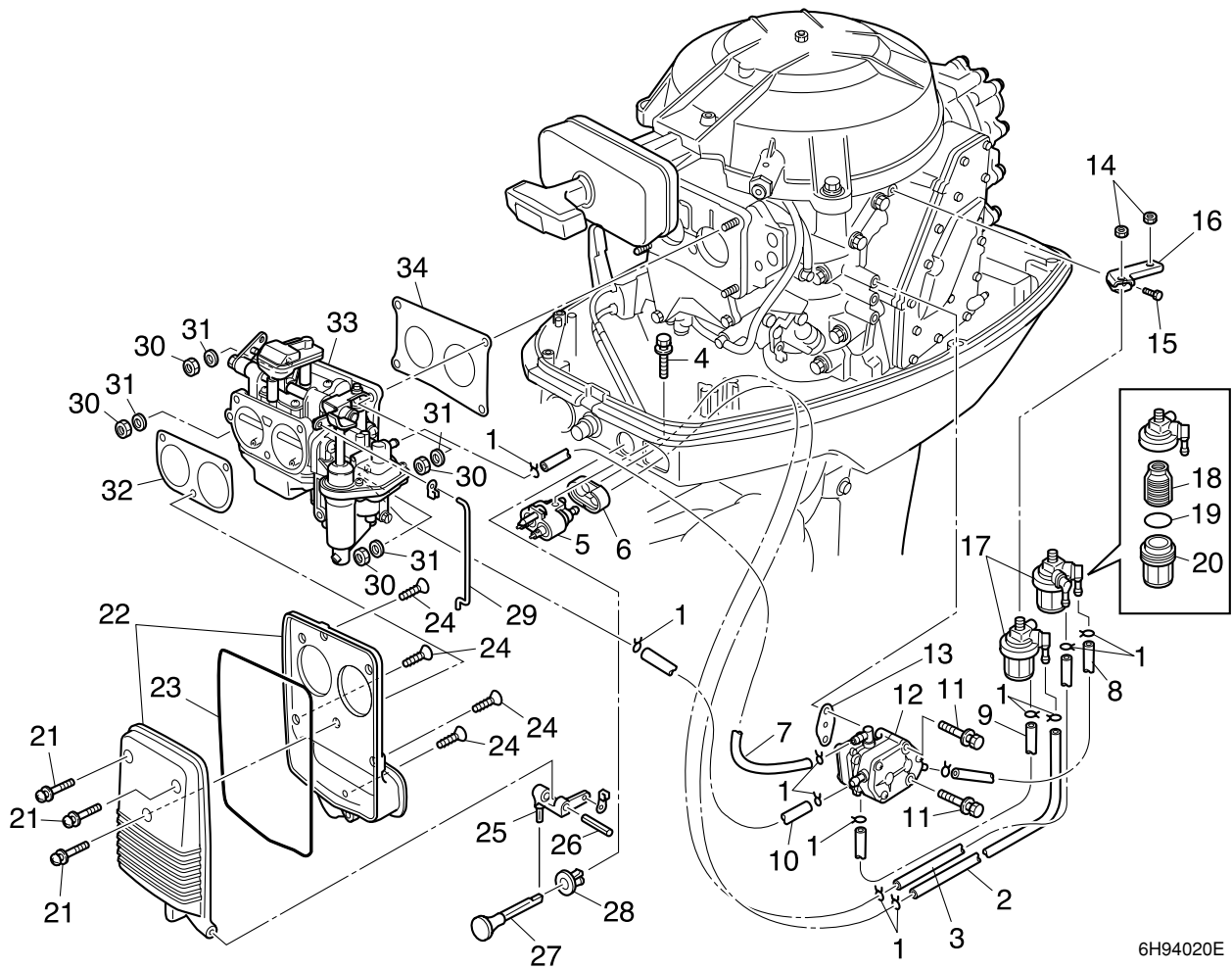
**Fuel line**



6H94020E

No.	Part name	Q'ty	Remarks
1	Clip	12	
2	Fuel hose	1	
3	Fuel hose	1	
4	Bolt	1	M6 × 25 mm
5	Fuel joint	1	
6	Grommet	1	
7	Fuel hose	1	
8	Fuel hose	1	
9	Fuel hose	1	
10	Fuel hose	1	
11	Bolt	2	M6 × 55 mm
12	Fuel pump	1	
13	Gasket	1	Not reusable
14	Nut	2	
15	Bolt	1	Not reusable
16	Bracket	1	
17	Fuel filter assembly	2	



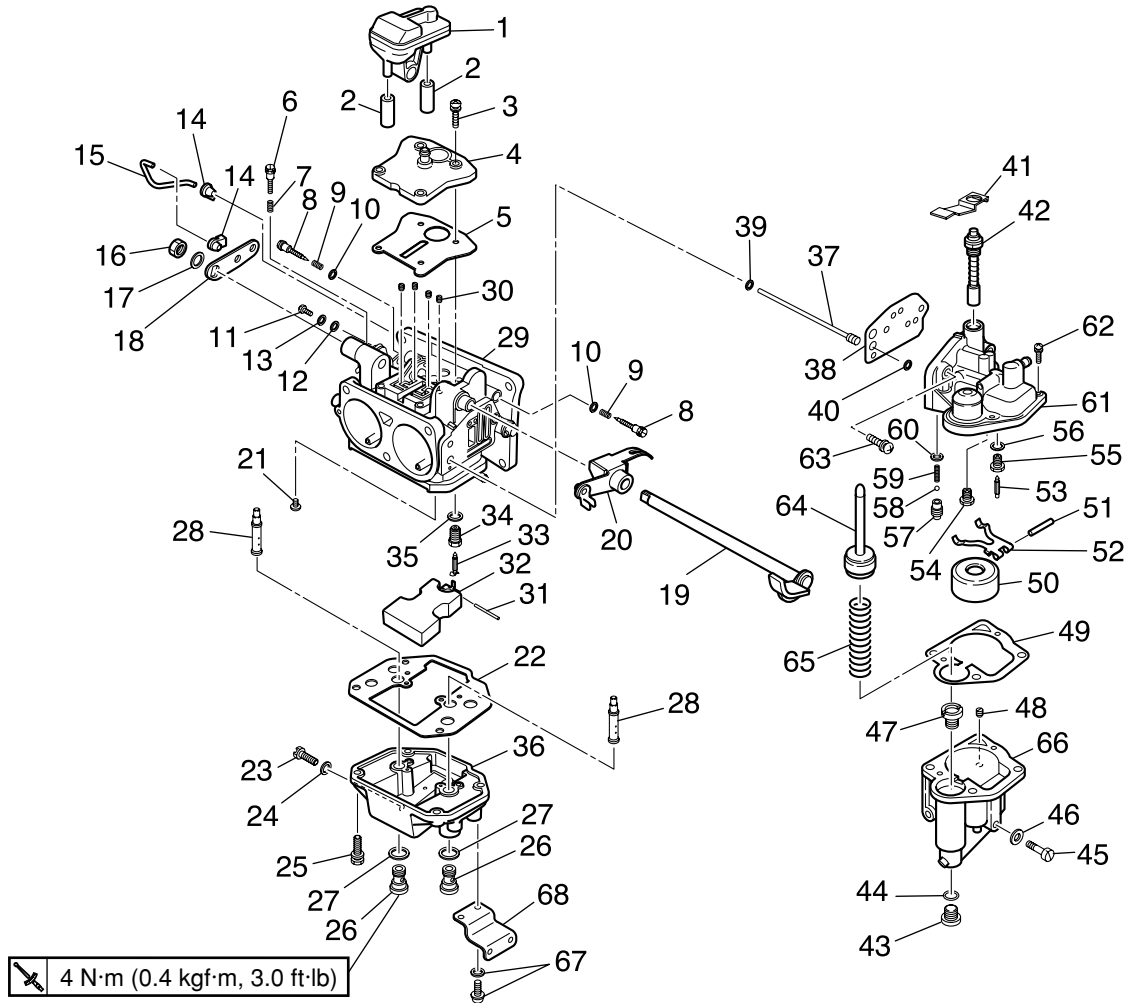


6H94020E

4

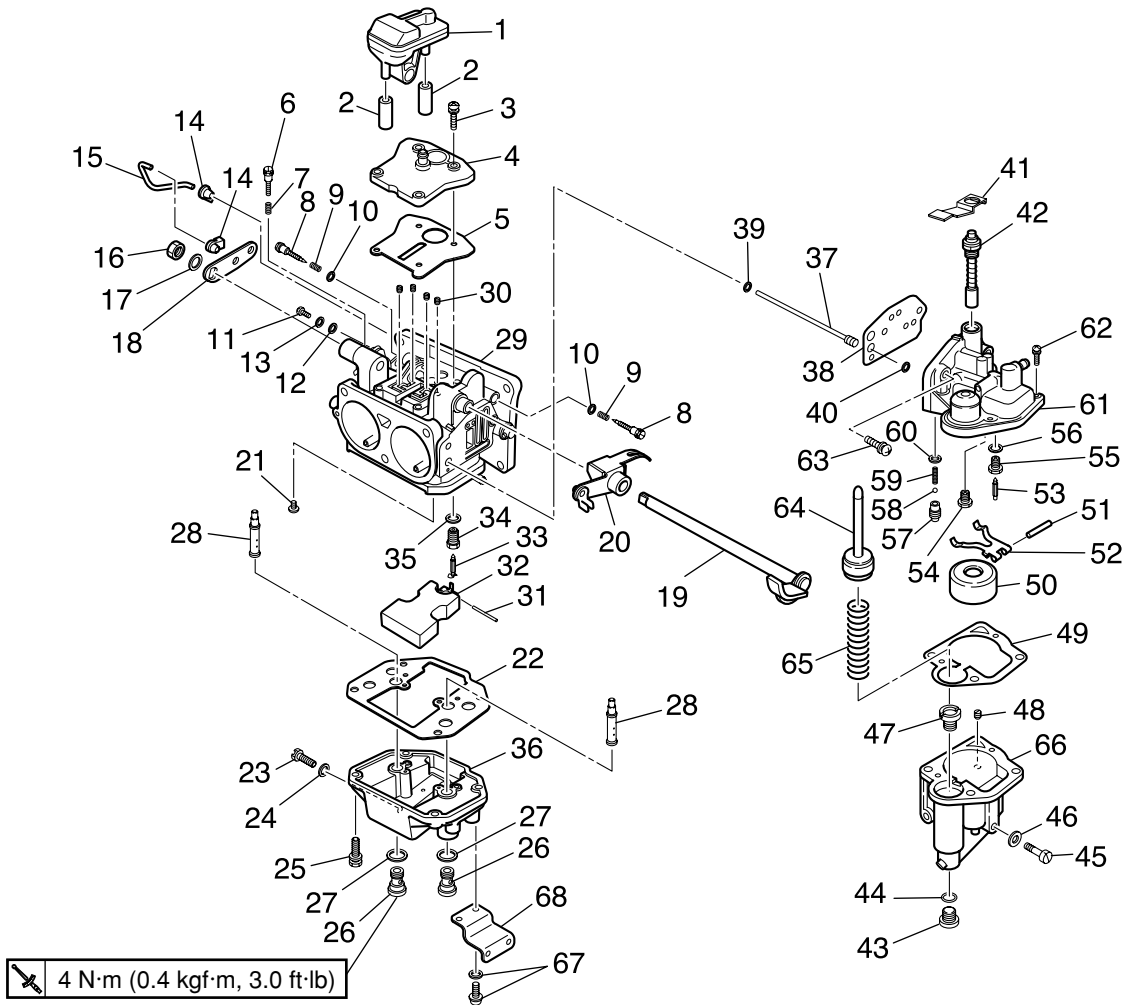
No.	Part name	Q'ty	Remarks
18	Fuel filter element	2	
19	O-ring	2	
20	Cup	2	
21	Screw	3	ø6 × 30 mm
22	Intake silencer	1	
23	O-ring	1	Not reusable
24	Screw	4	ø6 × 12 mm
25	Link lever	1	
26	Pin	1	
27	Choke rod	1	
28	Collar	1	
29	Link rod	1	
30	Nut	4	
31	Washer	4	
32	Gasket	1	Not reusable
33	Carburetor assembly	1	
34	Gasket	1	Not reusable

**Carburetor**



6H94040E

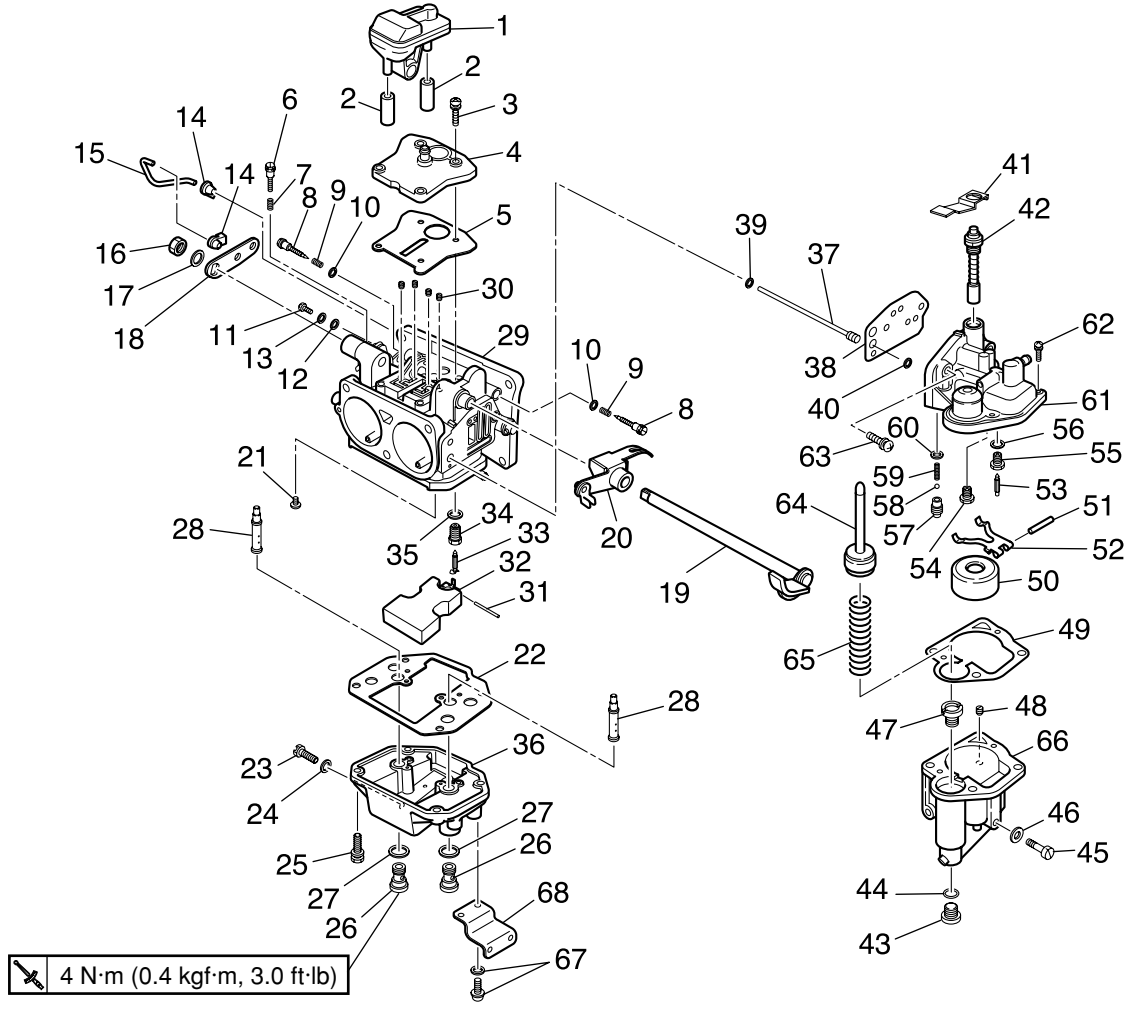
No.	Part name	Q'ty	Remarks
1	Damper	1	
2	Hose	2	
3	Screw	4	ø4 × 14 mm
4	Cover	1	
5	Gasket	1	Not reusable
6	Throttle stop screw	1	
7	Spring	1	
8	Pilot screw	2	
9	Spring	2	
10	O-ring	2	
11	Screw	1	ø4 × 5 mm
12	Gasket	1	Not reusable
13	Washer	1	
14	Joint	1	
15	Link rod	1	
16	Nut	1	
17	Washer	1	



6H94040E

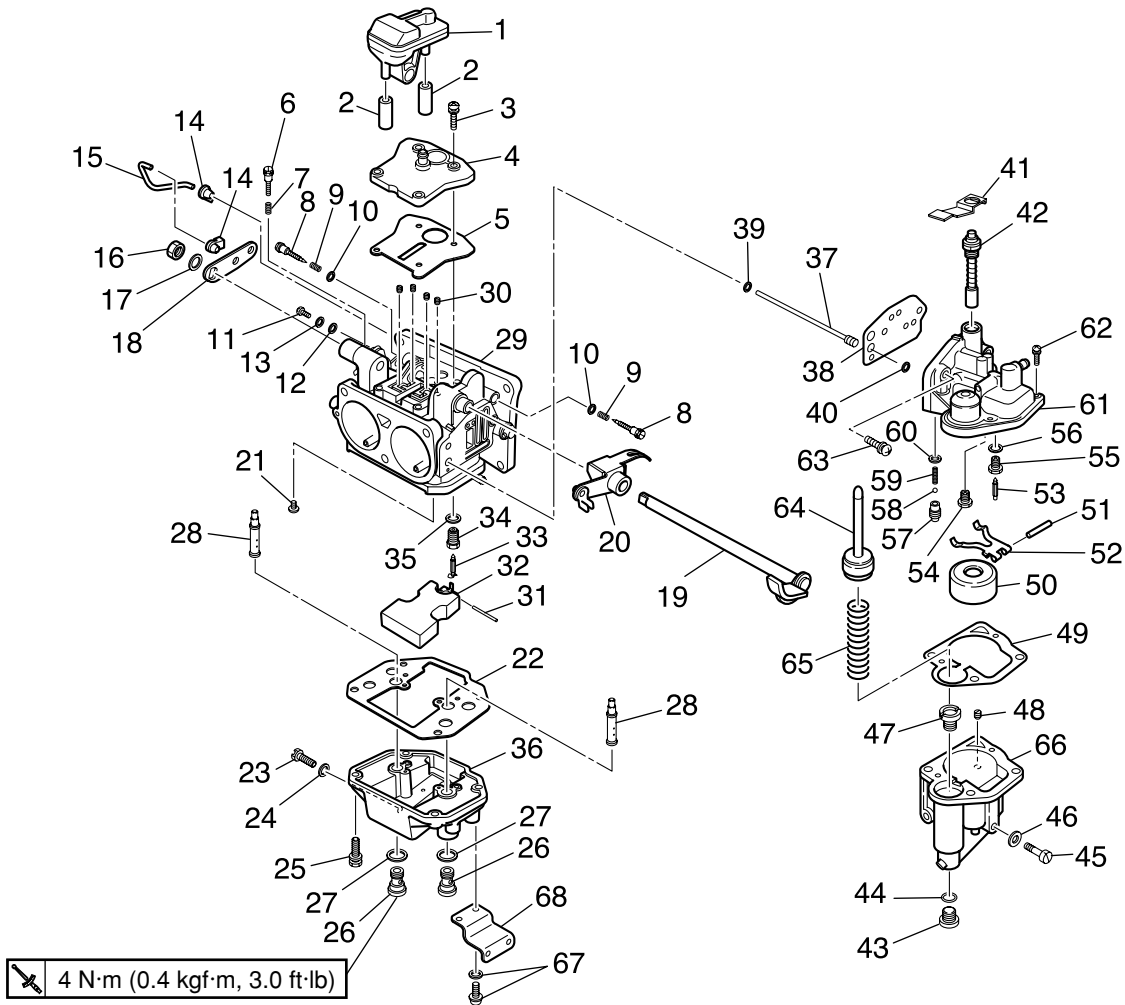
4

No.	Part name	Q'ty	Remarks
18	Lever	1	
19	Pump lever assembly	1	
20	Cam	1	
21	Screw	1	ø4 × 5 mm
22	Gasket	1	Not reusable
23	Drain screw	1	
24	Gasket	1	Not reusable
25	Screw	4	ø5 × 16 mm
26	Main jet	2	
27	Gasket	2	Not reusable
28	Main nozzle	2	
29	Carburetor body	1	
30	Pilot jet	4	
31	Float pin	1	
32	Float	1	
33	Needle valve	1	
34	Valve seat	1	



6H94040E

No.	Part name	Q'ty	Remarks
35	Gasket	1	Not reusable
36	Float chamber	1	
37	Nozzle	1	
38	Gasket	1	Not reusable
39	O-ring	1	Not reusable
40	O-ring	1	Not reusable
41	Stopper	1	
42	Plunger	1	
43	Drain screw	1	
44	Gasket	1	Not reusable
45	Drain screw	1	
46	Gasket	1	Not reusable
47	Check valve	1	
48	Starter jet	1	
49	Gasket	1	Not reusable
50	Float	1	
51	Float pin	1	



6H94040E

4

No.	Part name	Q'ty	Remarks
52	Float arm	1	
53	Needle valve	1	
54	Screw	1	ø4 × 5 mm
55	Valve seat	1	
56	Gasket	1	Not reusable
57	Ball seat	1	
58	Ball	1	
59	Spring	1	
60	Gasket	1	Not reusable
61	Carburetor body	1	
62	Screw	8	ø5 × 16 mm
63	Screw	2	ø6 × 19 mm
64	Starter plunger	1	
65	Spring	1	
66	Float chamber	1	
67	Screw	4	ø5 × 12 mm
68	Holder	1	



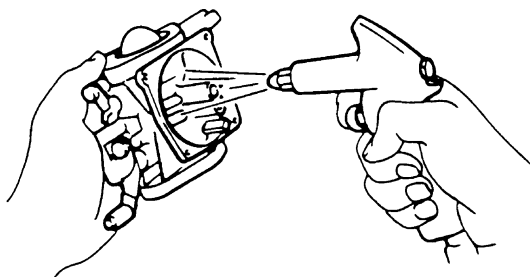
### Disassembling the carburetor

**NOTE:**

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

### Checking the carburetor

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



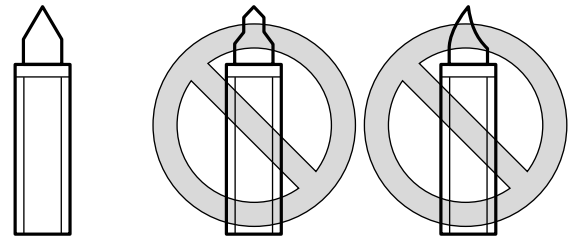
6D440025

**CAUTION:**

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

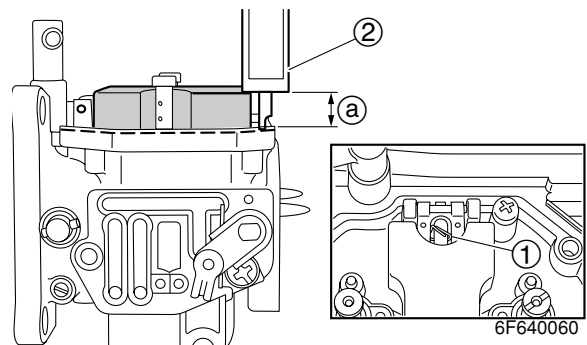
3. Check the main jet, pilot jet, and main nozzle for dirt or residue. Clean if necessary.

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

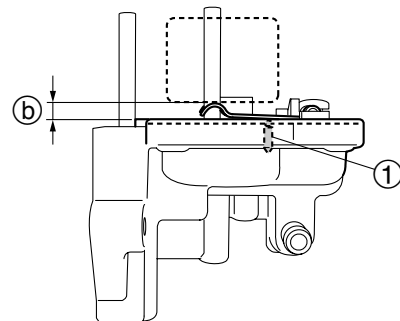


6B440040

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



6F640060



6H940065

**NOTE:**

- The float should be resting on the needle valve (1), but not compressing it.
- Measure the height (a) from the gasket to the float as shown for the kerosene side.
- Measure the height (b) from the gasket to the float as shown for the gasoline side.



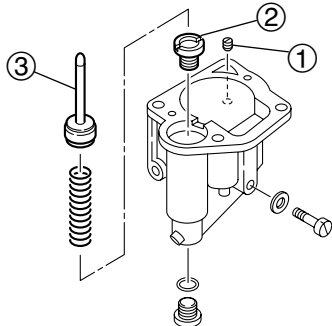
Digital caliper (2): 90890-06704



Float height (a): (kerosene)  
12.5—13.0 mm (0.47—0.51 in)  
Float height (a): (gasoline)  
4.0—5.0 mm (0.16—0.20 in)

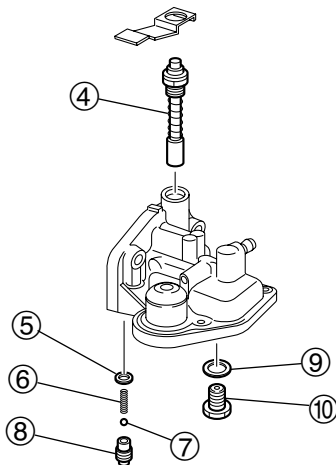
**Assembling the carburetor**

1. Install the starter jet ① and check valve ②, then install the plunger ③ onto the float chamber of the gasoline side.



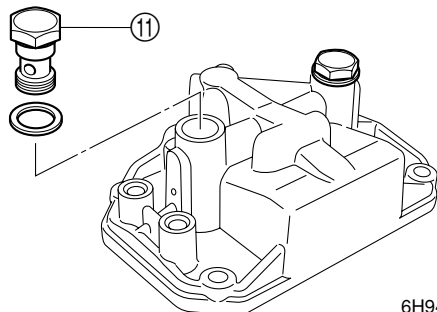
6H940120

2. Install the starter plunger ④, new gasket ⑤, spring ⑥, ball ⑦, ball seat ⑧, new gasket ⑨ and valve seat ⑩ onto the carburetor body of the gasoline side.



6H940130

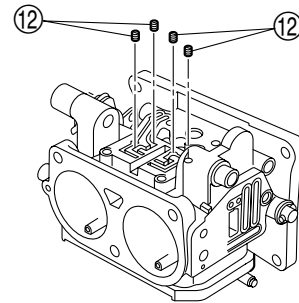
3. Install the main jet ⑪ onto the float chamber of the kerosene side.



6H940140

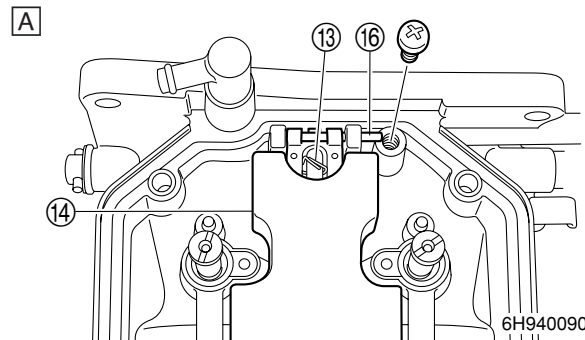
	<p>Main jet: 4 N·m (0.4 kgf·m, 3.0 ft·lb)</p>
---	---

4. Install the pilot jet ⑫, new gasket and cover to the carburetor body of the kerosene side as shown.

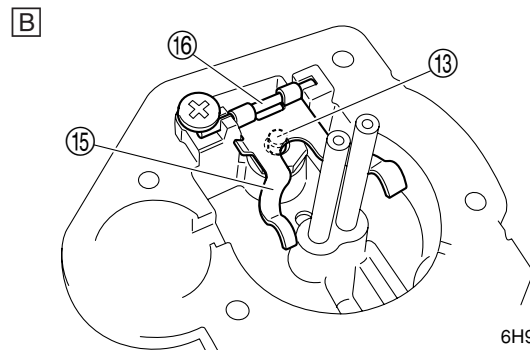


6H940080

5. Install the needle valve ⑬, float ⑭, float arm ⑮, and float pin ⑯, gasoline side float, and then check the float for smooth operation.



6H940090



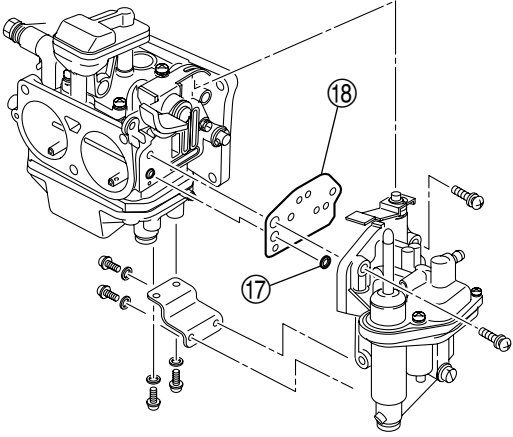
6H940095

- A: Kerosene side
- B: Gasoline side

**NOTE:** \_\_\_\_\_  
Place the needle valve in the valve seat when installing the float to the carburetor.

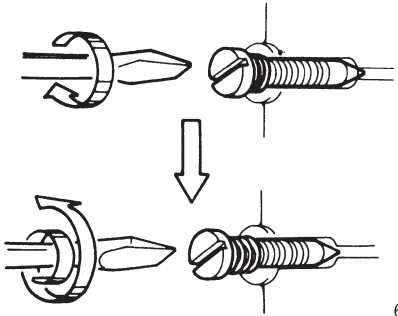
6. Install the new gasket onto the each carburetor body, and then install the float chamber.

7. Install a new O-ring (17), and new gasket (18), onto the carburetor body of the gasoline side, and then install the carburetor body of the kerosene side.




6H940150

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



6F640100

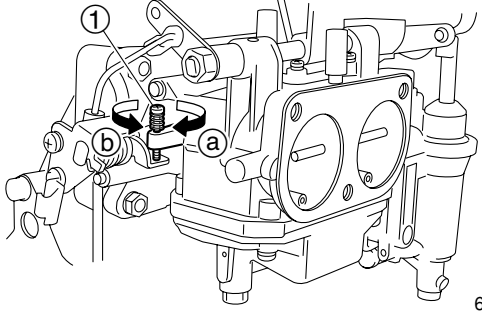
- NOTE:**
- Adjust the throttle cable whenever the carburetor has been disassembled or the engine idle speed has been adjusted.
  - For adjustment procedures, see Chapter 3.

	Pilot screw setting: 3/4 — 1 1/4 turns out
---	---

9. Install the carburetor assembly.


**Adjusting the throttle stop screw**

1. Start the engine and warm it up for 5 minutes.
2. Turn the throttle stop screw (1) in direction (a) or (b) until the specified engine idle speed is obtained.



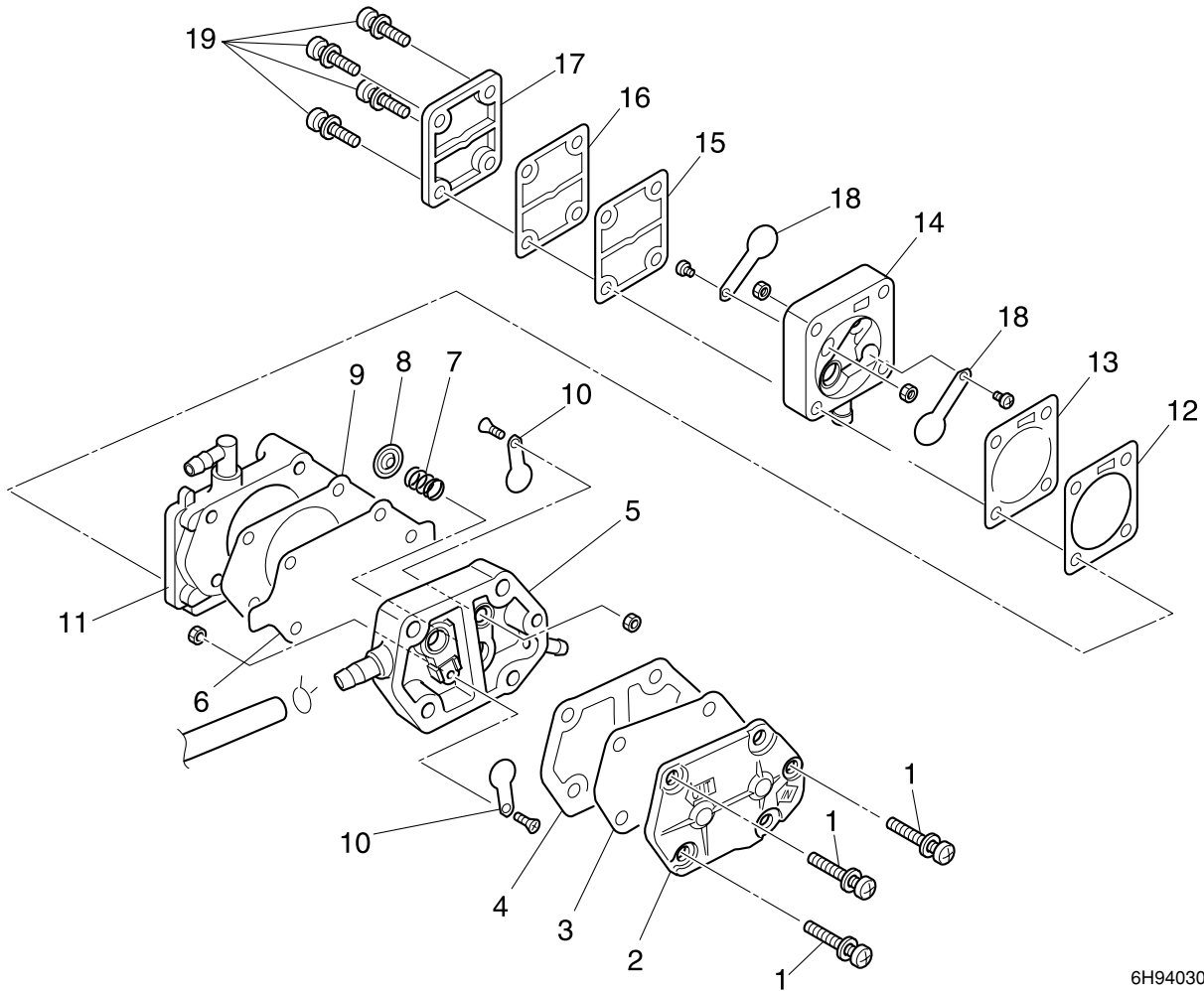
6H940110

- NOTE:**
- To increase the idle speed, turn the throttle stop screw in direction (a).
  - To decrease the idle speed, turn the throttle stop screw in direction (b).

	Engine idle speed: 1,050—1,150 r/min
---	---



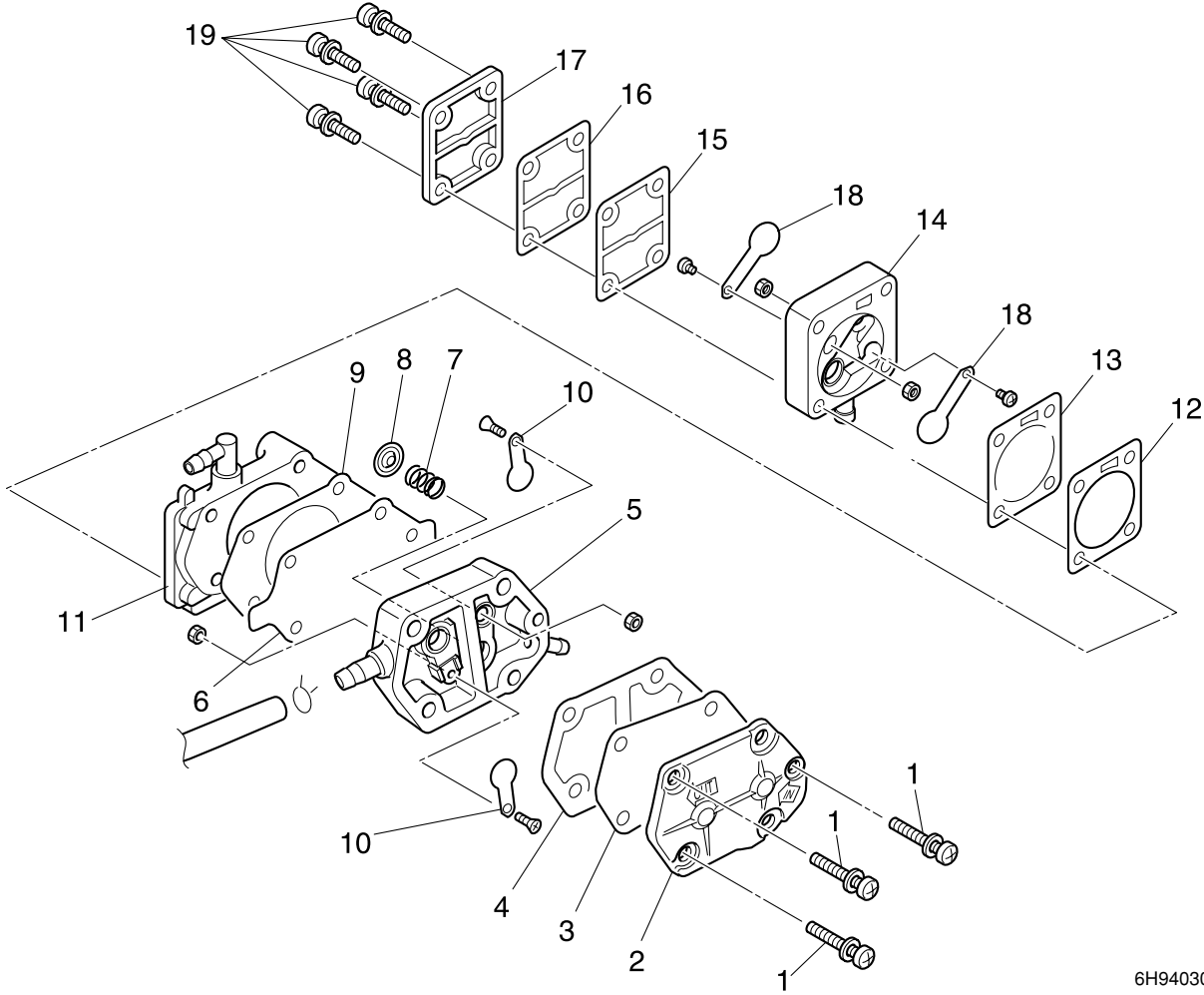
Fuel pump



4

6H94030E

No.	Part name	Q'ty	Remarks
1	Screw	3	ø5 × 30 mm
2	Cover	1	
3	Diaphragm	1	
4	Gasket	1	Not reusable
5	Fuel pump body	1	
6	Diaphragm	1	
7	Spring	1	
8	Spring plate	1	
9	Gasket	1	Not reusable
10	Check valve	2	
11	Cover	1	
12	Gasket	1	Not reusable
13	Diaphragm	1	
14	Pump body	1	
15	Gasket	1	Not reusable
16	Diaphragm	1	
17	Cover	1	

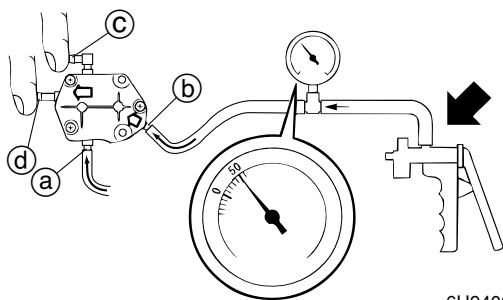


6H94030E

No.	Part name	Q'ty	Remarks
18	Check valve	2	
19	Screw	4	ø5 × 24 mm

### Checking the fuel pump

1. Place a drain pan under the fuel hose connections, and then disconnect the fuel hoses from the fuel pump.
2. Connect the special service tool to the fuel pump inlet (a) or (b).
3. Cover the fuel pump outlet (c) or (d) with a finger, and then apply the specified positive pressure. Check that there is not air leakage.



6H940010

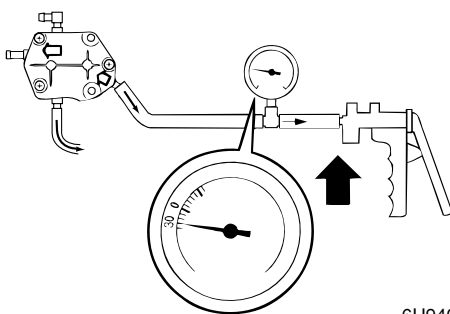
Connecting location:

- (a) Gasoline inlet
- (b) Kerosene inlet
- (c) Gasoline outlet
- (d) Kerosene outlet

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

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

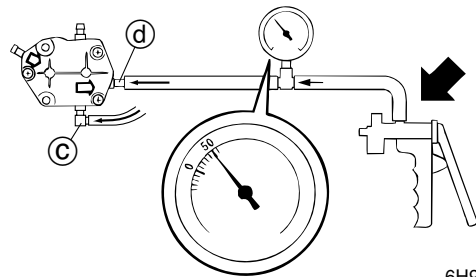
4. Apply the specified negative pressure and check that there is no air leakage.



6H940020

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

5. Connect the special service tool to the fuel pump outlet (c) or (d).



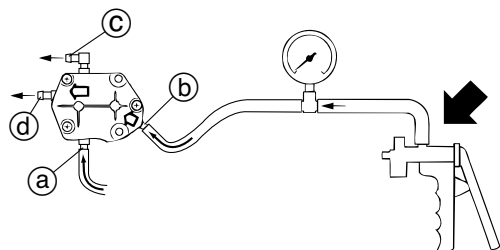
6H940030

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

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

**NOTE:** Assemble the fuel pump valve to the fuel pump body, and moisten the inside of fuel pump with gasoline to ensure a better seal.

7. lastly, connect the special service tool to the inlet (a) or (b), and then apply the positive pressure, check that there is smooth blow from outlet (c) or (d). Reassemble the fuel pump if necessary.



6H940040

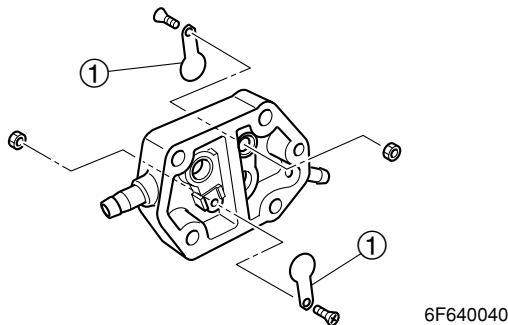
**Disassembling the fuel pump**

1. Disassemble the fuel pump.
2. Check the diaphragms for tears or damage. Replace if necessary.
3. Check the valves for bends or damage. Replace if necessary. Also, check the fuel pump body for damage. Replace if necessary.
4. Clean the fuel pump body.

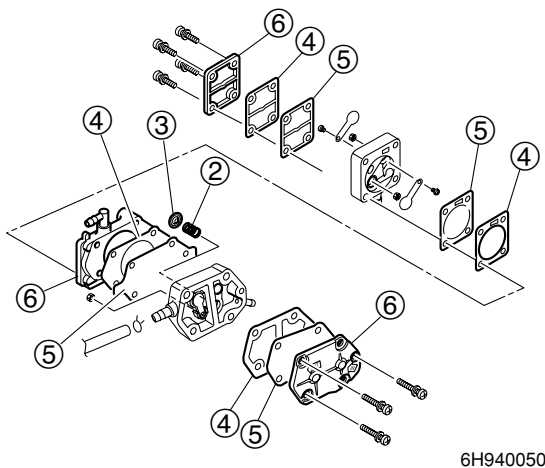
**Assembling the fuel pump**

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

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



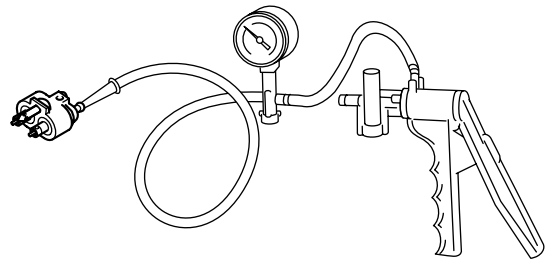
2. Install the spring ②, spring plate ③, new gaskets ④, the diaphragms ⑤, and covers ⑥.




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


**Checking the fuel joint**

1. Visually check the fuel joint for cracks or damage.
2. Connect the special service tool at the outlet of fuel joint.
3. Apply the specified pressure to check that the pressure is maintained for 10 seconds. Replace the fuel joint if necessary.



6B740020

 Vacuum/pressure pump gauge set:  
90890-06756

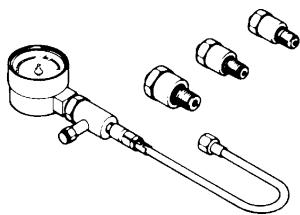
 Specified pressure:  
50 kPa (0.5 kgf/cm<sup>2</sup>, 7.3 psi)

## Power unit

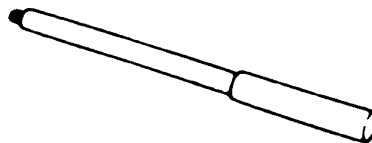
<b>Special service tools .....</b>	<b>5-1</b>
<b>Power unit .....</b>	<b>5-4</b>
Checking the compression pressure .....	5-4
Disassembling the manual starter .....	5-13
Checking the spiral spring .....	5-13
Checking the drive pawl .....	5-13
Measuring the starter rope .....	5-13
Assembling the manual starter .....	5-14
Removing the power unit .....	5-15
Removing the flywheel magnet .....	5-16
Removing the electrical components .....	5-17
Removing the throttle pulley assembly .....	5-17
Disassembling the base assembly .....	5-18
Assembling the base assembly .....	5-18
<b>Reed valves .....</b>	<b>5-19</b>
Removing the reed valve assembly .....	5-21
Checking the reed valves .....	5-21
<b>Cylinder head .....</b>	<b>5-22</b>
Removing the cylinder head .....	5-24
Checking the cylinder head .....	5-24
Removing the exhaust cover .....	5-24
Checking the exhaust cover .....	5-24
<b>Crankcase .....</b>	<b>5-25</b>
Removing the crankcase .....	5-27
Removing the crankshaft assembly and oil seal housing .....	5-27
Checking the cylinder bore .....	5-27
Disassembling the oil seal housing .....	5-28
Checking the oil seal housing .....	5-28
Assembling the oil seal housing .....	5-28
Disassembling the piston .....	5-28
Checking the piston diameter .....	5-29
Checking the piston clearance .....	5-29
Checking the piston rings .....	5-29
Checking the piston ring side clearance .....	5-30
Checking the piston pin boss bore .....	5-30
Checking the piston pin .....	5-30
Checking the internal anodes .....	5-30
Disassembling the crankshaft .....	5-30
Checking the crankpin .....	5-32
Assembling the crankshaft .....	5-32
Checking the crankshaft .....	5-36
Installing the crankshaft bearings .....	5-36
Assembling the piston .....	5-37
Assembling the power unit .....	5-37
Installing the power unit .....	5-39



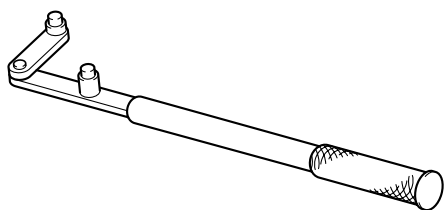
### Special service tools



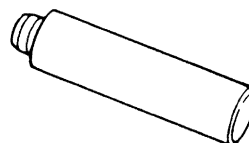
**Compression gauge**  
90890-03160



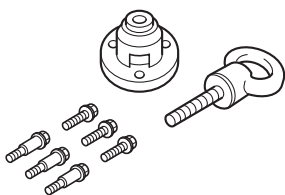
**Driver rod L3**  
90890-06652



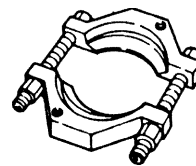
**Flywheel holder**  
90890-06522



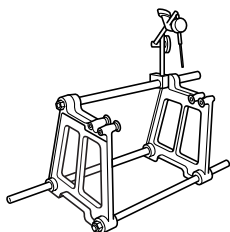
**Driver rod LS**  
90890-06606



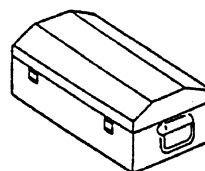
**Flywheel puller**  
90890-06521



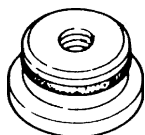
**Bearing Separator**  
90890-06534



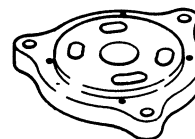
**Crankshaft aligner**  
90890-03107



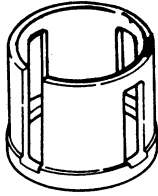
**Crank jig set**  
90890-02422



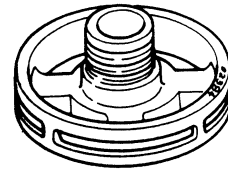
**Needle bearing attachment**  
90890-06613, 90890-06628,  
90890-06631, 90890-06654



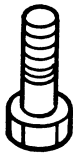
**Flange**  
90890-02351



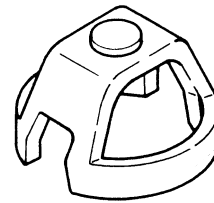
**Body**  
90890-02352



**Pressure plate**  
90890-02384



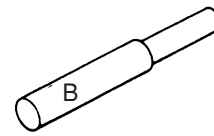
**Bolt**  
90890-02353



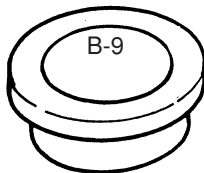
**Press body**  
90890-02385



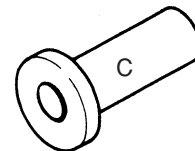
**Washer**  
90890-02354



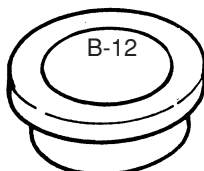
**Pressure pin B**  
90890-02390



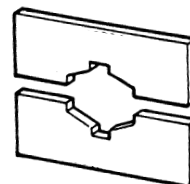
**Bushing-9 (D30)**  
90890-02363



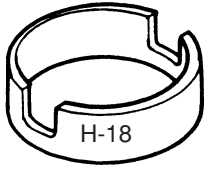
**Bearing pressure C**  
90890-02393



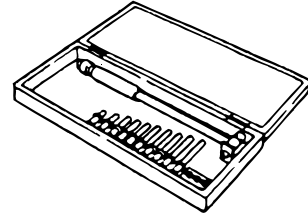
**Bushing-12 (D35)**  
90890-02366



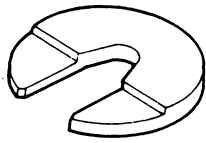
**Support**  
90890-02394



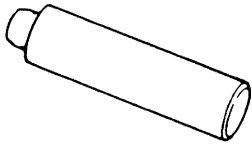
**Height ring (H-18)**  
90890-02401



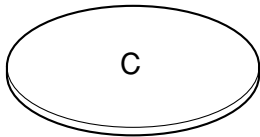
**Cylinder gauge**  
90890-06759



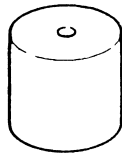
**Plate C**  
90890-02402



**Pressure pin C**  
90890-02403



**Spacer C**  
90890-02404



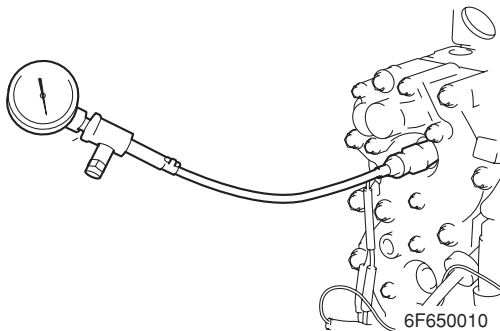
**Small end bearing installer**  
90890-06527



## Power unit

### Checking the compression pressure

1. Start the engine, warm it up for 5 minutes, and then turn it off.
2. Remove the clip from the engine stop lanyard switch.
3. Remove the spark plug caps and all spark plugs, and then install the special service tools into a spark plug hole.



#### CAUTION:

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



Compression gauge:  
90890-03160

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

#### NOTE:

Do not pull the choke knob when checking the compression pressure.

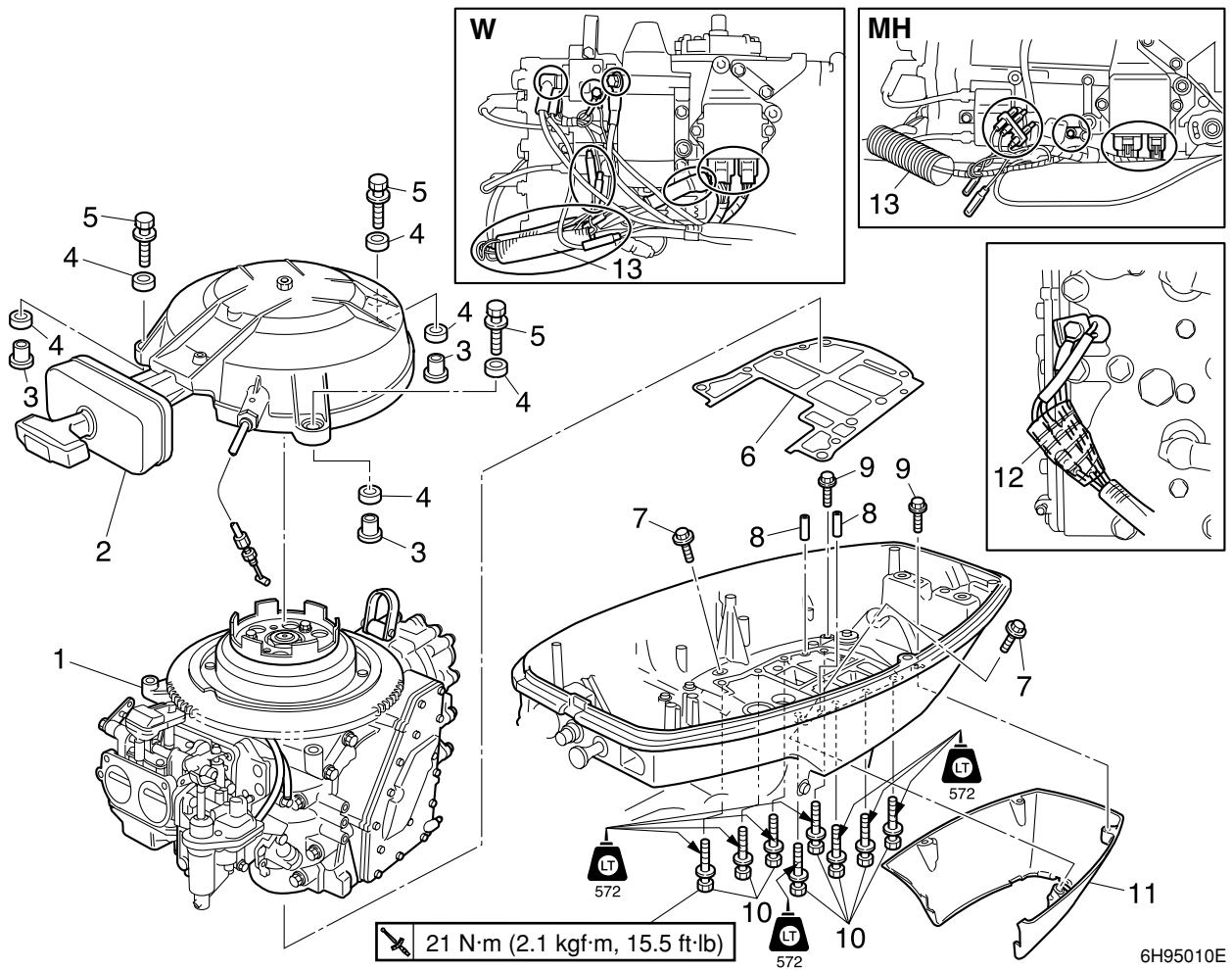


Minimum compression pressure  
(reference data):  
400 kPa (4.0 kgf/cm<sup>2</sup>, 58 psi)

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

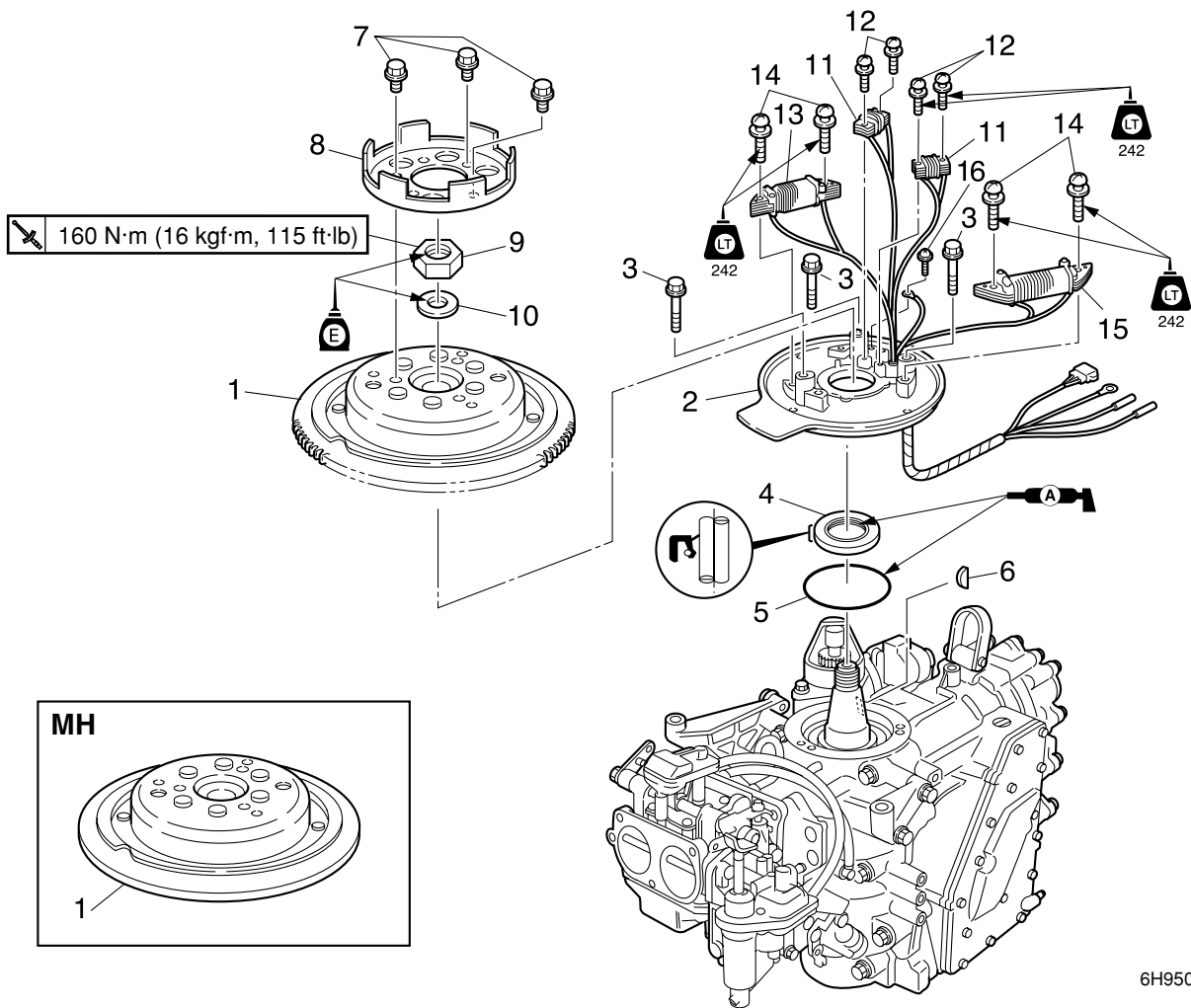
#### NOTE:

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



6H95010E

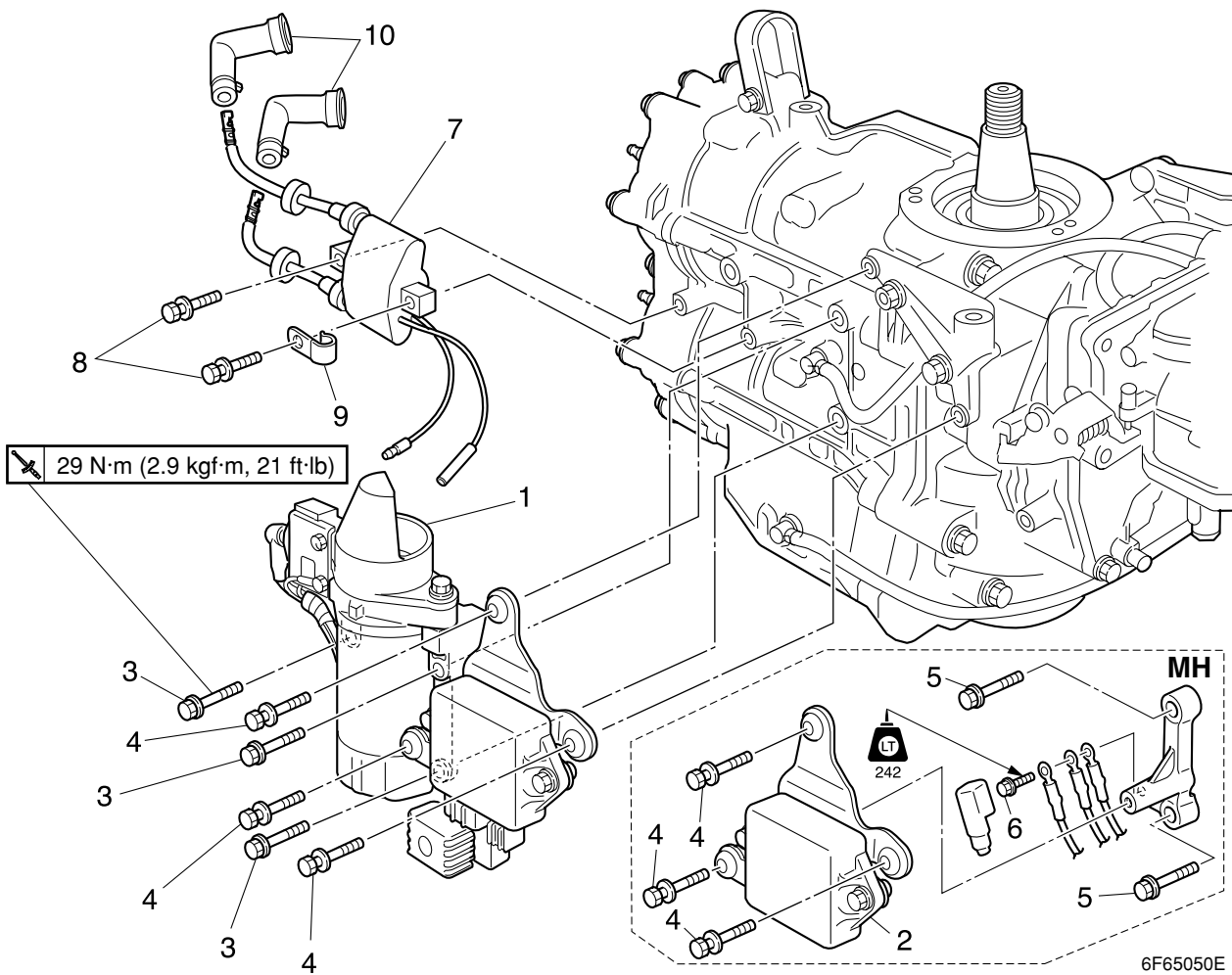
No.	Part name	Q'ty	Remarks
1	Power unit	1	
2	Manual starter assembly	1	
3	Collar	3	
4	Grommet	6	
5	Bolt	3	M8 × 35 mm
6	Gasket	1	<b>Not reusable</b>
7	Bolt	2	M6 × 12 mm
8	Dowel pin	2	
9	Bolt	2	M6 × 25 mm
10	Bolt	8	M8 × 40 mm
11	Apron	1	
12	Spiral tube	1	
13	Corrugated tube	1	



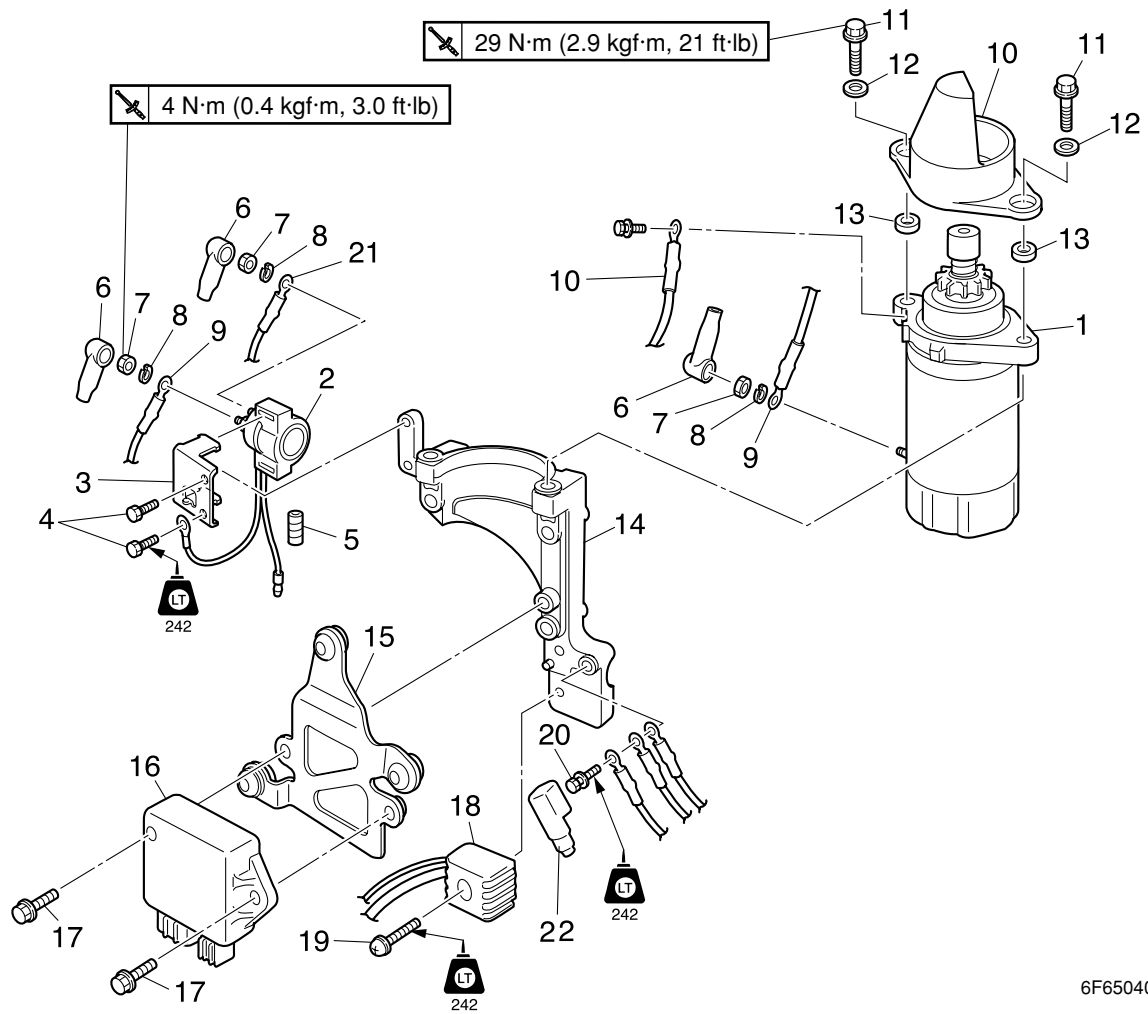
6H95030E

5

No.	Part name	Q'ty	Remarks
1	Flywheel magnet	1	
2	Base assembly	1	
3	Bolt	3	M6 × 40 mm
4	Oil seal	1	Not reusable
5	O-ring	1	Not reusable
6	Woodruff key	1	
7	Bolt	3	M8 × 14 mm
8	Starter pulley	1	
9	Nut	1	
10	Washer	1	
11	Pulser coil	2	
12	Screw	4	ø5 × 24 mm
13	Charge coil	1	
14	Screw	4	ø6 × 25 mm
15	Light coil	1	
16	Screw	1	ø4 × 6 mm



No.	Part name	Q'ty	Remarks
1	Electric starter unit and CDI unit assembly	1	W model
2	CDI unit assembly	1	
3	Bolt	3	M8 × 48 mm
4	Bolt	3	M6 × 30 mm
5	Bolt	2	M8 × 25 mm
6	Bolt	1	M6 × 16 mm
7	Ignition coil	1	
8	Bolt	2	M6 × 25 mm
9	Clamp	1	
10	Plug cap	2	

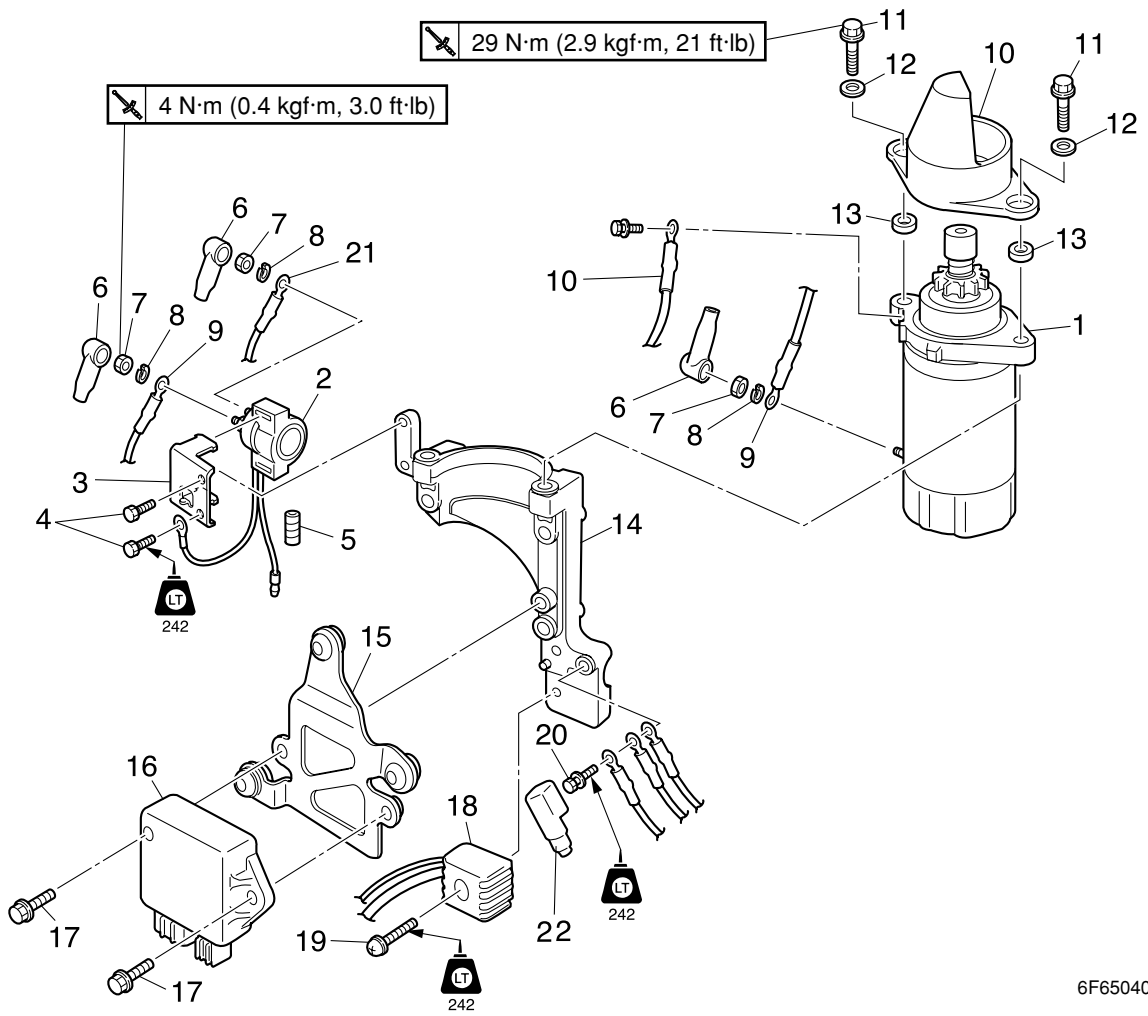


5

6F65040E

No.	Part name	Q'ty	Remarks
1	Starter motor	1	
2	Starter relay	1	
3	Bracket	1	
4	Bolt	2	M6 × 12 mm
5	Spiral tube	1	
6	Cap	3	
7	Nut	3	
8	Spring washer	3	
9	Starter motor lead	1	
10	Battery negative lead	1	
11	Bolt	2	M8 × 16 mm
12	Washer	2	
13	Collar	2	
14	Bracket	1	
15	Bracket	1	
16	CDI unit	1	
17	Bolt	2	M6 × 20 mm

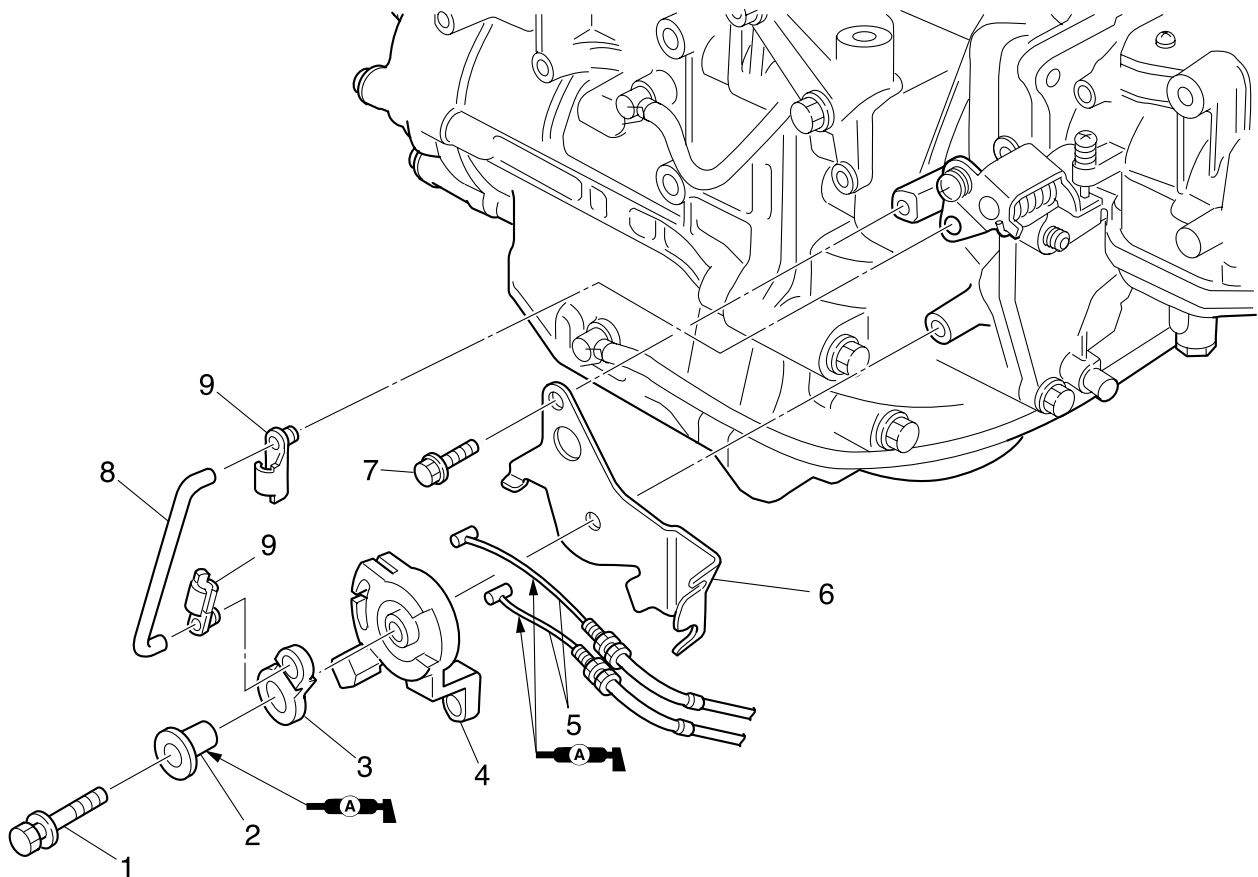
All components are for W model only.



6F65040E

No.	Part name	Q'ty	Remarks
18	Rectifier	1	
19	Screw	1	ø6 × 25 mm
20	Bolt	1	M6 × 16 mm
21	Battery positive lead	1	
22	Cap	1	

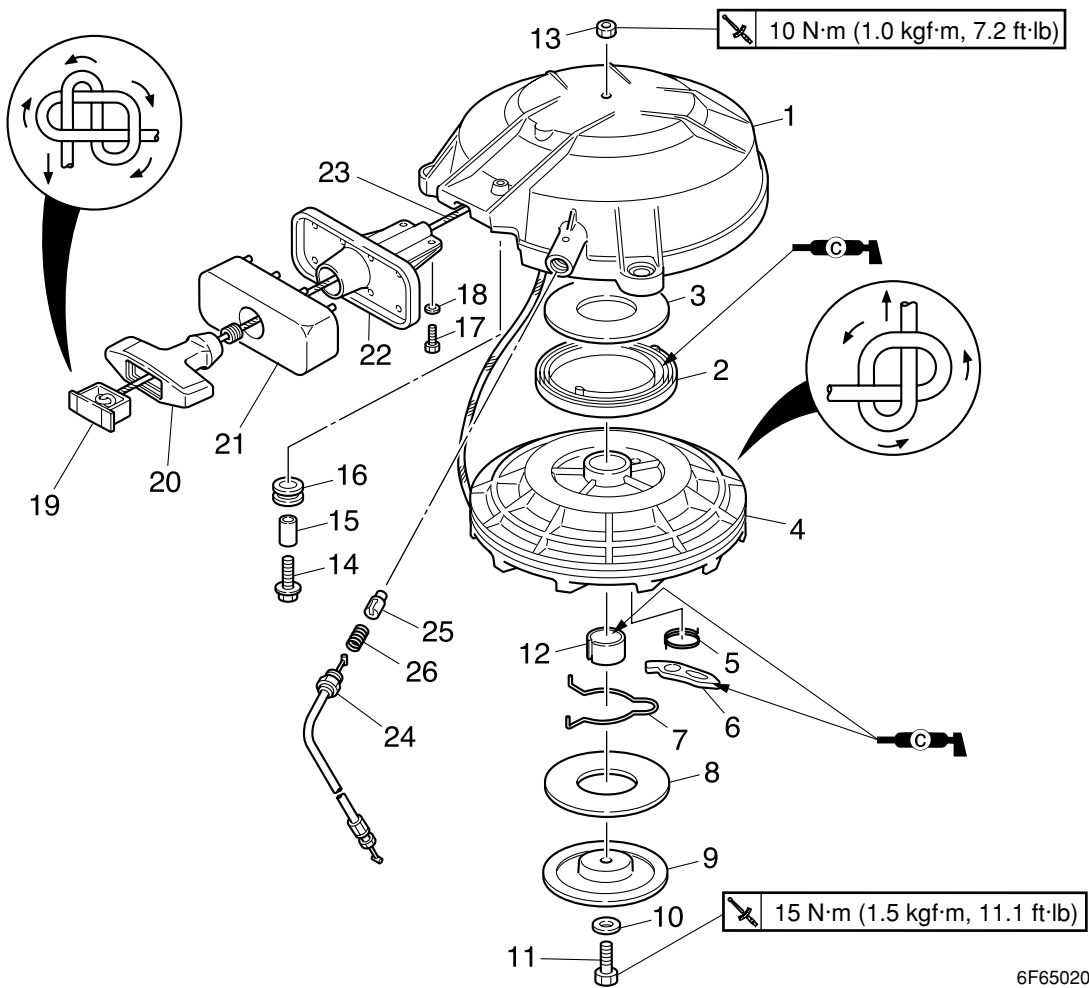
All components are for W model only.



5

6F65060E

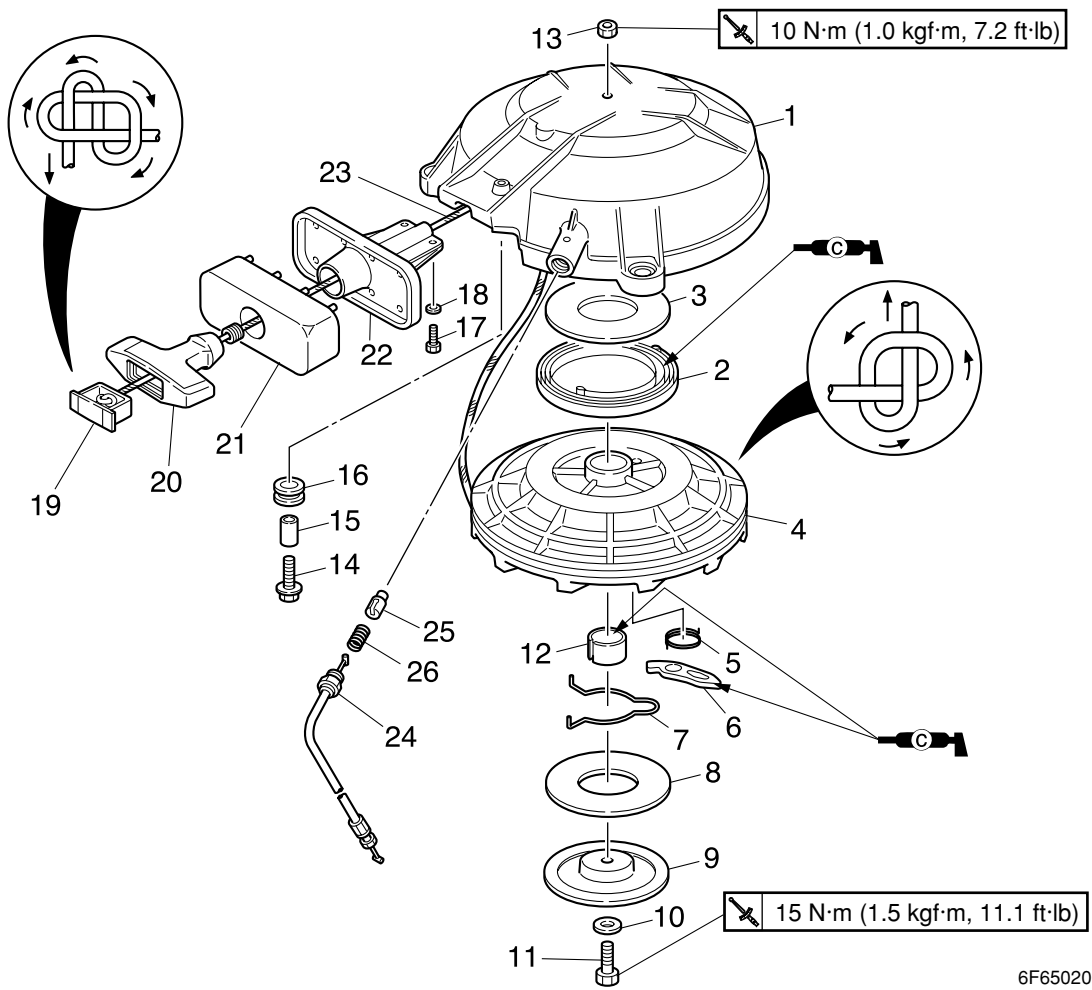
No.	Part name	Q'ty	Remarks
1	Bolt	1	M6 × 30 mm
2	Collar	1	
3	Throttle control lever	1	
4	Throttle pulley	1	
5	Throttle cable	2	
6	Bracket	1	
7	Bolt	1	M6 × 15 mm
8	Link rod	1	
9	Joint	2	



6F65020E

No.	Part name	Q'ty	Remarks
1	Manual starter case	1	
2	Spiral spring	1	
3	Washer	1	
4	Sheave drum	1	
5	Spring	1	
6	Drive pawl	1	
7	Spring	1	
8	Washer	1	
9	Drive plate	1	
10	Washer	1	
11	Bolt	1	M8 × 30 mm
12	Collar	1	
13	Nut	1	
14	Bolt	1	M6 × 20 mm
15	Collar	1	
16	Roller	1	
17	Bolt	2	M6 × 16 mm





6F65020E

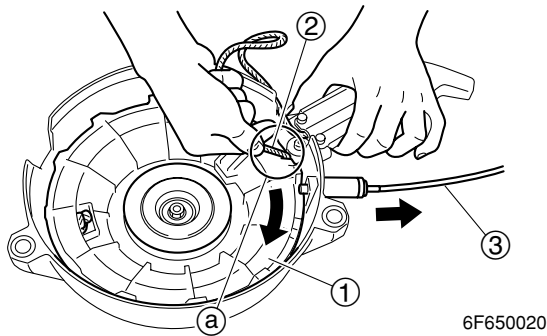
5

No.	Part name	Q'ty	Remarks
18	Washer	2	
19	Cover	1	
20	Manual starter handle	1	
21	Damper	1	
22	Starter rope guide	1	
23	Starter rope	1	
24	Start-in-gear protection cable	1	
25	Plunger	1	
26	Spring	1	



**Disassembling the manual starter**

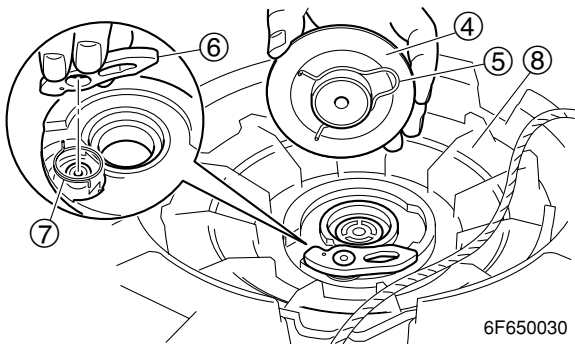
1. Turn the sheave drum ① clockwise until the spiral spring is free.



**NOTE:**

- Turn the sheave drum so that the notch on the outer surface of the sheave drum faces toward the manual starter handle.
- Pass the starter rope ② through the notch ①.
- When turn the sheave drum, pulling the start-in-protection cable ③.

2. Remove the bolt, drive plate ④, spring ⑤, drive pawl ⑥ and drive pawl spring ⑦.



**⚠WARNING**

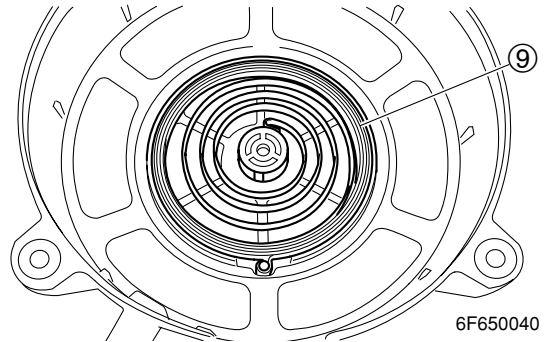
The sheave drum can pop out. Hold the sheave drum with your hand, then pull it out.

3. Remove the sheave drum ⑧.

**⚠WARNING**

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

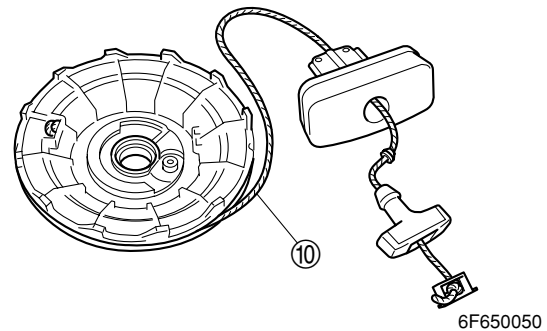
4. Remove the spiral spring ⑨ from the manual starter case.



**⚠WARNING**

The spiral spring can pop out. To remove the spring, cover it with cloths.

5. Remove the starter rope ⑩.



**Checking the spiral spring**

1. Check the spiral spring for cracks, bends, or damage. Replace if necessary.

**Checking the drive pawl**

1. Check the drive pawl for cracks or damage. Replace if necessary.

**Measuring the starter rope**

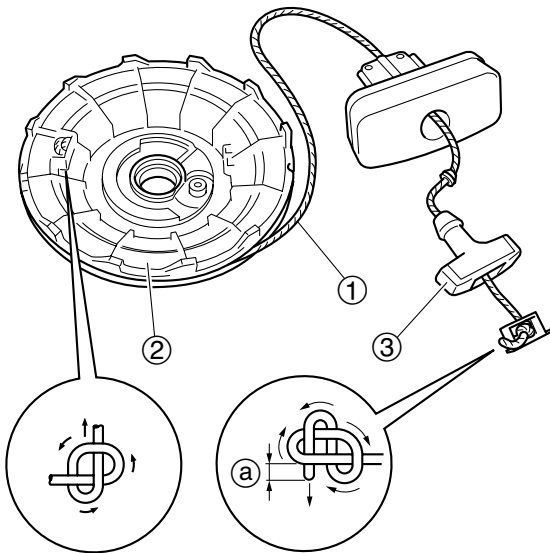
1. Measure the starter rope length. Replace if the length is below specification.



Starter rope length:  
1,900 mm (74.8 in)

**Assembling the manual starter**

1. Install the starter rope ① into the sheave drum ②.
2. Install the drive pawl and springs.
3. Install the manual starter handle ③.

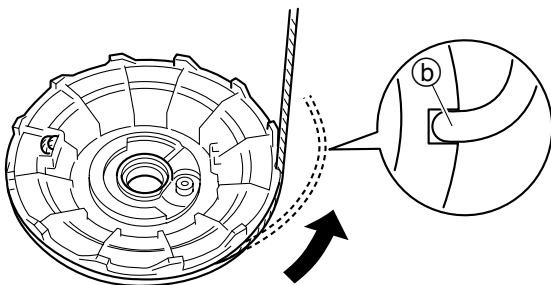


6F650060

**NOTE:**

- Tie a knot at the end of the starter rope as shown in the illustration.
- Be sure to leave 5.0—10.0 mm (0.2—0.4 in) at the end ① of the starter rope.

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

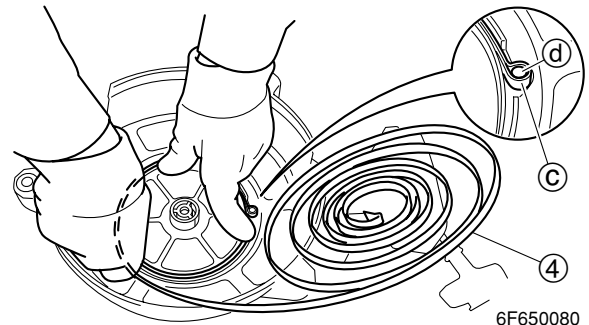


6F650070

**NOTE:**

After winding the starter rope around the sheave drum, install the starter rope in the notch ①.

5. Install the spiral spring ④ into the starter case.

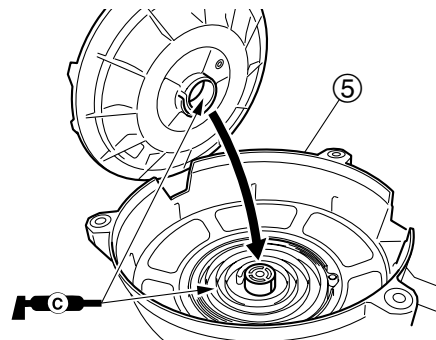


6F650080

**NOTE:**

Install the outer end ③ of the spiral spring onto the pin ④ of the starter case.

6. Install the sheave drum into the manual starter case ⑤.

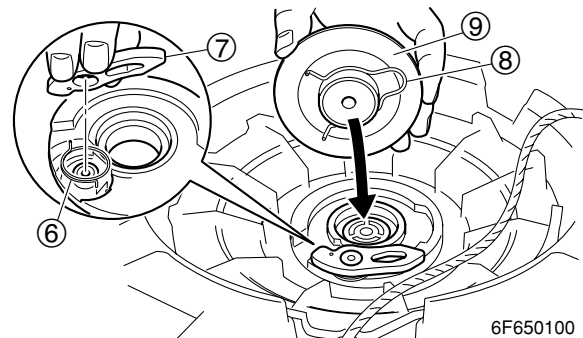


6F650090

**NOTE:**

Install the sheave drum, then set the spiral spring by turning the sheave drum.

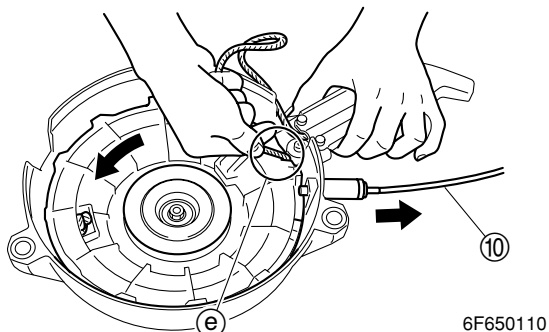
7. Install the drive pawl spring ⑥, drive pawl ⑦, spring ⑧ and drive plate ⑨.



6F650100



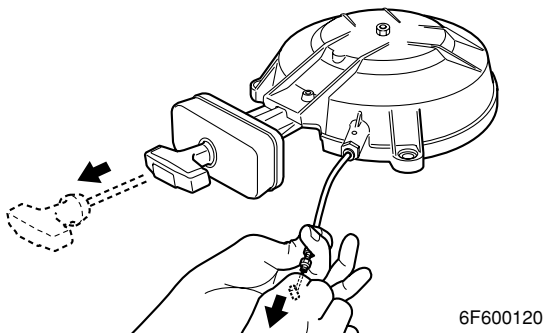
- Turn the sheave drum 3 times in the direction of the arrow shown, and then remove the starter rope from the notch (e).



6F650110

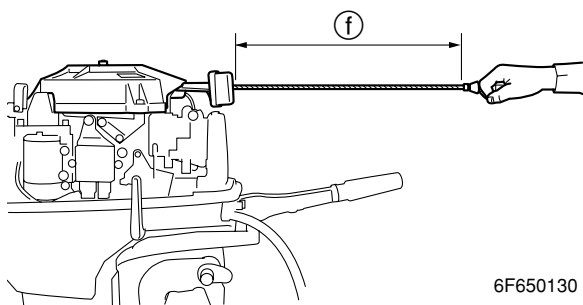
**NOTE:** Pull the start-in-gear protection cable ⑩ while turning the sheave drum as shown.

- Pull the manual starter handle several times to check that the sheave drum turns smoothly and to check the starter rope for slack. Repeat steps 4—8 if necessary.



6F600120

- Pull the manual starter handle completely, then measure the starter rope length. Adjust if the starter rope length is out of specification.



6F650130

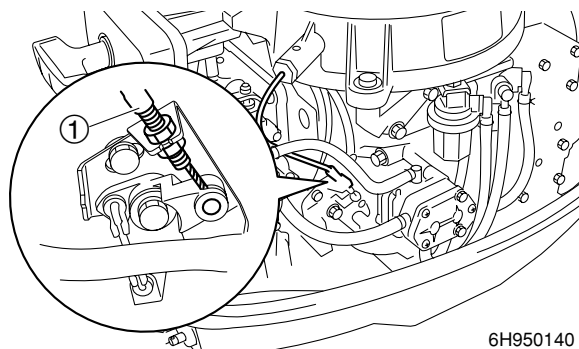


**Starter rope length (f):**  
1,300–1,500 mm (51.2–59.1 in)

## Removing the power unit

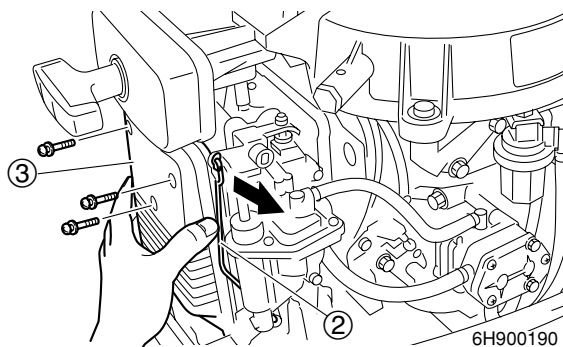
**NOTE:** It is recommended to loosen the flywheel magnet nut before removing the power unit to improve working efficiency.

- Disconnect the start-in-gear protection cable ①, and then remove the manual starter.



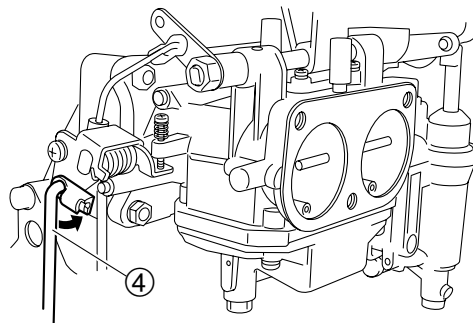
6H950140

- Remove the choke link rod ② and intake silencer ③.



6H900190

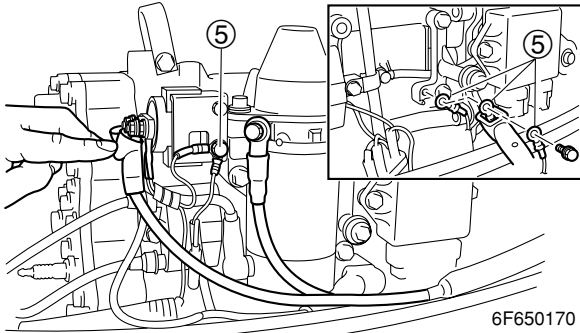
- Disconnect the throttle link rod ④.



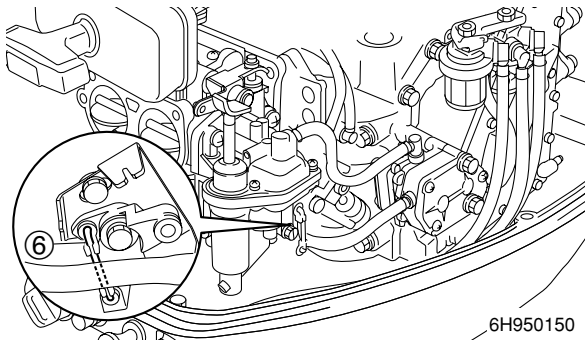
6H950160

4. Disconnect the remote control cables (remote control model) or throttle cables (tiller handle model).

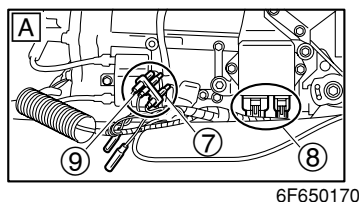
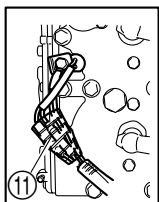
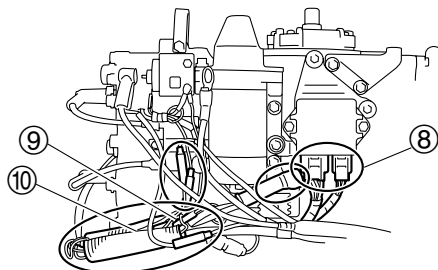
5. Disconnect the battery leads and ground leads ⑤. (W)



6. Disconnect the shift link rod ⑥.

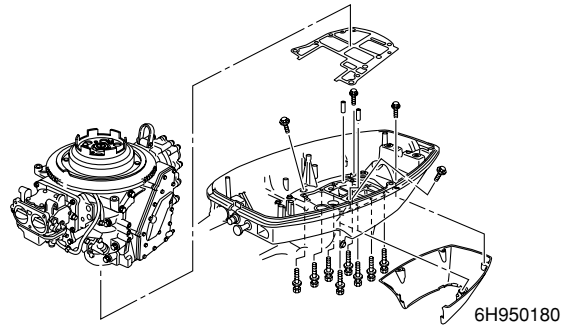


7. Disconnect the engine stop lanyard switch leads ⑦ (MH), CDI unit couplers ⑧, Ignition coil leads ⑨ and rectifier (W) leads ⑩, thermoswitch leads ⑪, fuel hose and pilot water hose.



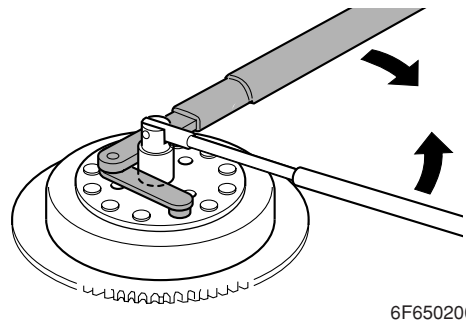
A MH model

8. Remove the apron, and then remove the power unit by removing the bolts.



### Removing the flywheel magnet

1. Remove the starter pulley, and then loosen the flywheel magnet nut.



### CAUTION:

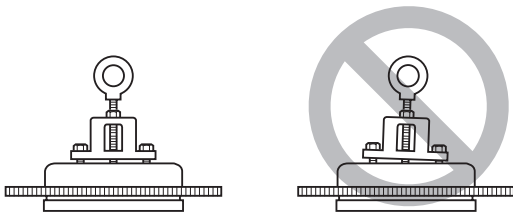
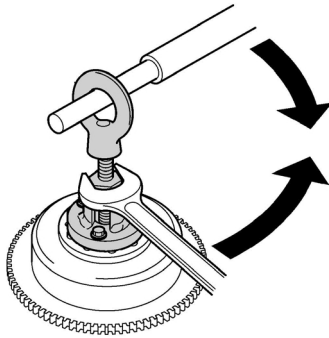
Apply force in the direction of the arrows shown. While working, do not allow the flywheel holder to slip off the flywheel.



Flywheel holder: 90890-06522



- Remove the flywheel magnet.



6B450090

**CAUTION:**

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

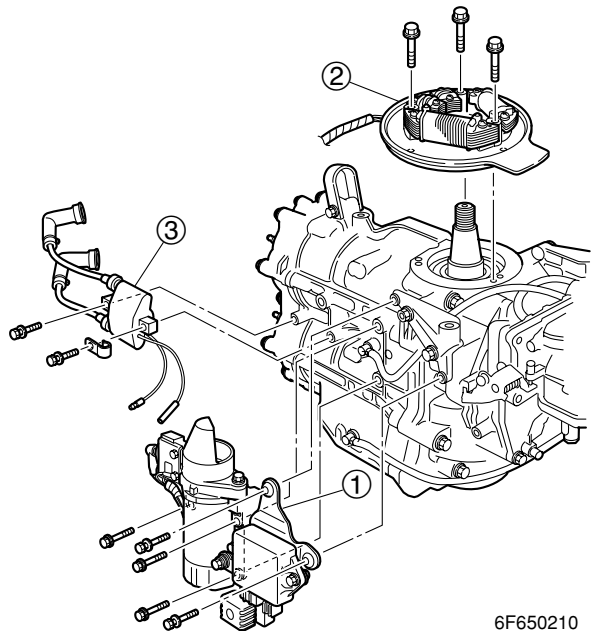


Flywheel puller: 90890-06521

- Remove the Woodruff key.

**Removing the electrical components**

- Remove the bracket ①. (W: CDI unit, starter motor, starter relay and rectifier)
- Remove the base assembly ②.

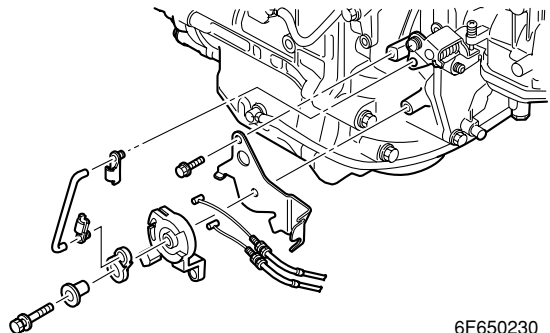


6F650210

- Remove the spark plug caps from the spark plugs, and then remove the ignition coil ③.

**Removing the throttle pulley assembly**

- Removing the throttle pulley assembly.

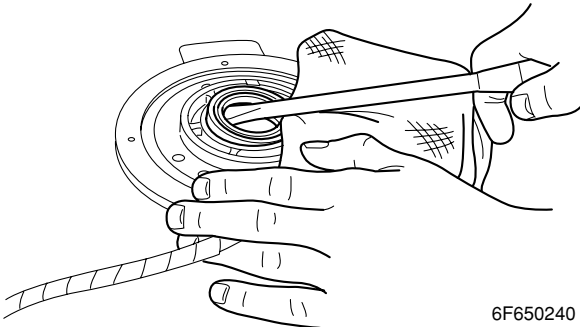


6F650230



### Disassembling the base assembly

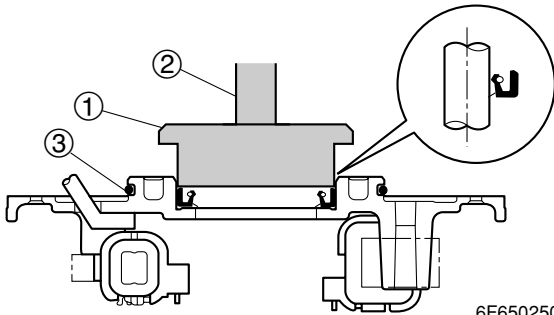
1. Remove the O-ring and oil seal.



6F650240

### Assembling the base assembly

1. Apply grease to a new oil seal, then install it into the base assembly.

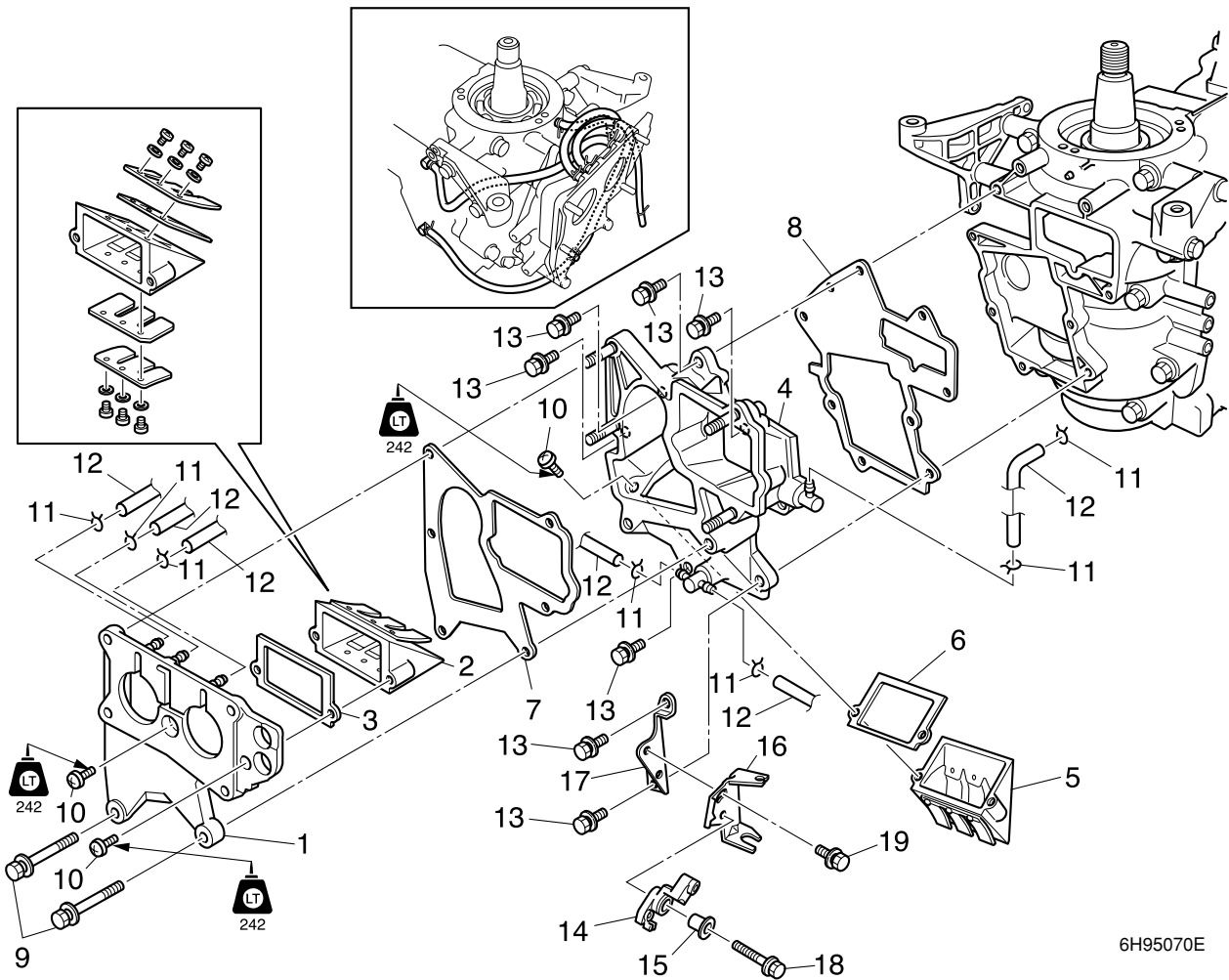


6F650250

	<p>Needle bearing attachment ①: 90890-06654</p> <p>Driver rod L3 ②: 90890-06652</p>
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2. Install a new O-ring ③.

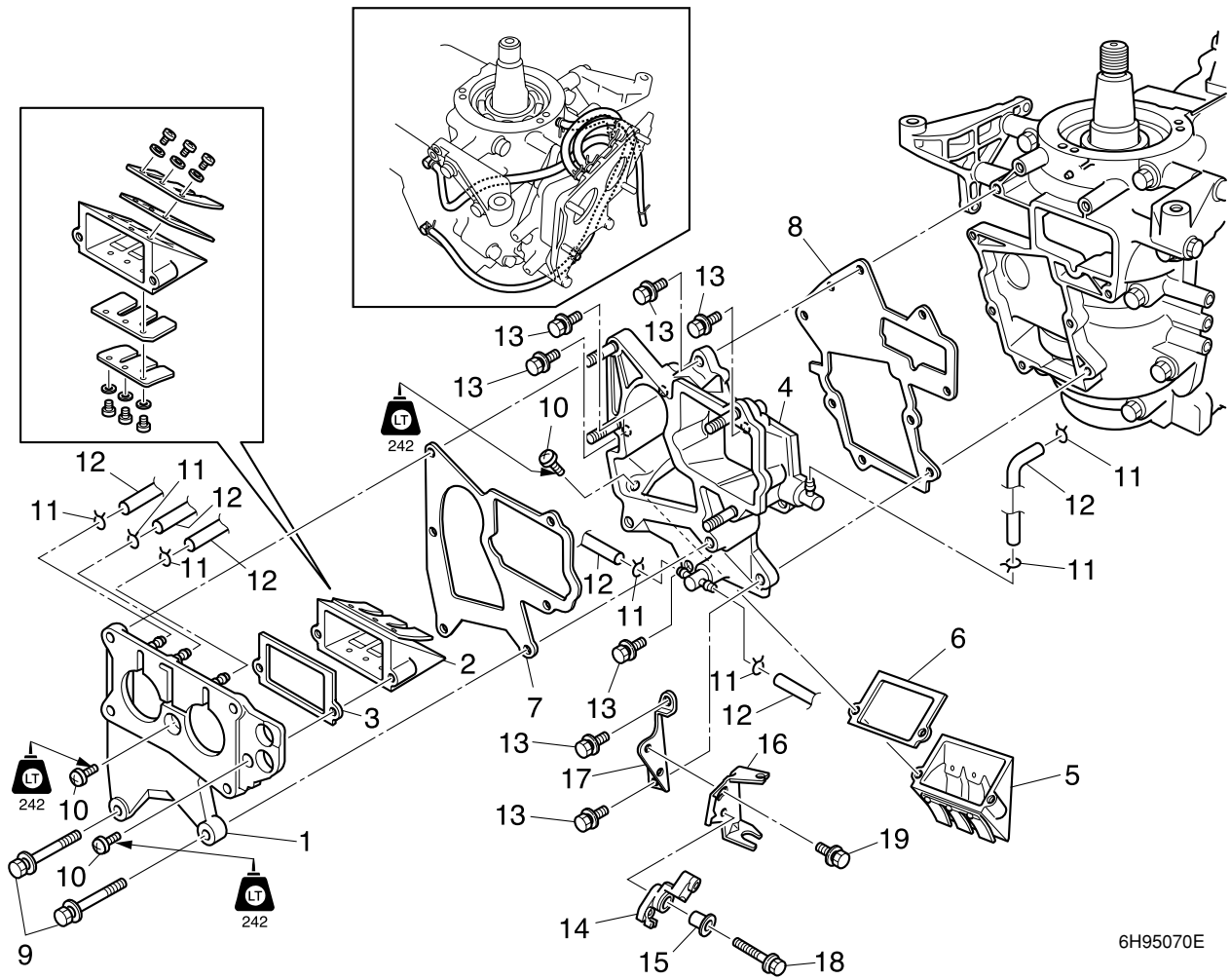
**Reed valves**



6H95070E

No.	Part name	Q'ty	Remarks
1	Intake manifold #1	1	
2	Reed valve assembly #1	1	
3	Gasket	1	Not reusable
4	Intake manifold #2	1	
5	Reed valve assembly #2	1	
6	Gasket	1	Not reusable
7	Gasket	1	Not reusable
8	Gasket	1	Not reusable
9	Bolt	2	M6 × 65 mm
10	Screw	4	ø5 × 12 mm
11	Clip	10	
12	Hose	5	
13	Bolt	7	M6 × 25 mm
14	Arm	1	
15	Collar	1	
16	Bracket	1	
17	Bracket	1	





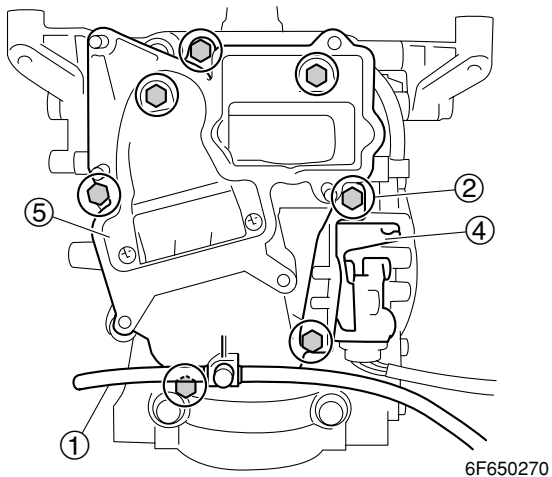
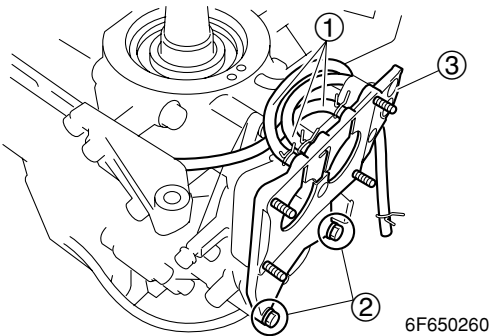
6H95070E

No.	Part name	Q'ty	Remarks
18	Bolt	1	M6 × 30 mm
19	Bolt	1	M6 × 15 mm



**Removing the reed valve assembly**

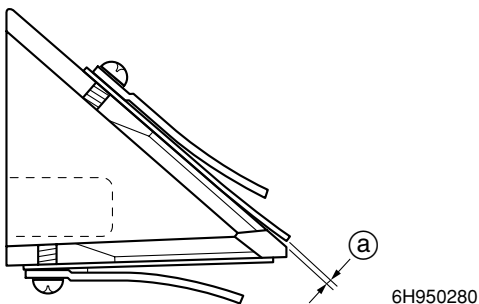
1. Remove the hoses ①.
2. Remove the intake manifold bolts ②, and then remove the intake manifold cover, gasket and reed valve assembly #1 ③.



3. Remove the stay ④, intake manifold and reed valve assembly #2 ⑤.

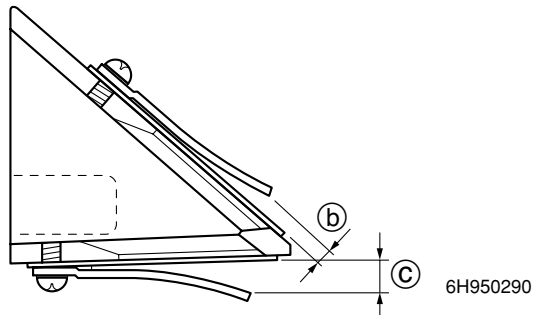
**Checking the reed valves**

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



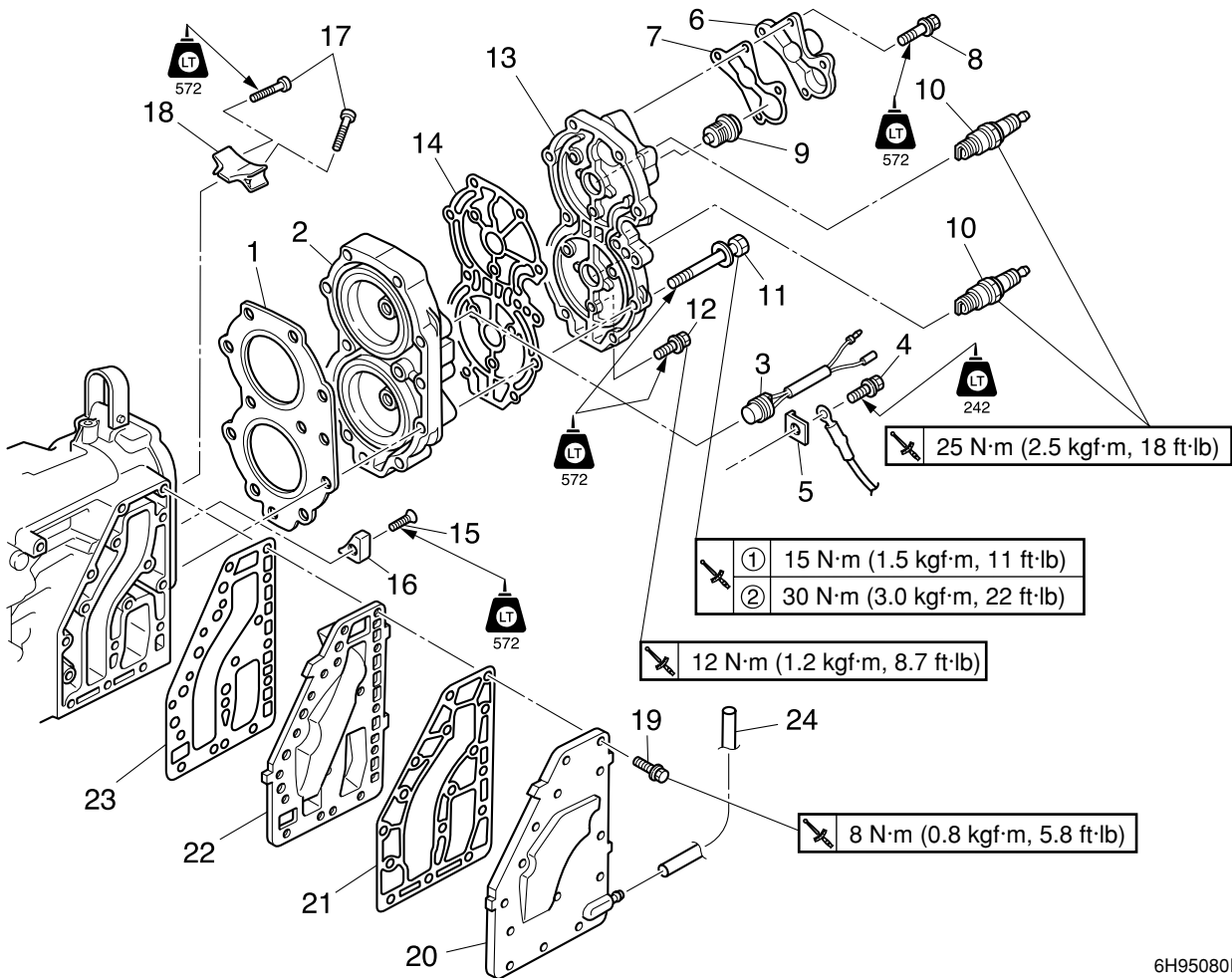
Valve bend limit ①:  
0.20 mm (0.0079 in)

2. Measure the valve stopper height ② and ③. Replace if out of specification.



Valve stopper height ②:  
2.2—2.6 mm (0.87—0.102 in)  
Valve stopper height ③:  
4.0—4.4 mm (0.157—0.173 in)

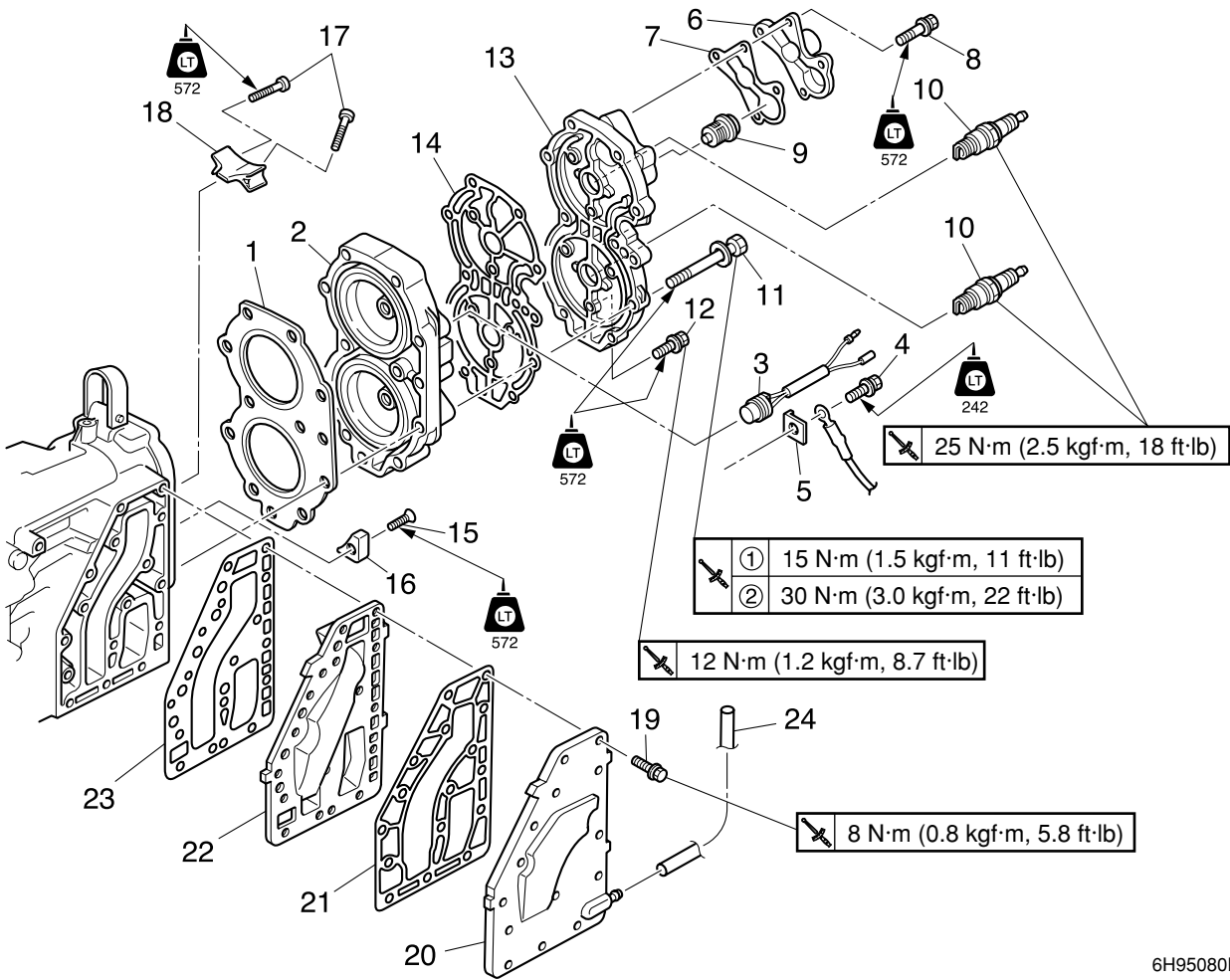
Cylinder head



6H95080E

5

No.	Part name	Q'ty	Remarks
1	Gasket	1	Not reusable
2	Cylinder head	1	
3	Thermoswitch	1	
4	Bolt	1	M6 × 14 mm
5	Holder	1	
6	Cover	1	
7	Gasket	1	Not reusable
8	Bolt	4	M6 × 30 mm
9	Thermostat	1	
10	Spark plug	2	
11	Bolt	11	M8 × 0 mm
12	Bolt	5	M6 × 25 mm
13	Cylinder head cover	1	
14	Gasket	1	Not reusable
15	Screw	1	
16	Anode	1	
17	Screw	2	

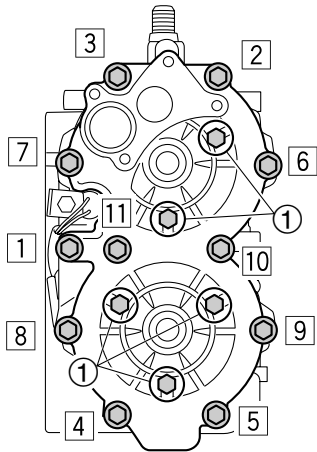


6H95080E

No.	Part name	Q'ty	Remarks
18	Anode	1	
19	Bolt	16	M6 × 25 mm
20	Exhaust outer cover	1	
21	Gasket	1	<b>Not reusable</b>
22	Exhaust inner cover	1	
23	Gasket	1	<b>Not reusable</b>
24	Hose	1	

### Removing the cylinder head

1. Remove the spark plugs, thermostat cover, thermostat and thermoswitch.
2. Remove the cylinder head cover bolts ①.
3. Remove the cylinder head bolts in the sequence shown.



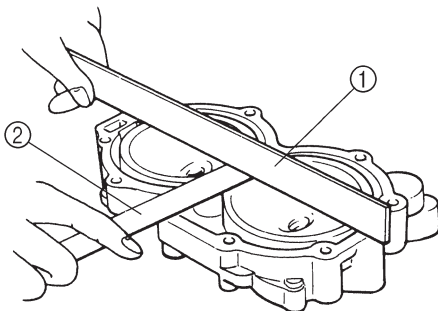
6H950300

**CAUTION:**

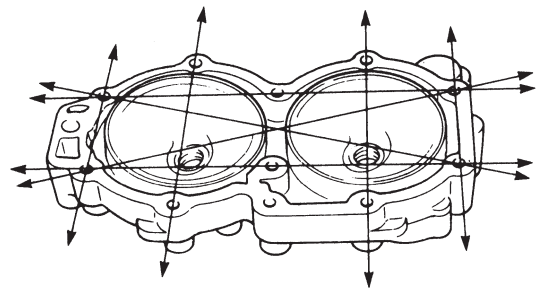
Do not scratch or damage the mating surfaces of the cylinder head and cylinder block.

### Checking the cylinder head

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



6F650310



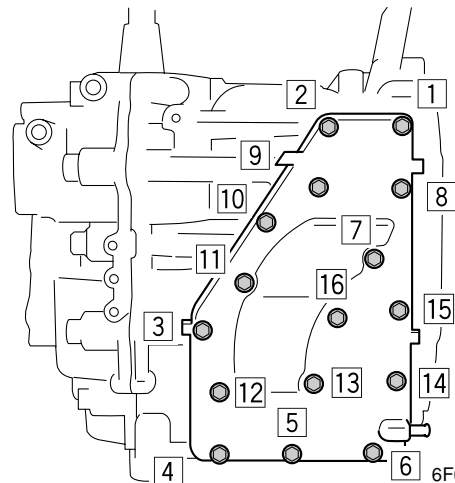
6F650320



Cylinder head warpage limit:  
0.1 mm (0.0039 in)

### Removing the exhaust cover

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

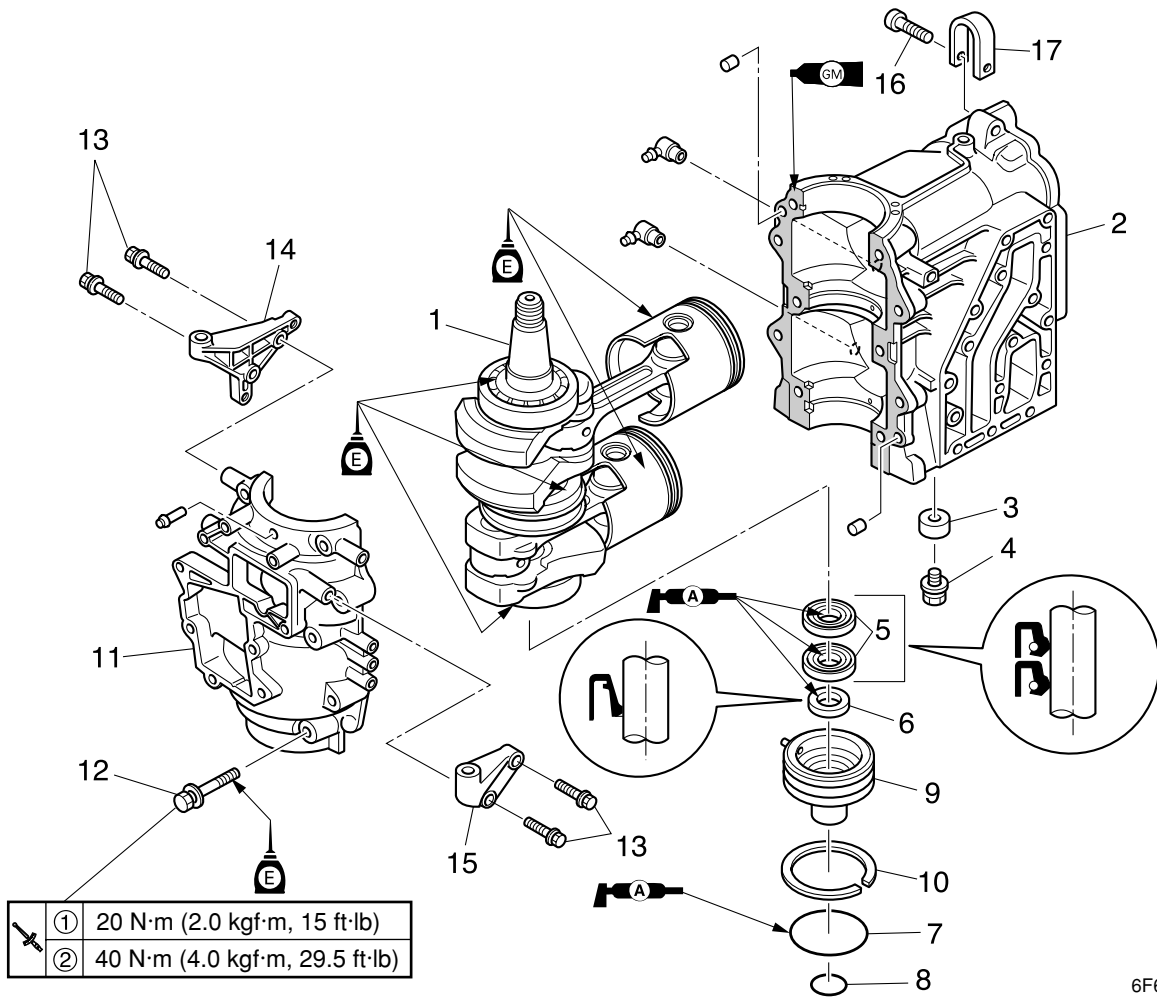


6F605330

### Checking the exhaust cover

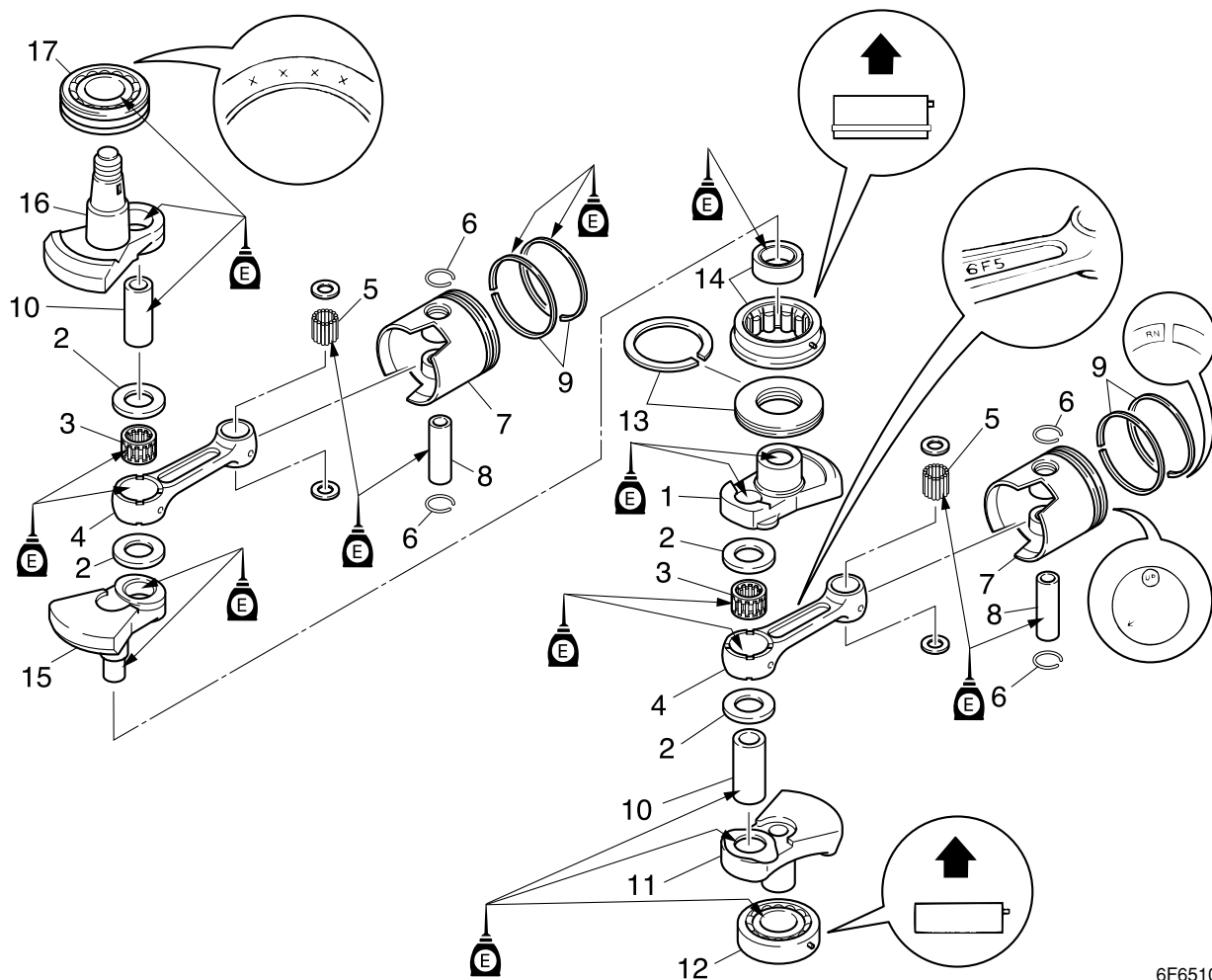
1. Check the exhaust cover for distortion or corrosion. Replace if necessary.

**Crankcase**



6F65090E

No.	Part name	Q'ty	Remarks
1	Crankshaft assembly	1	
2	Cylinder Block	1	
3	Anode	1	
4	Bolt	1	M6 × 16 mm
5	Oil seal	2	Not reusable
6	Oil seal	1	Not reusable
7	O-ring	1	Not reusable
8	O-ring	1	Not reusable
9	Oil seal housing	1	
10	Circlip	1	
11	Crankcase	1	
12	Bolt	10	M10 × 55 mm
13	Bolt	4	M8 × 35 mm
14	Bracket	1	
15	Bracket	1	
16	Bolt	1	M8 × 35 mm
17	Engine hanger	1	



6F65100E

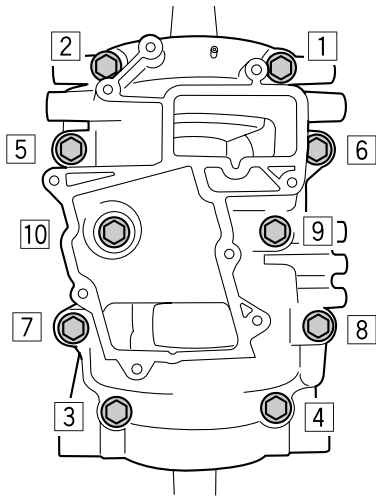
5

No.	Part name	Q'ty	Remarks
1	Crank 3	1	
2	Washer	4	
3	Roller bearing	2	
4	Connecting rod	2	
5	Needle bearing	56	
6	Circlip	4	Not reusable
7	Piston	2	
8	Piston pin	2	
9	Piston ring set	2	
10	Crank pin	2	
11	Crank 4	1	
12	Ball bearing	1	Not reusable
13	Labyrinth seal	1	
14	Roller bearing assembly	1	
15	Crank 2	1	
16	Crank 1	1	
17	Ball bearing	1	Not reusable

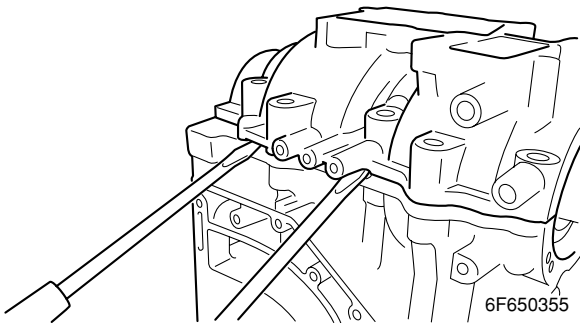


### Removing the crankcase

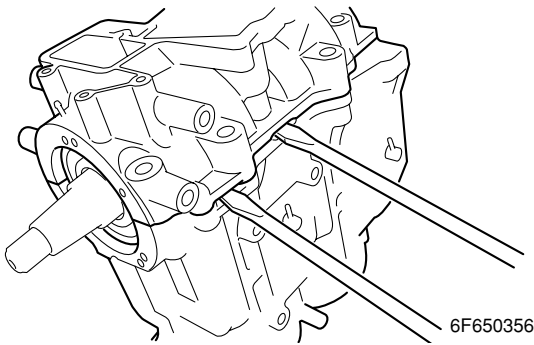
1. Remove the crankcase bolts in the sequence shown.



6F650350



6F650355



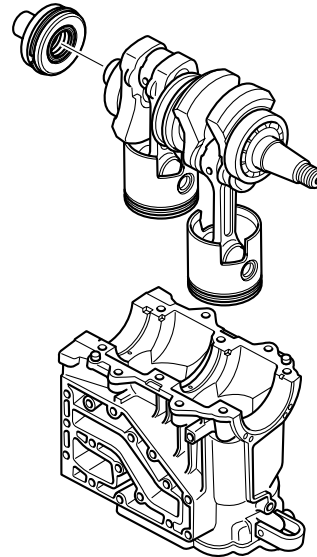
6F650356

**NOTE:**

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

### Removing the crankshaft assembly and oil seal housing

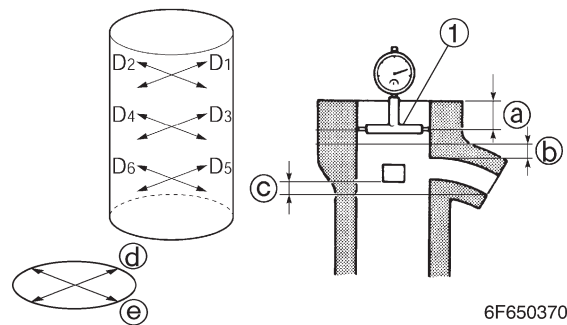
1. Remove the crankshaft assembly and oil seal housing.



6F650360

### Checking the cylinder bore

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



6F650370

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




Cylinder bore diameter ( $D_1 - D_6$ ):  
78.000 — 78.020mm  
(3.0709 — 3.0716 in)




Cylinder gauge ①:  
90890-06759



- Calculate the taper limit. Replace or rebores the cylinder block if above specification.

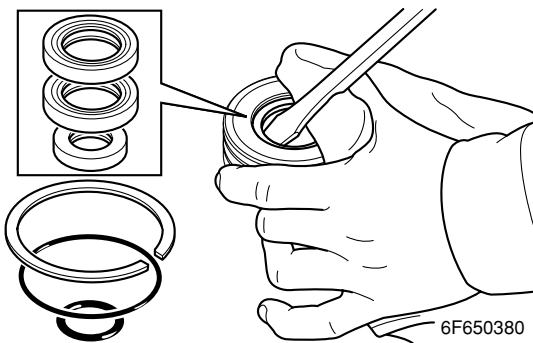
 Taper limit:  
 $D_1 - D_5$  (direction Ⓓ)  
 $D_2 - D_6$  (direction Ⓔ)  
 0.08 mm (0.0032 in)

- Calculate the out-of-round limit. Replace or rebores the cylinder block if above specification.

 Out of round limit:  
 $D_2 - D_1$  (direction Ⓐ)  
 $D_6 - D_5$  (direction Ⓒ)  
 0.05 mm (0.0020 in)

### Disassembling the oil seal housing

- Remove the O-ring and oil seals.

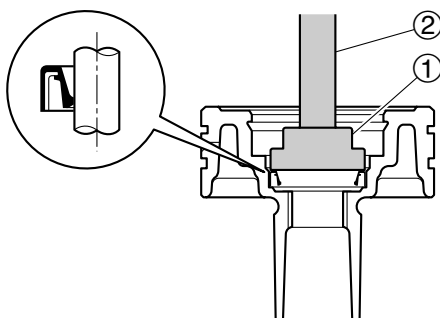



### Checking the oil seal housing

- Check the oil seal housing for cracks, damage, or corrosion. Replace if necessary.

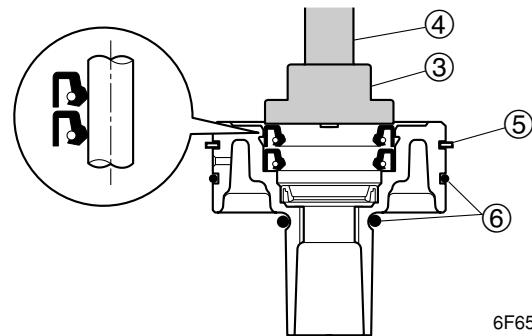
### Assembling the oil seal housing


- Apply grease to new oil seals, then install them into the oil seal housing.



 Needle bearing attachment ①:  
 90890-06613  
 Driver rod L3 ②:90890-06652

- Apply grease to new oil seals, then install them into the oil seal housing.



 Needle bearing attachment ③:  
 90890-06631  
 Driver rod LS ④:90890-06606

- Install the circlip ⑤, apply grease to new O-rings ⑥, and then install them.

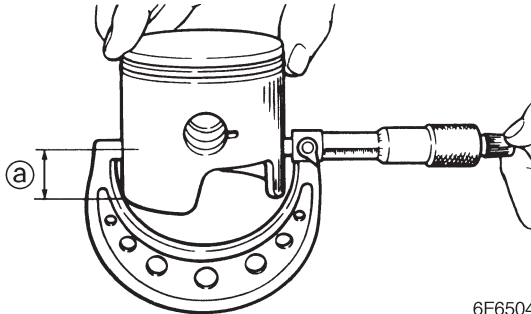
### Disassembling the piston

- Remove the clips with pliers, and then remove the piston pin.
- Separate the piston from the connecting rod.
- Remove the bearing and washers at the connecting rod small end.
- Remove the top ring and 2nd piston ring.



**Checking the piston diameter**

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



6F650420



**Piston outside diameter:**  
 77.940—77.965 mm  
 (3.0685—3.0695 in)  
**Measuring point (a):**  
 10.0 mm (0.39 in) up from the bottom of the piston skirt.  
**Oversize piston diameter:**  
 1st:  
 78.190—78.215 mm  
 (3.0783—3.0793 in)  
 2nd:  
 78.440—78.465 mm  
 (3.0882—3.0892 in)

**Checking the piston clearance**

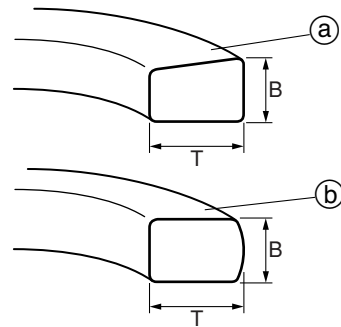
1. Calculate the piston clearance using the piston outside diameter and the cylinder bore specifications. Replace the piston and piston rings as a set or the cylinder block or all parts, or rebore the cylinder if out of specification.



**Piston clearance:**  
 0.055—0.060 mm  
 (0.0022—0.0024 in)

**Checking the piston rings**

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

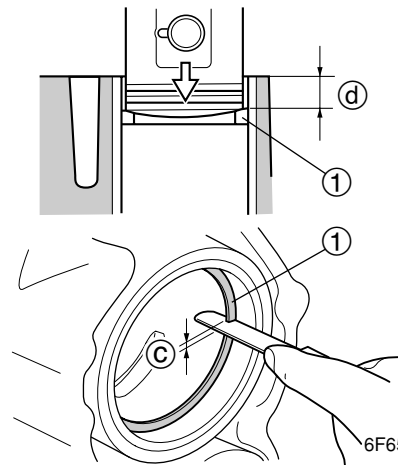


6B450460



**Piston ring dimensions**  
 Top ring (a) and 2nd piston ring (b):  
 B: 1.970—1.990 mm  
 (0.0776—0.0783 in)  
 T: 2.500—2.700 mm  
 (0.0984—0.1063 in)

2. Level the piston rings (1) in a cylinder with a piston crown.
3. Check the piston ring end gap (C) at the specified measuring point. Replace if out of specification.



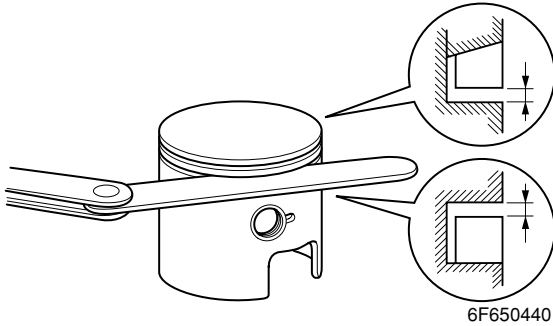
6F650430



**Piston ring end gap (C):**  
 Top ring and 2nd piston ring:  
 0.30—0.50 mm  
 (0.0118—0.0197 in)  
**Measuring point (d):**  
 10.0 mm (0.39 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.



6F650440



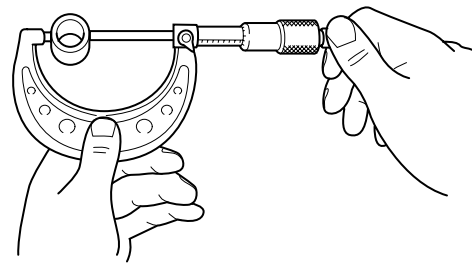
Piston ring side clearance:

Top ring:

0.02—0.06 mm  
(0.0008—0.0024 in)

2nd piston ring:

0.03—0.07 mm  
(0.0012—0.0028 in)



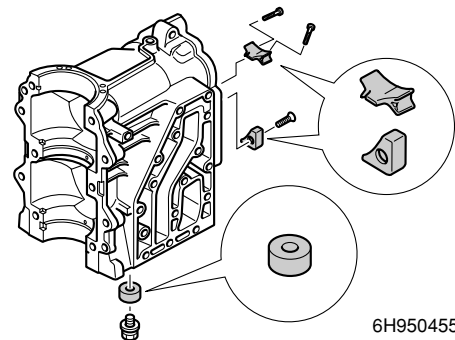
6B450530



Piston pin diameter:  
19.895—19.90 mm  
(0.7833—0.7835 in)

## Checking the internal anodes

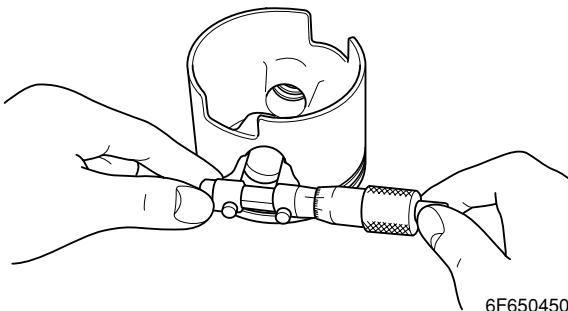
1. Check the anodes on the cylinder block.  
Clean the anode's surface and replace if it has been eroded into half size or smaller.



6H950455

## Checking the piston pin boss bore

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



6F650450



Piston pin boss bore:  
19.904—19.915 mm  
(0.7836—0.7841 in)

## Checking the piston pin

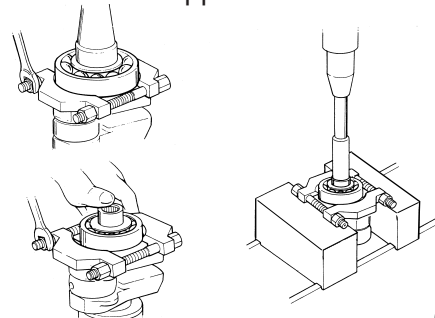
1. Measure the piston pin outside diameter.  
Replace if out of specification.

### CAUTION:

Do not oil, grease, or the anodes, otherwise they will not be able to prevent galvanic corrosion effectively.

## Disassembling the crankshaft

1. Remove the upper and lower bearings.



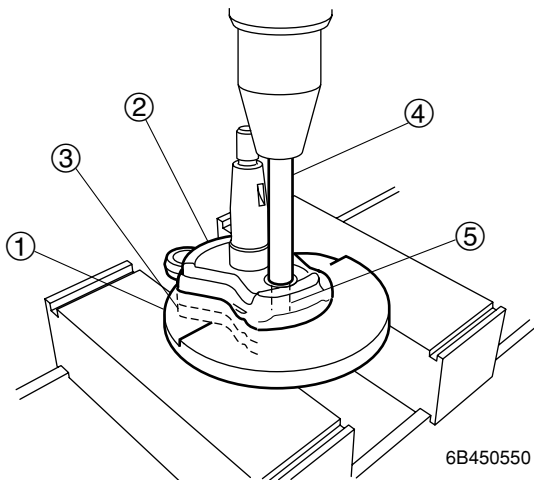
6B450545



Bearing separator: 90890-06534



2. Insert the plate C ① between crank 1 ② and crank 2 ③. Place pressure pin C ④ in the end of the crank pin ⑤.



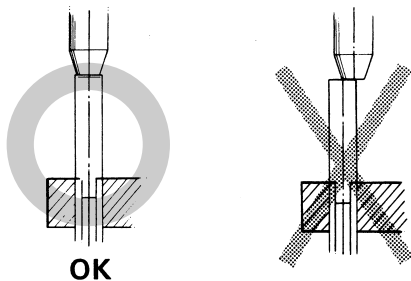
**NOTE:**

Remove the bearing before starting this procedures.



Plate C ①: 90890-02402  
Pressure pin C ④: 90890-02403

3. Remove the crank pin by applying pressure to pressure pin C ④ with a press.



6B450560

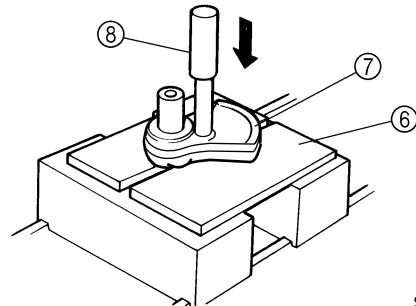
**CAUTION:**

- Apply pressure to pressure pin C slowly.
- Hold pressure pin C in line with the press screw spindle.

**NOTE:**

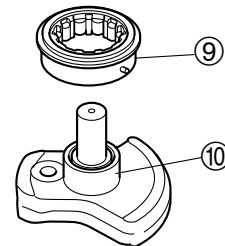
- When forcing out the crank pin, use care so that the crank does not fall.
- To remove crank 4, follow the same procedure.

4. Remove the washers, roller bearing and connecting rod.
5. Insert the support ⑥ between crank 2 and 3 ⑦ with crank 3 on top. Place pressure pin B ⑧ on the shaft, and force it out using a press.

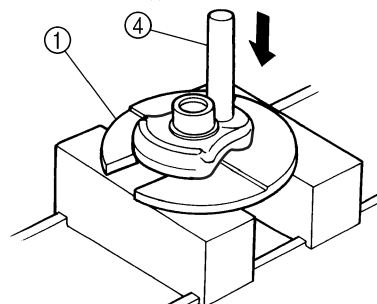


Support ⑥: 90890-02394  
Pressure pin B ⑧: 90890-02390

6. Remove the roller bearing ⑨ from the inner race ⑩.



7. Remove the crankpin between cranks 2 and 3 by applying pressure to pressure pin C using a press.



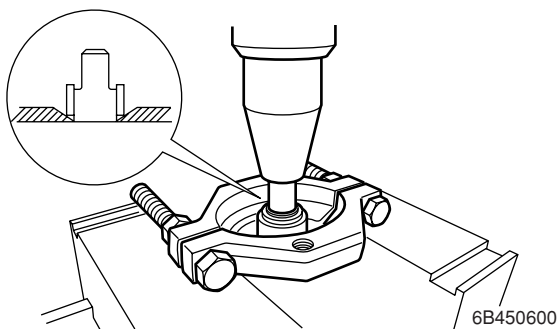
**NOTE:**

Pressure pin C should be pressed down straight.



Plate C ①: 90890-02402  
Pressure pin C ④: 90890-02403

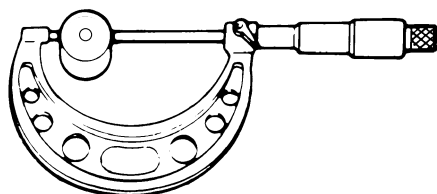
- Using the bearing separator to slightly move the inner race off the shaft, and then remove the inner race.



**NOTE:** \_\_\_\_\_  
Use care not to scratch the shaft.

### Checking the crankpin

- Measure the crankpin diameter. Replace if out of specification.



6F650490

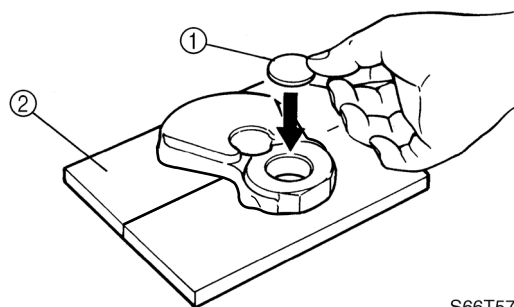
	Crankpin diameter: 26.995—27.000 mm (1.0627—1.0629 in)
--	--

### Assembling the crankshaft

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

- When reassembling the crankshaft, wash all component parts in clean kerosene (do not use gasoline).
- Do not reuse bearings, always replace them with new ones.

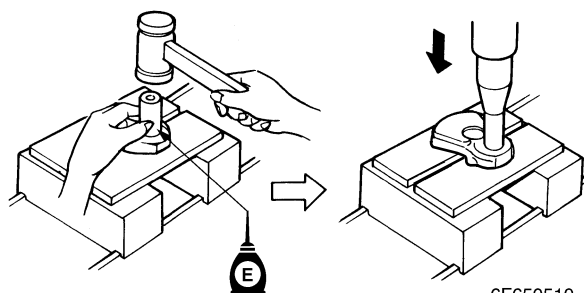
- Insert spacer C ① into the crankpin hole of crank 2 (or crank 4).



S66T5710

	Spacer C ①: 90890-02404 Support ②: 90890-02394
--	---

- Apply engine oil to the crankpin and insert it into the crankpin hole by tapping it with a copper hammer, and then install the crankpin using a press.



6F650510

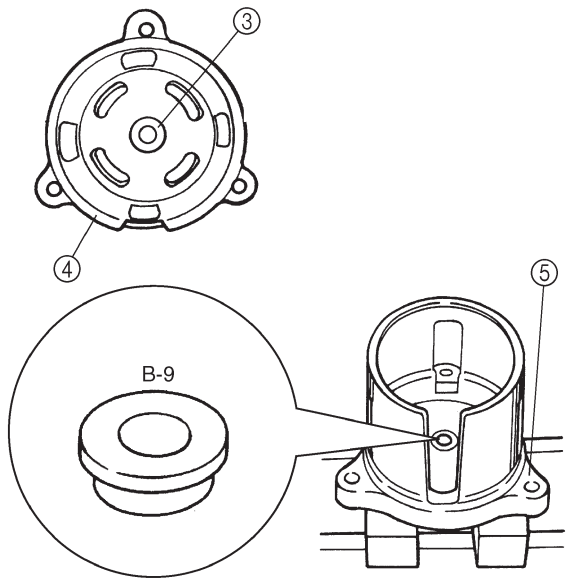
**CAUTION:** \_\_\_\_\_

- Take care so that the crank pin is set squarely into the crank web.
- Do not apply force in excess of 5 tons.


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

Follow the same procedure for both crank 2 and crank 4 to install the crankpins using a press.

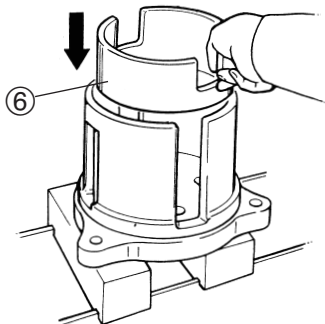
3. Insert the bushing ③ into the body ④.



6F650520


	Bushing-9 (D30) ③: 90890-02363 Body④: 90890-02352 Flange⑤: 90890-02351
--	--

4. Place the height ring ⑥ in the body.

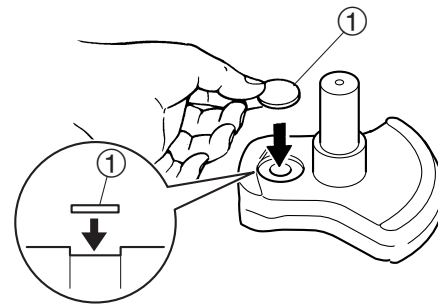


6B450650


**NOTE:** \_\_\_\_\_  
Align the slot in the height ring with the slot in the body.

	Height ring (H-18) ⑥: 90890-02401
---	--------------------------------------

5. Set the spacer on the crank 2 (or crank 4).

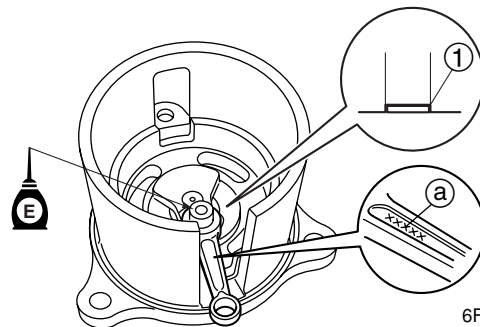


6F650530

	Spacer C ①: 90890-02404
---	-------------------------

6. Set crank 2 (or crank 4) on the special service tool.

7. Mount the washers, roller bearing, and connecting rod on the crankpin.

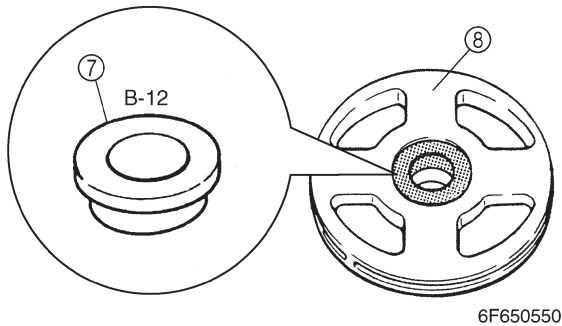


6F650540

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

- Take care so that spacer C ① does not fall out of the crank, turn the crank over so that the crankpin is on top, and then insert the crank into the special service tool.
- The model number ① on the connecting rod should face up.

8. Install the bushing ⑦ on the pressure plate ⑧.

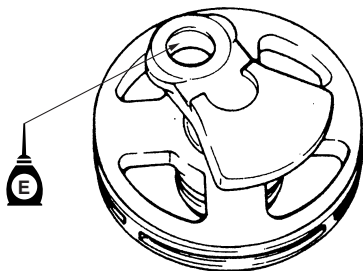


6F650550

**NOTE:** \_\_\_\_\_  
When installing crank 3 to the pressure plate, do not use the bushing ⑦.

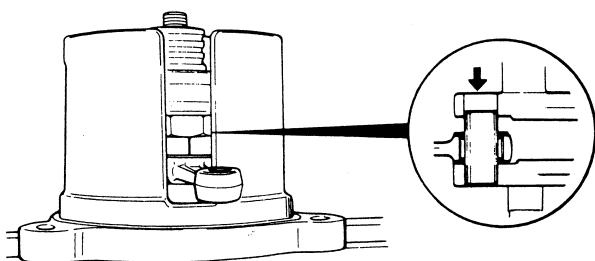
	Bushing-12 (D35) ⑦: 90890-02366
	Pressure plate ⑧: 90890-02384

9. Install crank 1 (or crank 3) to the pressure plate.



6B450690

10. Align the crankpin hole in crank 1 (or crank 3) with the crankpin fitted to crank 2 (or crank 4) and place the pressure plate in the body.



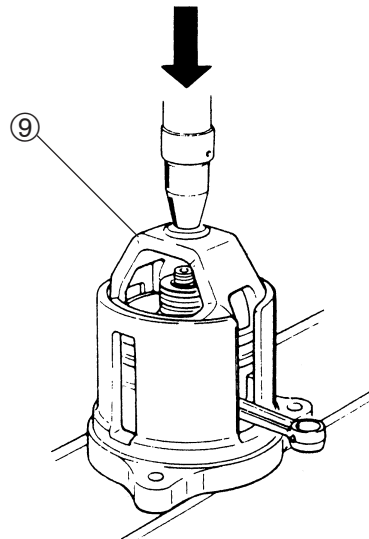
6B450700

**NOTE:** \_\_\_\_\_  
Apply engine oil to the crankpin.

11. Insert the press body ⑨, and install crank 1 (or crank 3) onto the crankpin using a press.

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

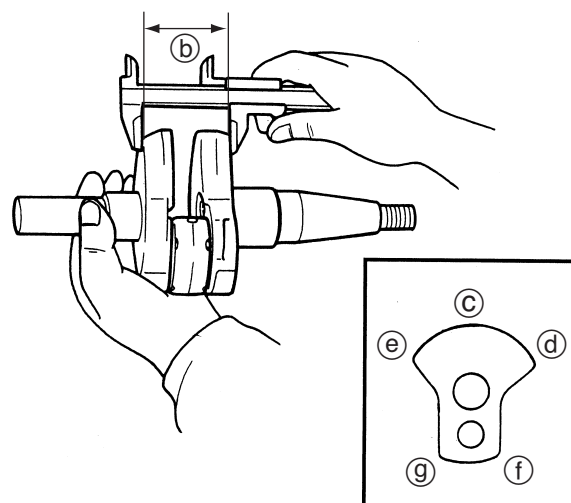
**Do not apply force in excess of 5 tons.**



6B450710

	Press body ⑨: 90890-02385
--	---------------------------

12. Measure the width ⑥ of the assembled crankshaft using calipers. Measurements should be made at positions ③ to ⑨.



6B450720





**NOTE:**

If any of the measurements are out of specification, reassemble the crankshaft.



Crankshaft width (b):  
61.40–61.45 mm  
(2.4173–2.4193 in)

13. Install the inner race (10) onto crank 2 by using a press and the bushing (3). Carefully press the inner race onto the shaft.

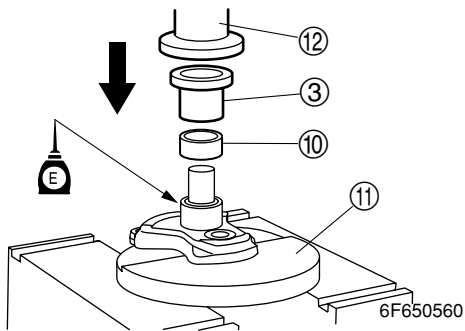
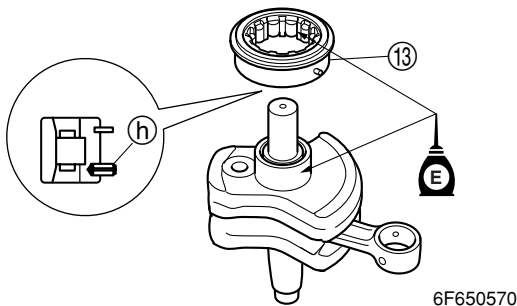


Plate C (11): 90890-02402  
Bushing-9 (D30) (3): 90890-02363  
Bearing pressure C (12):  
90890-02393

14. Install the roller bearing (13) onto crank 2.

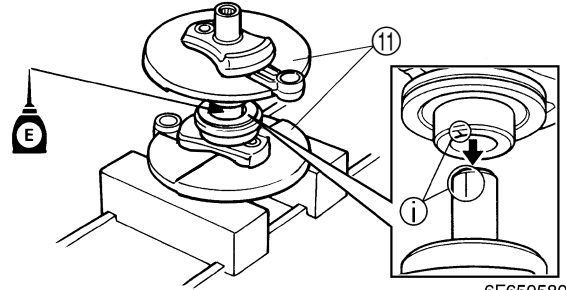


**NOTE:**

Make sure the pin (h) side of the bearing faces crank 2.

15. Insert plate C (11) between crank 1 and crank 2, and install the labyrinth ring on crank 3, before connecting crankshaft assemblies 3 and 4.

16. Insert plate C (11) between crank 3 and crank 4, then place them onto the crankshaft assemblies 1 and 2.



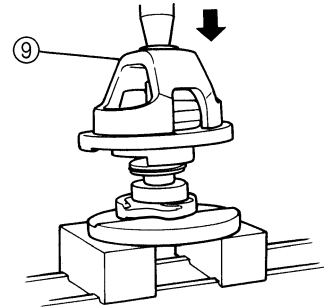
**NOTE:**

Align the alignment marks (i) on cranks 2 and 3.



Plate C (11): 90890-02402

17. Place the press body (9) on plate C and install the crank 2 into crank 3 using a press.



**CAUTION:**

Do not apply force in excess of 7 tons.

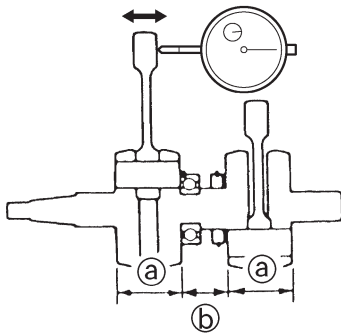


Press body (9): 90890-02385



### Checking the crankshaft

1. Measure the crankshaft widths (a) and (b). Repair or disassemble the crankshaft if out of specification.
2. Measure the connecting rod small end axial play. Replace the bearing and connecting rod if above specification.



6F650600

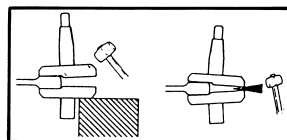
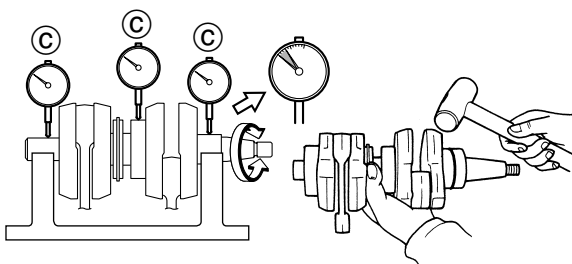


Crankshaft width (a):  
61.40–61.45 mm  
(2.4173–2.4193 in)

Crankshaft width (b):  
41.38–41.60 mm  
(1.6291–1.6378 in)

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

3. Measure the crankshaft runout. Repair or disassemble the crankshaft if above specification.



6B450790



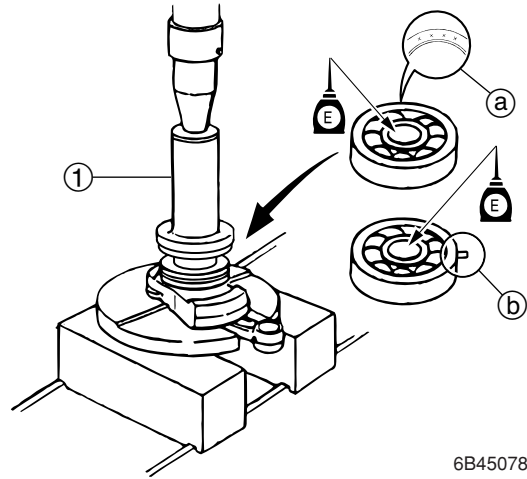
Crankshaft runout limit (c):  
0.03 mm (0.0012 in)



Crankshaft aligner:  
90890-03107

### Installing the crankshaft bearings

1. Install the upper and lower bearings using the bearing pressure C (1) and a press.



6B450780

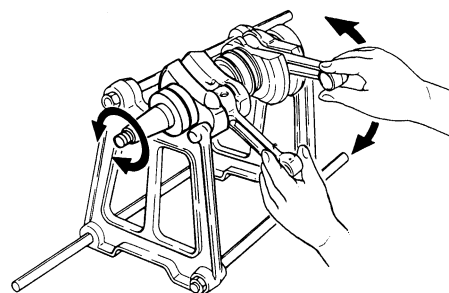
#### NOTE:

- Install the upper bearing so that the manufacture identification mark (a) faces the flywheel magnet side.
- Install the lower bearing so that the dowel (b) faces the flywheel magnet side.



Bearing pressure C (1):  
90890-02393

2. Slowly turn the crankshaft and connecting rods. If it does not turn smoothly, disassemble the crankshaft and adjust or replace any parts as necessary.

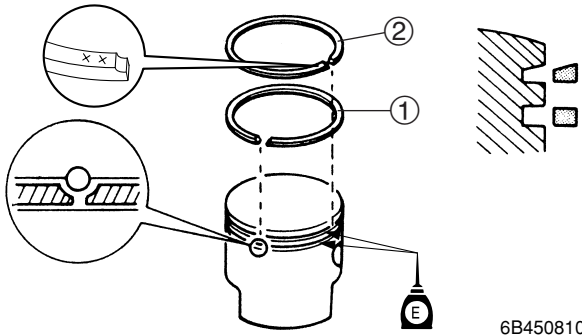


6B450800



**Assembling the piston**

1. Install the 2nd piston ring ① and top ring ② onto the pistons.

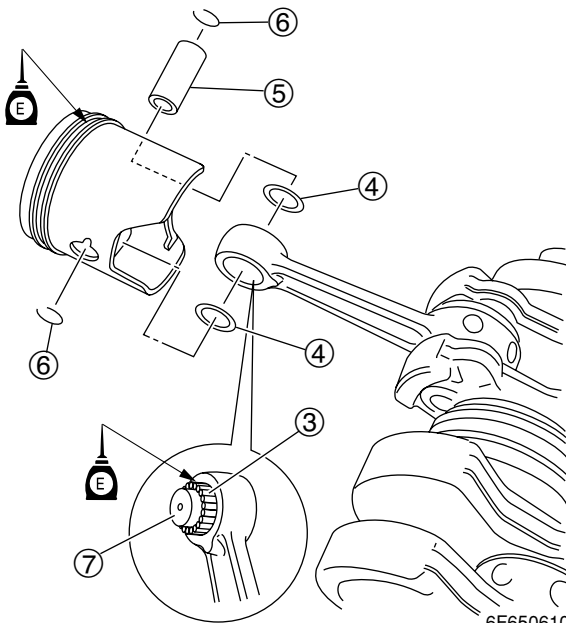


6B450810

**NOTE:**

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

2. Install the needle bearings ③, washers ④, piston pin ⑤, and new clips ⑥.



6F650610

**NOTE:**

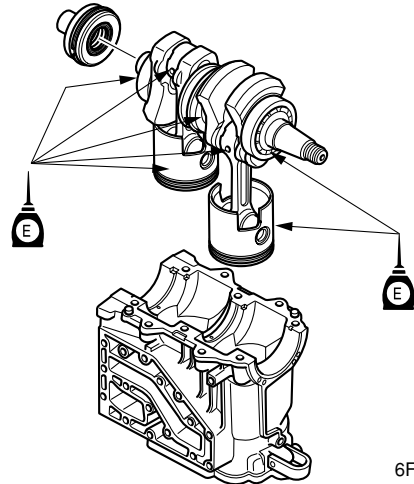
- Make sure that the piston and piston pin bearings are installed in their original combination.
- Use the small end bearing installer ⑦ to install the needle bearings.
- Make sure that the up mark on the piston crown faces the flywheel magnet side.



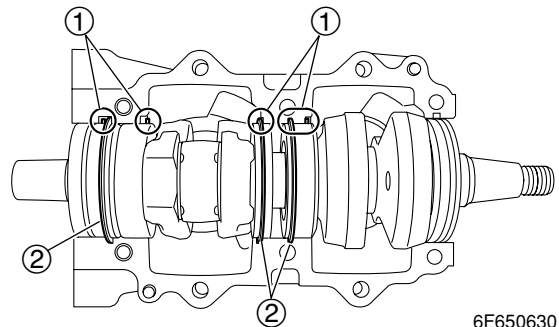
Small end bearing installer ⑦:  
90890-06527

**Assembling the power unit**

1. Install the oil seal housing to the crankshaft assembly.
2. Install the crankshaft assembly into the cylinder block.



6F650620

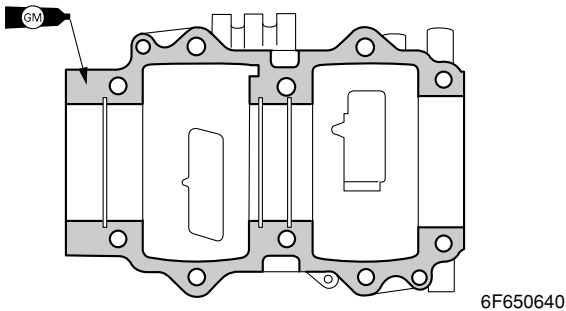


6F650630

**NOTE:**

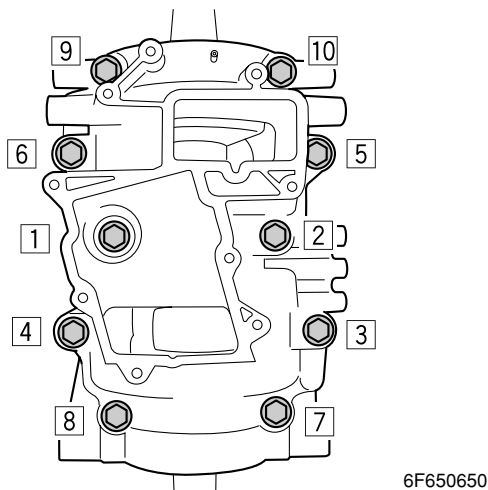
- Apply engine oil to the pistons, piston rings and bearings before installation.
- Align the dowels of the bearings with the slot ① on the cylinder block.
- Align the rings ② with the grooves in the cylinder block.

- Apply sealant to the mating surface of the crankcase.



**NOTE:**  
Do not get any sealant on the crankshaft journals.

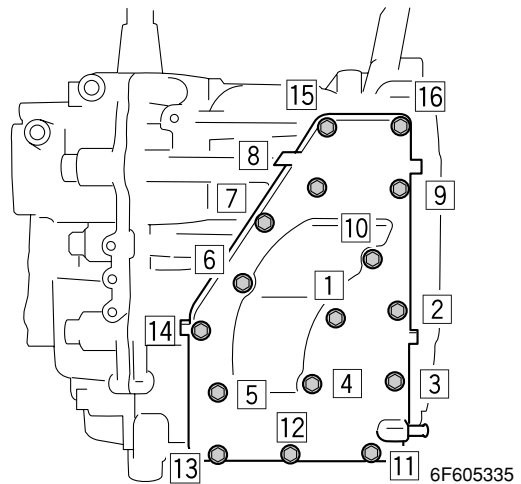
- Install the crankcase onto the cylinder block, and then tighten the crankcase bolts to the specified torques in two stages and in the sequence shown.



**NOTE:**  
Apply engine oil to the crankcase bolts before installation.

	<b>Crankcase bolt:</b>
	1st: 20 N·m (2.0 kgf·m, 15 ft·lb)
	2nd: 40 N·m (4.0 kgf·m, 29.5 ft·lb)

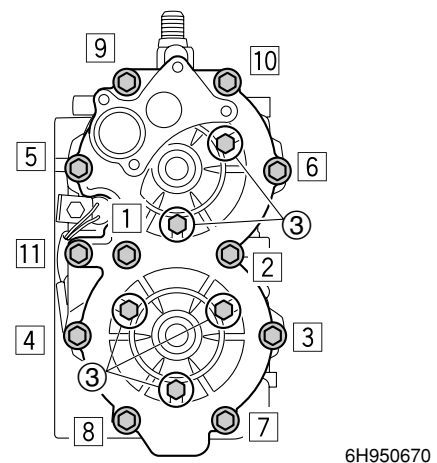
- Install a new gasket and the exhaust cover, and then tighten the bolts to the specified torques in two stages and in the sequence shown.



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

	<b>Exhaust outer cover bolt:</b>
	8 N·m (0.8 kgf·m, 5.8 ft·lb)

- Install a new cylinder head gasket, the cylinder head, thermoswitch, a new cylinder head cover gasket, and cylinder head cover, and then tighten the cylinder head bolts to the specified torques in two stages and in the sequence shown.
- Install the cylinder head cover bolts ③, and then tighten the bolts to the specified torques in two stages.





**NOTE:**

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



Cylinder head bolt:  
 1st: 15 N·m (1.5 kgf·m, 11.1 ft·lb)  
 2nd: 30 N·m (3.0 kgf·m, 22 ft·lb)  
 Cylinder head cover bolt ③:  
 12 N·m (1.2 kgf·m, 8.7 ft·lb)

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

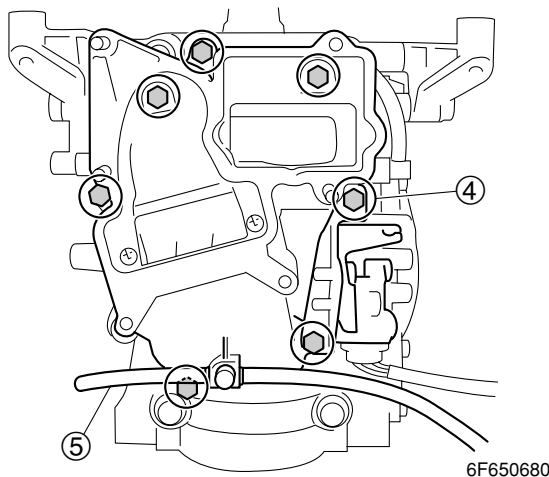
9. Install the spark plugs, tighten them finger tight, then to the specified torque with a spark plug wrench.



Spark plug:  
 25 N·m (2.5 kgf·m, 18 ft·lb)

10. Install the reed valve assembly and the intake manifold assembly, and then tighten the intake manifold bolts ④ to the specified torques in two stages.

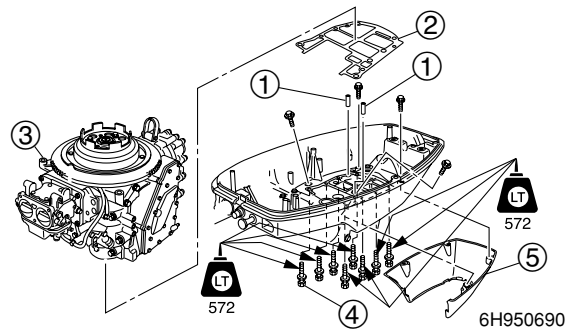
11. Connect the hoses ⑤.



12. Install the throttle pulley assembly, and the electrical components to the power unit.

**Installing the power unit**

1. Clean the power unit mating surface, and install the dowels ① and a new gasket ②.
2. Install the power unit ③, and then tighten the power unit mounting bolts ④ to the specified torque.
3. Install the apron ⑤.



**NOTE:**

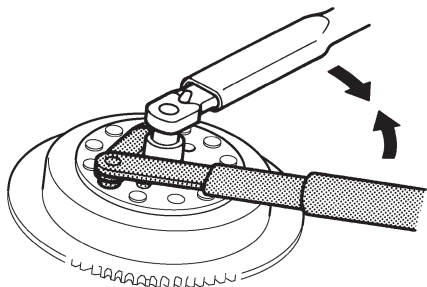
Apply LOCTITE 572 to the power unit mounting bolts before installation.



Power unit mounting bolt ④:  
 21 N·m (2.1 kgf·m, 15.5 ft·lb)

4. Connect the fuel hose and pilot water hose.
5. Connect the engine stop lanyard switch leads (MH).
6. Install the Woodruff key and flywheel magnet.

- Tighten the flywheel magnet nut to the specified torque.



6F650700

**CAUTION:**

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

**NOTE:**

Apply engine oil to the flywheel magnet nut before installation.



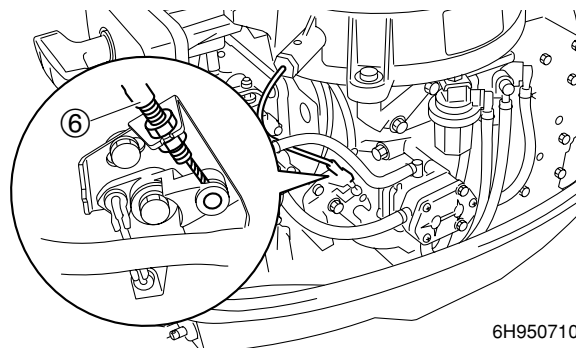
Flywheel holder: 90890-06522



Flywheel magnet nut:  
160 N·m (16.0 kgf·m, 115 ft·lb)

- Install the starter pulley.
- Connect the remote control cables (remote control model) or the throttle cables (tiller handle model), and then adjust their length. For adjustment procedures, see Chapter 3.

- Install the manual starter and start-in-gear protection cable ⑥, and then adjust its length. For adjustment procedures, see Chapter 3.



6H950710

- Connect the battery leads (W).
- Install all removed parts.

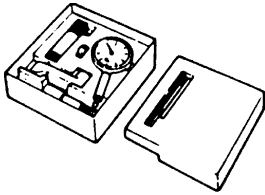
## Lower unit

<b>Special service tools .....</b>	<b>6-1</b>
<b>Lower unit (EK40G) .....</b>	<b>6-5</b>
Removing the lower unit .....	6-5
Removing the water pump and shift rod .....	6-5
Checking the water pump and shift rod .....	6-5
<b>Propeller shaft housing .....</b>	<b>6-11</b>
Removing the propeller shaft housing assembly .....	6-13
Disassembling the propeller shaft assembly .....	6-13
Disassembling the propeller shaft housing .....	6-13
Disassembling the forward gear .....	6-14
Checking the propeller shaft housing .....	6-14
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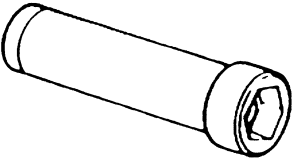
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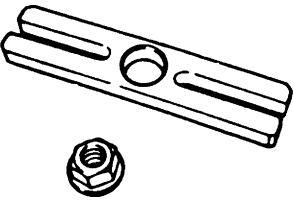
**Special service tools**



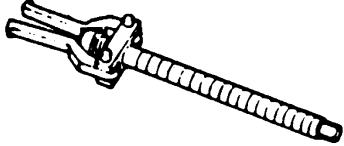
**Dial gauge set**  
90890-01252



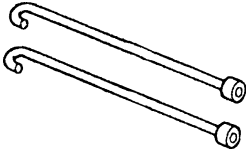
**Ring nut wrench extension**  
90890-06513



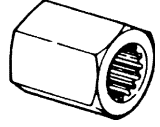
**Stopper guide plate**  
90890-06501



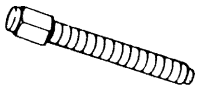
**Bearing puller assembly**  
90890-06535



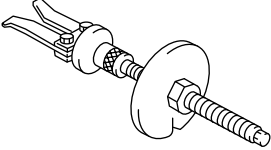
**Bearing housing puller claw M**  
90890-06503



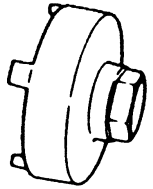
**Drive shaft holder 3**  
90890-06517



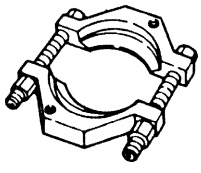
**Center bolt**  
90890-06504



**Bearing outer race puller assembly**  
90890-06523

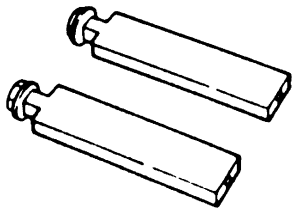


**Ring nut wrench**  
90890-06510

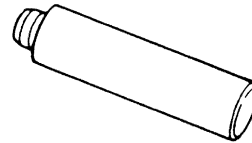


**Bearing Separator**  
90890-06534

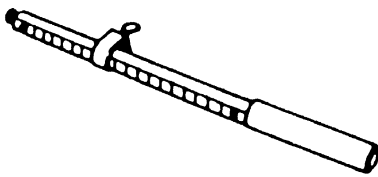




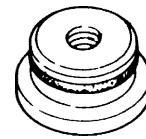
**Stopper guide stand**  
90890-06538



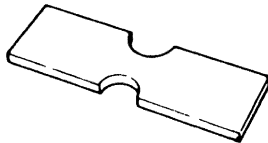
**Driver rod LS**  
90890-06606



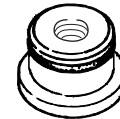
**Driver rod SL**  
90890-06602



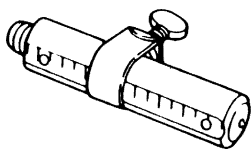
**Needle bearing attachment**  
90890-06608, 90890-06613,  
90890-06616, 90890-06653



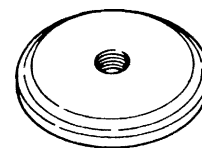
**Bearing depth plate**  
90890-06603



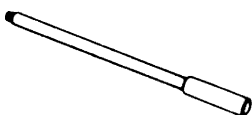
**Needle bearing attachment**  
90890-06614



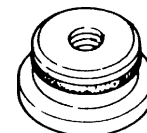
**Driver rod SS**  
90890-06604



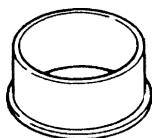
**Bearing outer race attachment**  
90890-06622



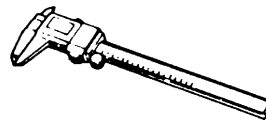
**Driver rod LL**  
90890-06605



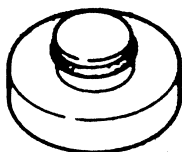
**Ball bearing attachment**  
90890-06634, 90890-06637



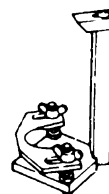
**Bearing inner race attachment**  
90890-06639, 90890-06640  
90890-06641, 90890-06644



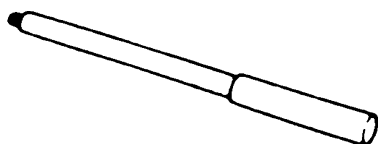
**Digital caliper**  
90890-06704



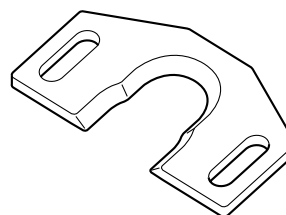
**Ball bearing attachment**  
90890-06631



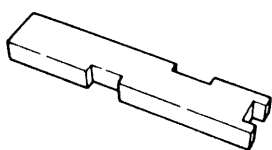
**Pinion height gauge**  
90890-06710



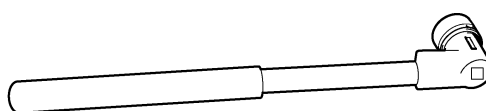
**Driver rod L3**  
90890-06652



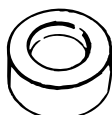
**Pinion height gauge plate B**  
90890-06712



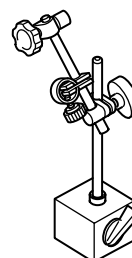
**Shimming plate**  
90890-06701



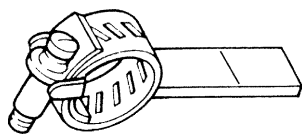
**Pinion nut holder**  
New: 90890-06715  
Current: 90890-06505



**Pinion height plate**  
90890-06703

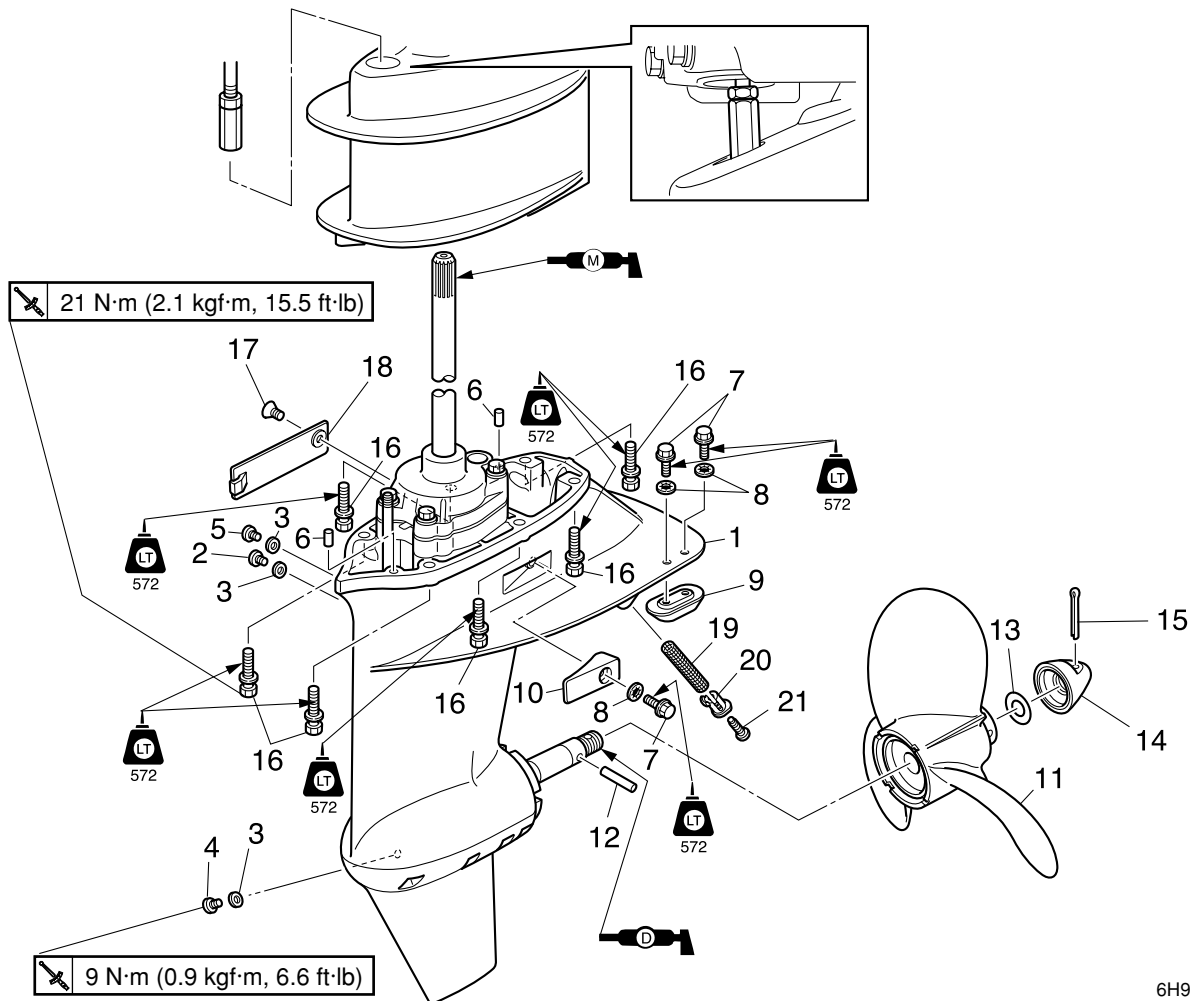


**Magnet base B**  
90890-06844



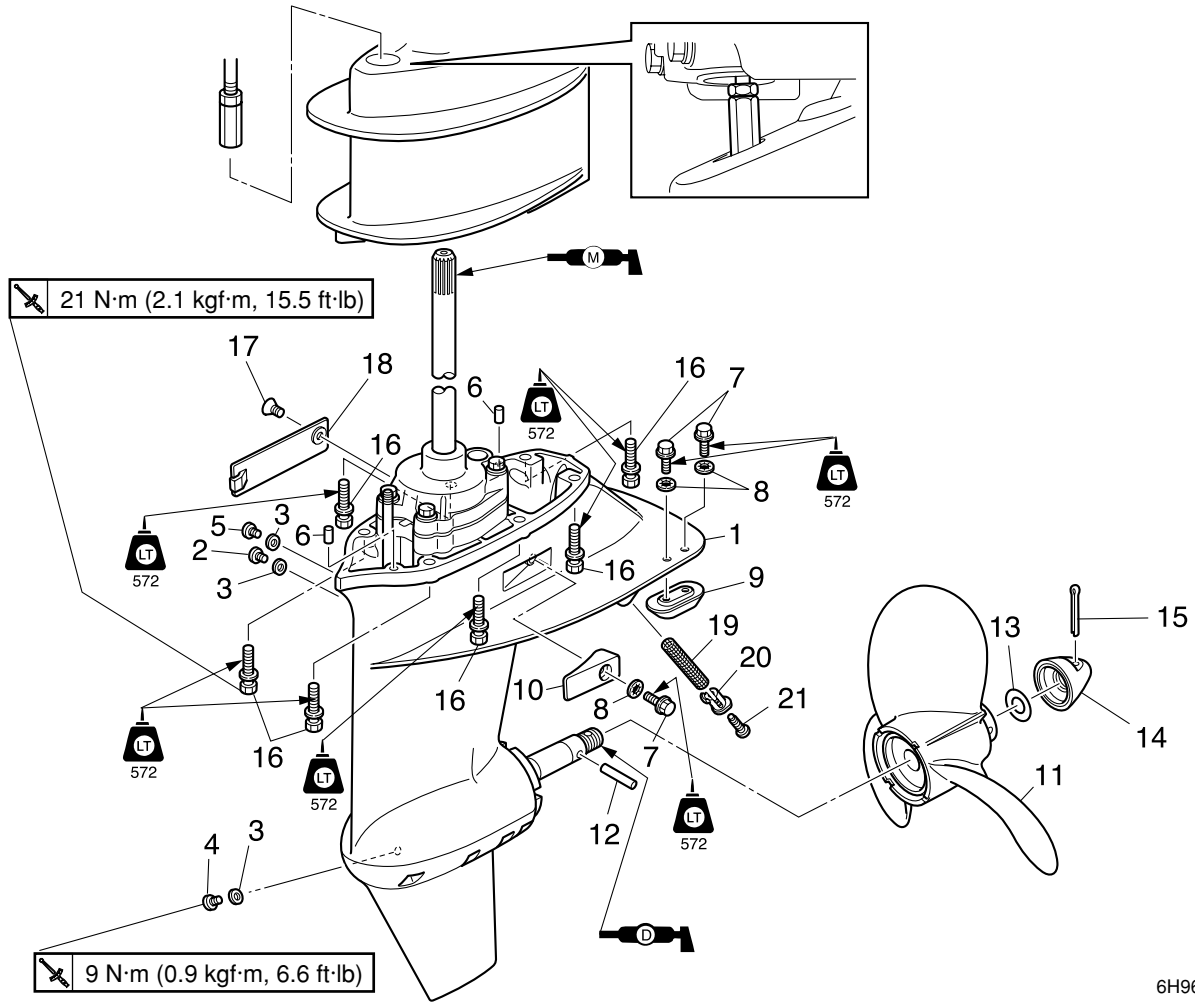
**Backlash indicator**  
**90890-06706**

**Lower unit (EK40G)**



6H96050E

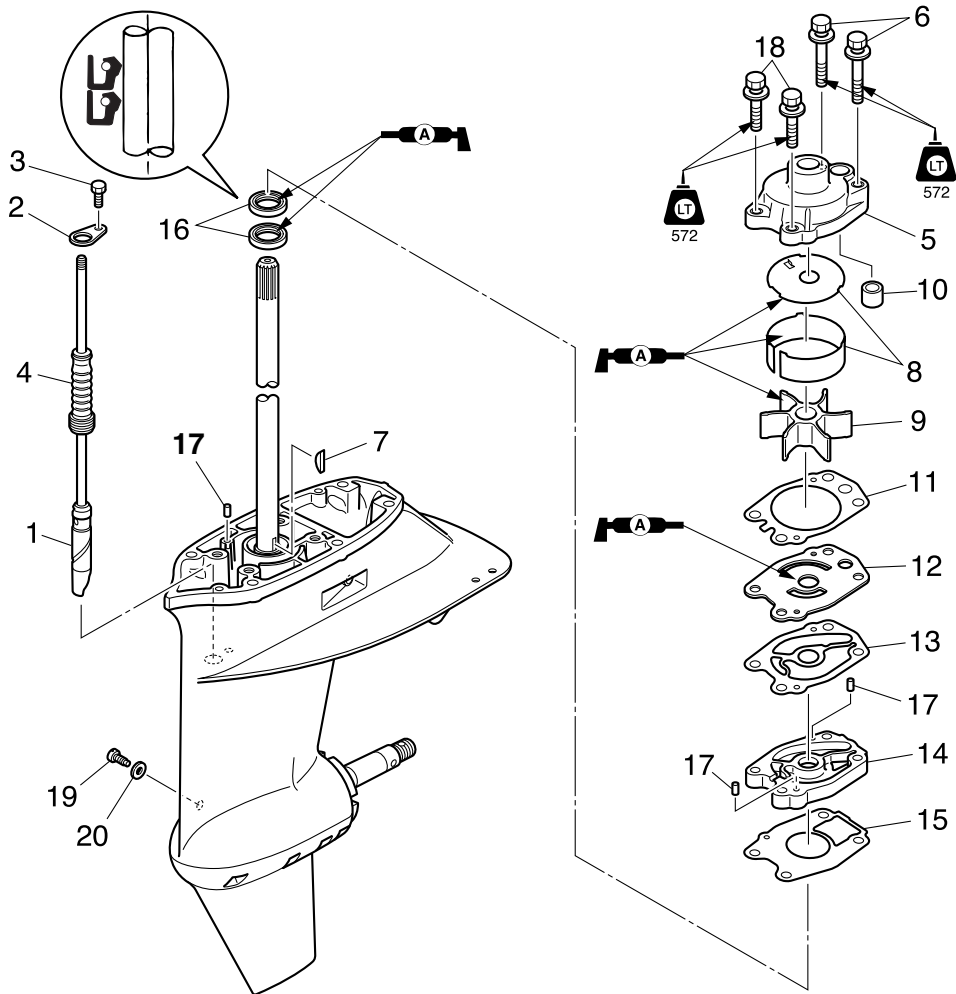
No.	Part name	Q'ty	Remarks
1	Lower unit	1	
2	Check screw	1	
3	Gasket	3	<b>Not reusable</b>
4	Drain screw	1	
5	Screw	1	
6	Dowel	2	
7	Bolt	3	M6 × 16 mm
8	Special washer	3	
9	Anode	1	
10	Anode	1	
11	Propeller	1	
12	Shear pin	1	
13	Washer	1	
14	Propeller nut	1	
15	Cotter pin	1	<b>Not reusable</b>
16	Bolt	6	M8 × 30 mm
17	Screw	1	



6H96050E

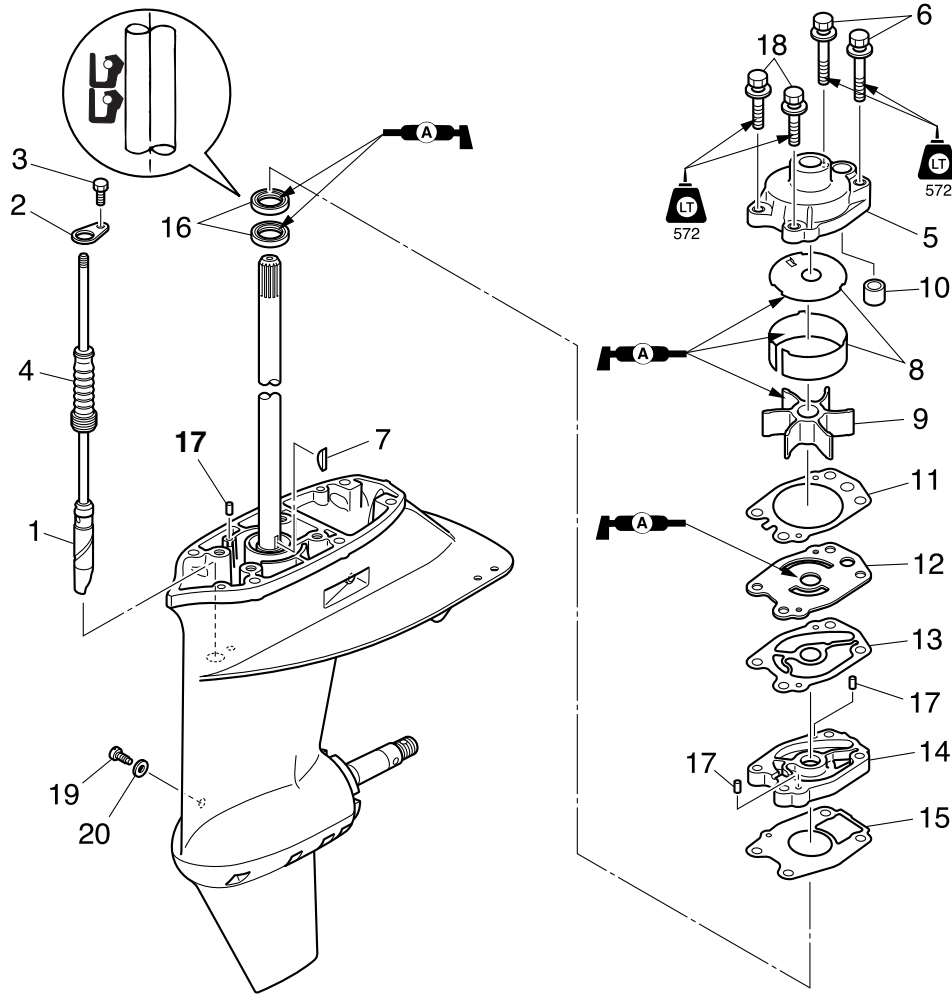
6

No.	Part name	Q'ty	Remarks
18	Cover	1	
19	Screen	1	
20	Cap	1	
21	Screw	1	



6F66060E

No.	Part name	Q'ty	Remarks
1	Shift rod	1	
2	Holder	1	
3	Bolt	1	M6 × 10 mm
4	Boot	1	
5	Water pump housing	1	
6	Bolt	2	M8 × 55 mm
7	Woodruff key	1	
8	Insert cartridge	1	
9	Impeller	1	
10	Seal	1	
11	Gasket	1	Not reusable
12	Outer plate cartridge	1	
13	Gasket	1	Not reusable
14	Oil seal housing	1	
15	Gasket	1	Not reusable
16	Oil seal	2	Not reusable
17	Dowel	3	



6F66060E

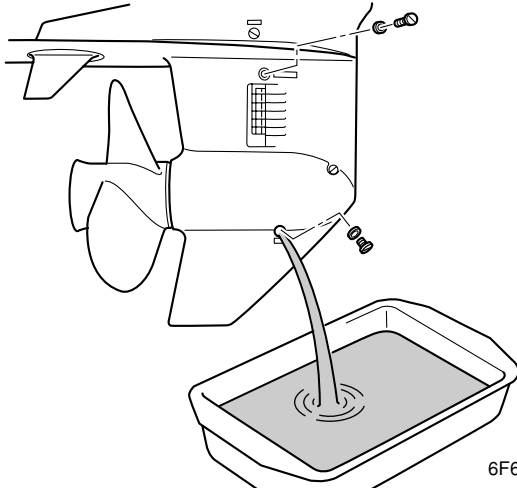
6

No.	Part name	Q'ty	Remarks
18	Bolt	2	M8 × 45 mm
19	Screw	1	
20	Gasket	1	Not reusable

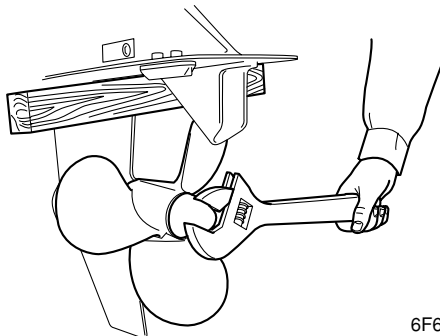


**Removing the lower unit**

1. Drain the gear oil.



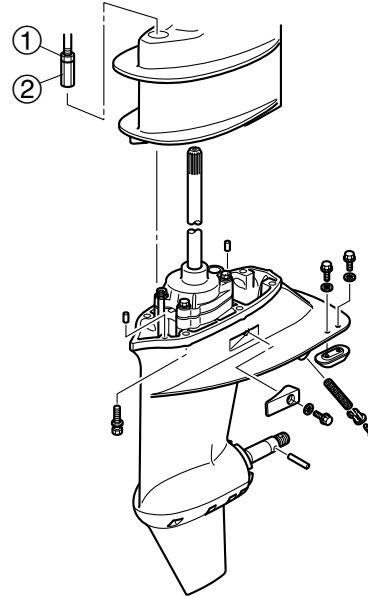
2. Shift the shift lever or remote control lever to neutral, place a block of wood between the anti-cavitation plate and propeller to keep the propeller from turning, and then remove the propeller nut and propeller.



**⚠ WARNING**

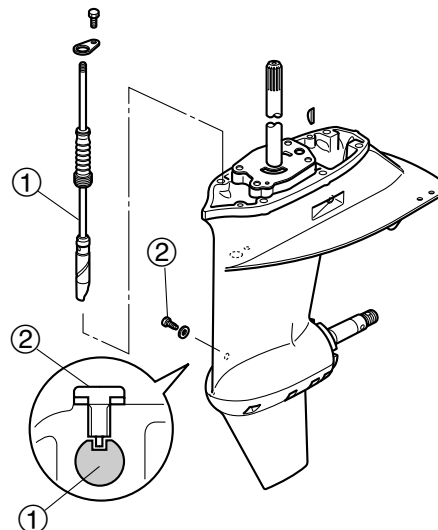
- Do not hold the propeller with your hands when loosening or tightening it.
- Be sure to disconnect the battery leads from the battery and the clip from the engine stop lanyard switch.
- Put a block of wood between the anti-cavitation plate and propeller to keep the propeller from turning.

3. Loosen the locknut ①, and then remove the adjusting nut ②.
4. Loosen the bolts, and then remove the lower unit from the upper case.



**Removing the water pump and shift rod**

1. Remove the water pump assembly and shift rod assembly ①.



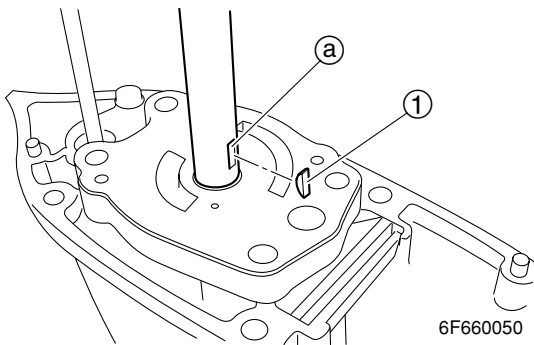
**NOTE:**

Before removing the shift rod assembly ①, remove the screw ②.



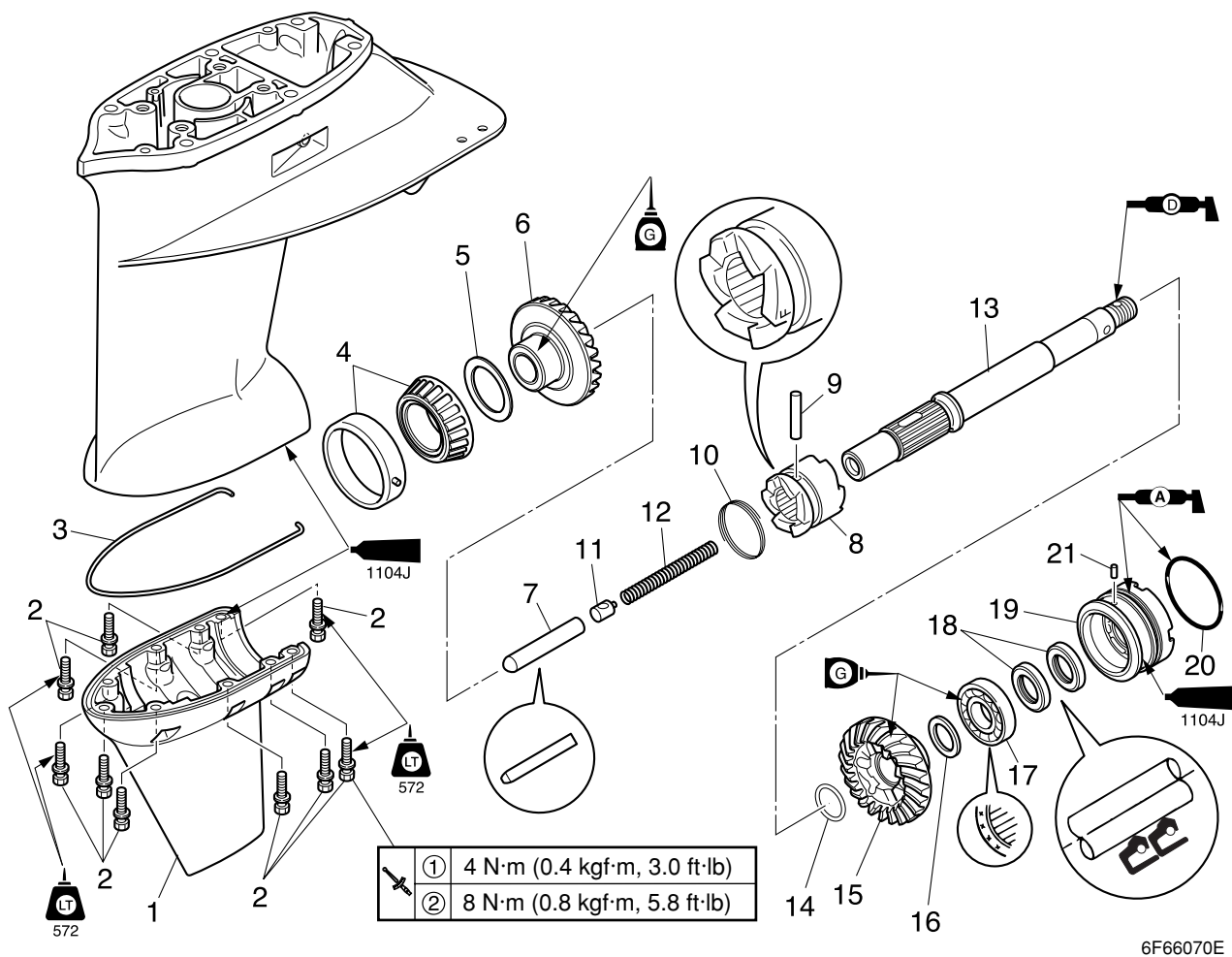
### Checking the water pump and shift rod

1. Check the water pump housing for deformation. Replace if necessary.
2. Check the impeller and insert cartridge for cracks or wear. Replace if necessary.
3. Check the Woodruff key ① and the keyway ② in the drive shaft for wear. Replace if necessary.



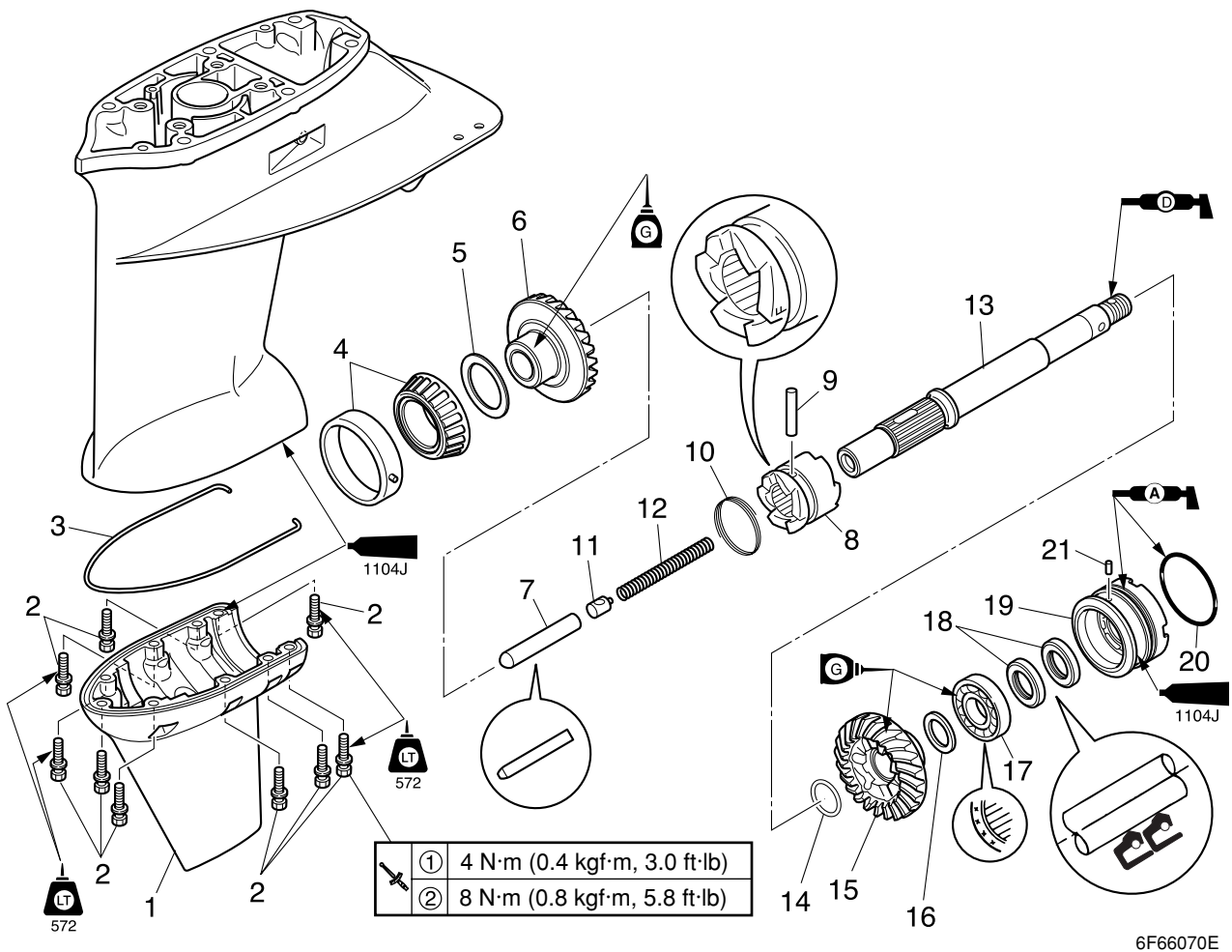
4. Check the shift rod for cracks or wear. Replace if necessary.

**Propeller shaft housing**



6F66070E

No.	Part name	Q'ty	Remarks
1	Lower case cap	1	
2	Bolt	9	M6 × 25 mm
3	Seal	1	<b>Not reusable</b>
4	Taper roller bearing assembly	1	<b>Not reusable</b>
5	Forward gear shim	—	
6	Forward gear	1	
7	Shift plunger	1	
8	Dog clutch	1	
9	Cross pin	1	
10	Spring	1	
11	Slider	1	
12	Spring	1	
13	Propeller shaft	1	
14	Washer	1	
15	Reverse gear	1	
16	Reverse gear shim	—	
17	Ball bearing	1	<b>Not reusable</b>



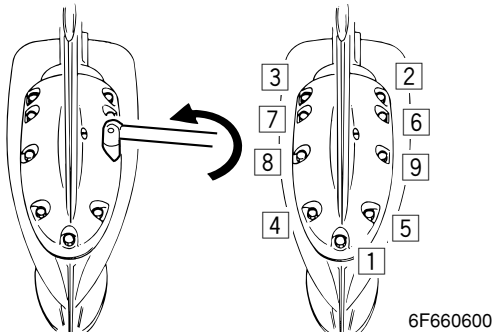
6

No.	Part name	Q'ty	Remarks
18	Oil seal	2	Not reusable
19	Propeller shaft housing	1	
20	O-ring	1	Not reusable
21	Dowel	1	



### Removing the propeller shaft housing assembly

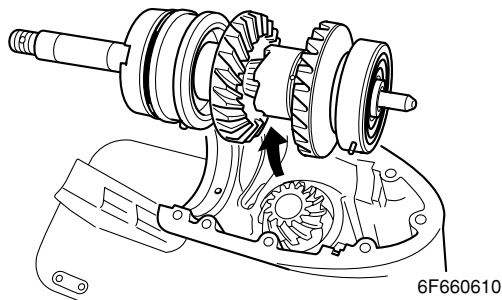
1. Remove the bolts, then separate the lower case cap.



6F660600

**NOTE:** \_\_\_\_\_  
Loosen the bolts in sequence as shown.

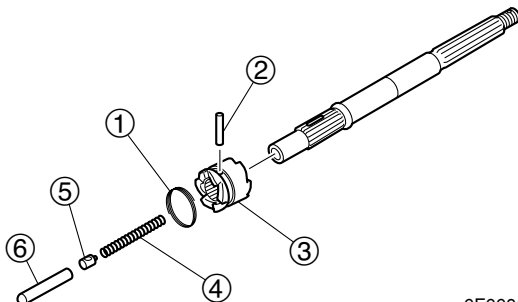
2. Remove the propeller shaft housing assembly.



6F660610

### Disassembling the propeller shaft assembly

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

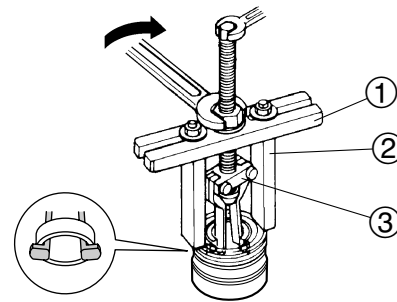


6F660080

### Disassembling the propeller shaft housing

1. Remove the reverse gear.

2. Remove the ball bearing.



6F660110

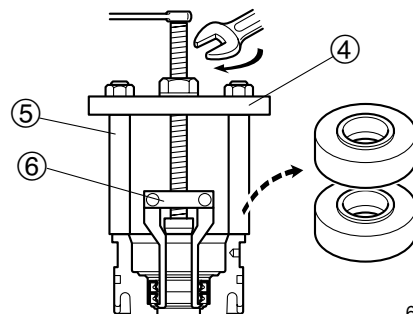
**CAUTION:** \_\_\_\_\_

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



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

3. Remove the oil seals.



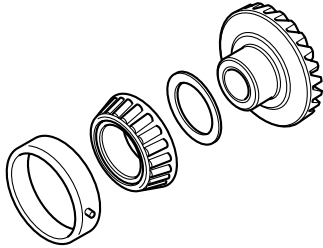
6F660630



- Stopper guide plate ④:  
90890-06501  
Stopper guide stand ⑤:  
90890-06538  
Bearing puller assembly ⑥:  
90890-06535

### Disassembling the forward gear

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



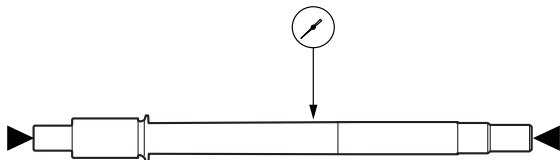
6F660215

### Checking the propeller shaft housing

1. Clean the propeller shaft housing using a soft brush and cleaning solvent, and then check it for cracks. Replace if necessary.
2. Check the teeth and dogs of the forward gear and reverse gear for cracks or wear. Replace the gear if necessary.
3. Check the bearings for pitting or rumbling. Replace if necessary.
4. Check the lower case cap for cracks or wear. Replace if necessary.

### Checking the propeller shaft

1. Check the propeller shaft for bends or wear. Replace if necessary.
2. Measure the propeller shaft runout.



6F660130

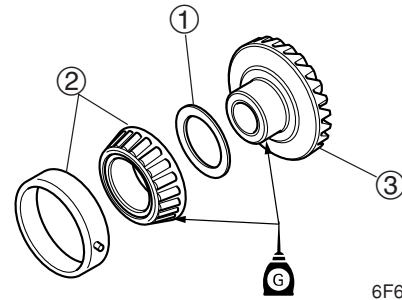


Runout limit: 0.02 mm (0.0008 in)

3. Check the dog clutch and shift plunger for cracks or wear. Replace if necessary.

### Assembling the forward gear

1. Install the original shim(s) ① and the taper roller bearing ② into the forward gear ③.



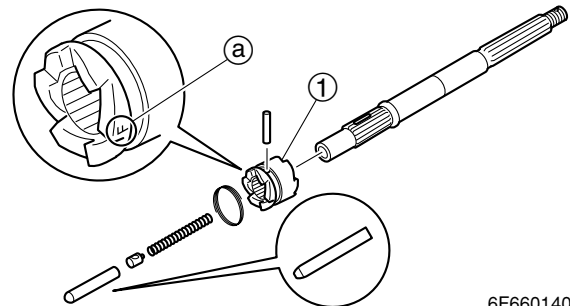
6F660785

### CAUTION:

Add or remove the shim(s), if necessary, if replacing the reverse gear, propeller shaft housing, or lower case.

### Assembling the propeller shaft assembly

1. Install the dog clutch as shown.



6F660140

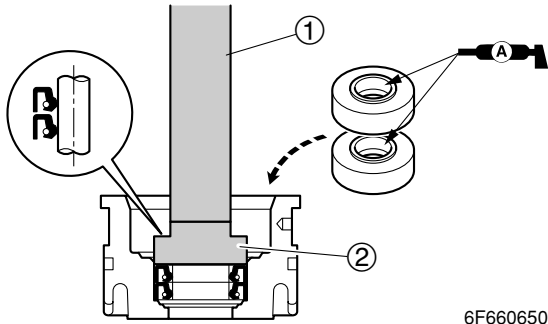
### NOTE:

Install the dog clutch ① with the "F" mark ② facing toward the shift plunger.



**Assembling the propeller shaft housing**

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



6F660650

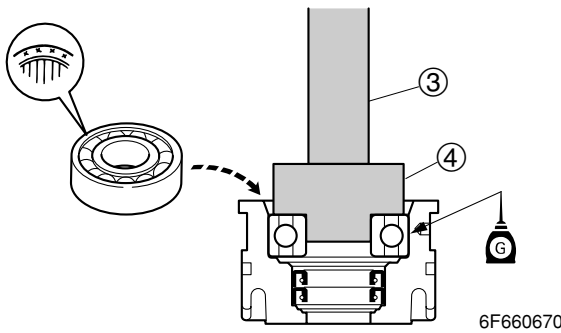
**NOTE:**

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



Driver rod L3 (1): 90890-06652  
Needle bearing attachment (2): 90890-06613

2. Install the new ball bearing onto the propeller shaft housing using a press.

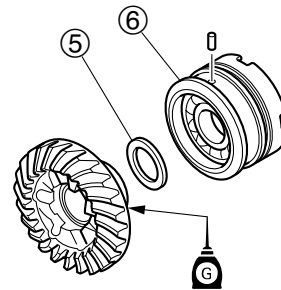


6F660670



Driver rod LS (3): 90890-06606  
Ball bearing attachment (4): 90890-06634

3. Install the original shim(s) (5) onto propeller shaft housing (6), then install the reverse gear assembly into the propeller shaft housing.

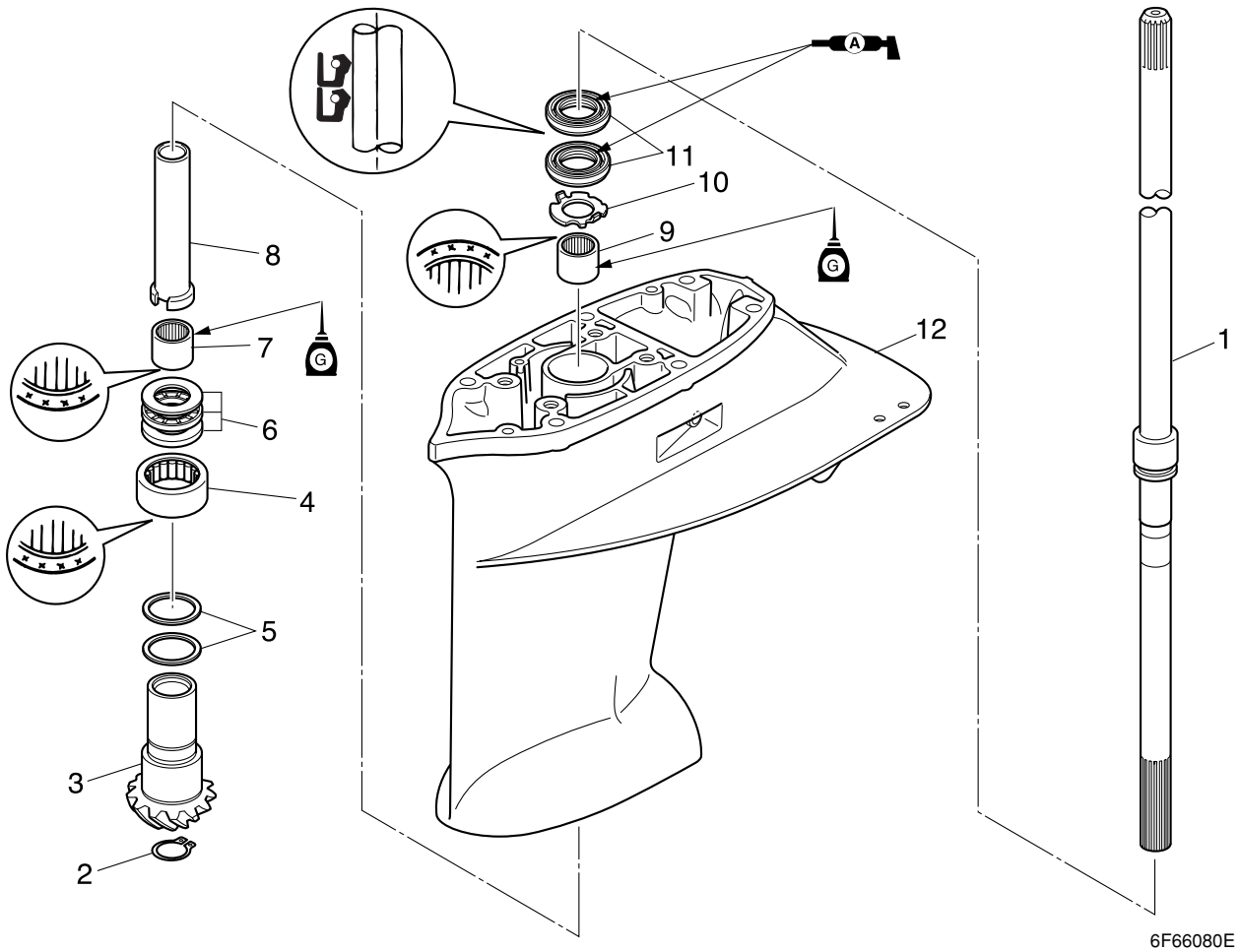


6F660660

**CAUTION:**

Add or remove the shim(s), if necessary, if replacing the reverse gear, propeller shaft housing, or lower case.

Drive shaft and lower case



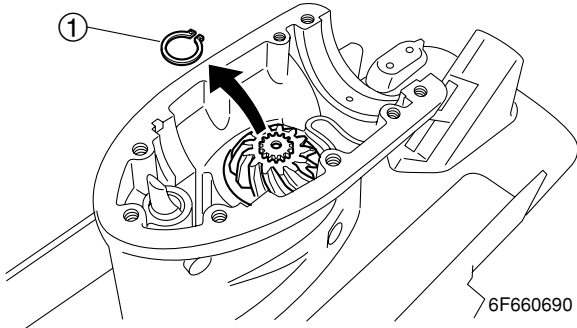
6

No.	Part name	Q'ty	Remarks
1	Drive shaft	1	
2	Circlip	1	
3	Pinion gear	1	
4	Roller bearing assembly	1	
5	Pinion gear shim	—	
6	Thrust bearing	1	
7	Needle bearing	1	
8	Sleeve	1	
9	Needle bearing	1	
10	Washer	1	
11	Oil seal	2	Not reusable
12	Lower case	1	



**Removing the drive shaft**

1. Remove the circlip ① from the pinion gear, and then remove the pinion gear and drive shaft assembly.

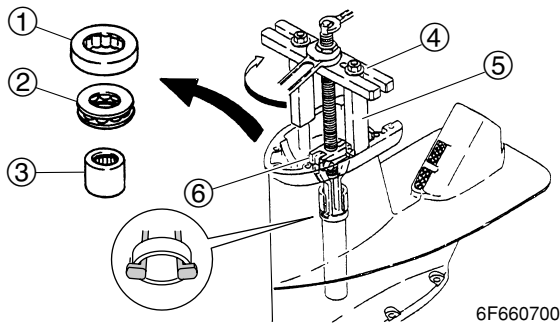


**CAUTION:**

When removing the drive shaft assembly, take care to falling the drive shaft assembly.

**Disassembling the lower case**

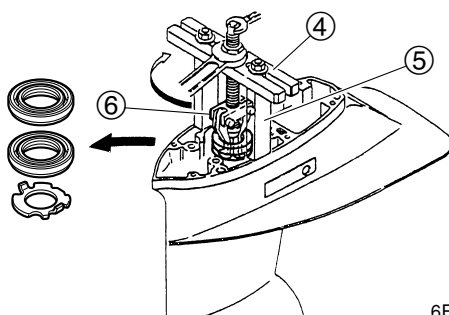
1. Remove the roller bearing assembly ①, thrust bearing ②, drive shaft needle bearing ③ and drive shaft sleeve.



**NOTE:**

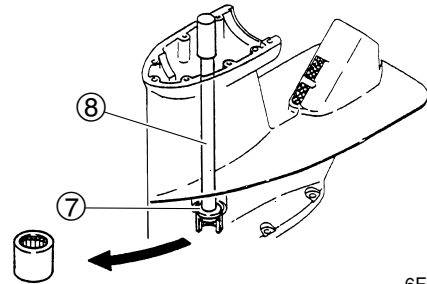
Install the claws as shown.

3. Remove the oil seals and thrust washer.



- Stopper guide plate ④ : 90890-06501
- Stopper guide stand ⑤ : 90890-06538
- Bearing puller assembly ⑥ : 90890-06535

4. Remove the needle bearing.



- Needle bearing attachment ⑦ : 90890-06614
- Driver rod L3 ⑧ : 90890-06652

**Checking the pinion gear**

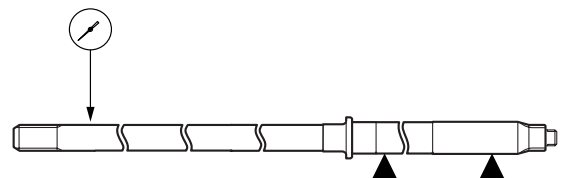
1. Check the teeth of the pinion for cracks or wear. Replace if necessary.

**Checking the bearings**

1. Check the bearings for pitting or rumbling. Replace if necessary.

**Checking the drive shaft**

1. Check the drive shaft for bends or wear. Replace if necessary.
2. Measure the drive shaft runout.



Runout limit: 0.3 mm (0.012 in)

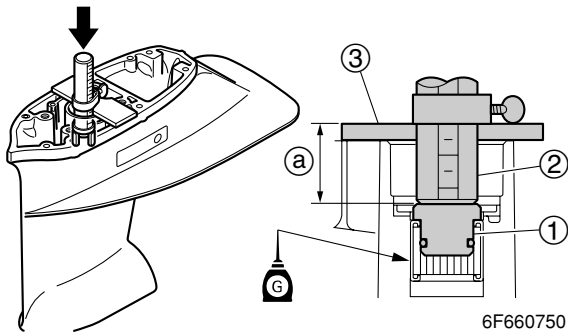


### Checking the lower case and lower case cap

1. Check the skag and torpedo for cracks or damage. Replace the lower case and lower case cap if necessary.

### Assembling the lower case

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



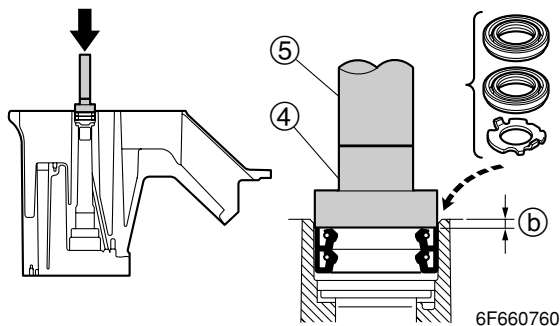
**NOTE:**

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

	Ball bearing attachment ①: 90890-06616
	Driver rod SS ②: 90890-06604
	Bearing depth plate ③: 90890-06603

	Depth ①a): 24.7—25.3 mm (0.97—1.00 in)
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2. Install the washer and new oil seals into the lower case to the specified depth.

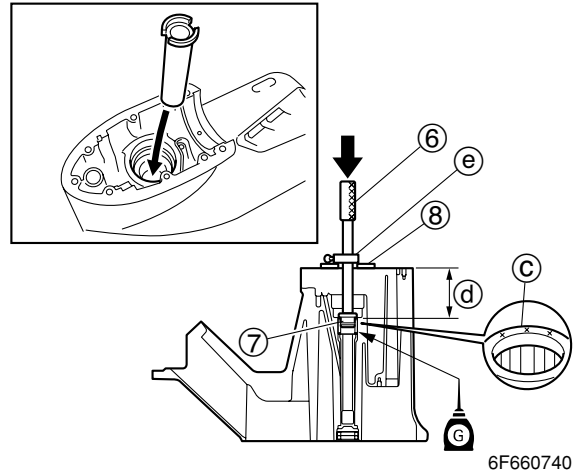


	Ball bearing attachment ④: 90890-06637
	Driver rod SS ⑤: 90890-06604

6H95G11

	Depth ①b): 2.2—2.8 mm (0.09—0.11 in)
--	---

3. Install the sleeve and needle bearing into the lower case to the specified depth.



**NOTE:**

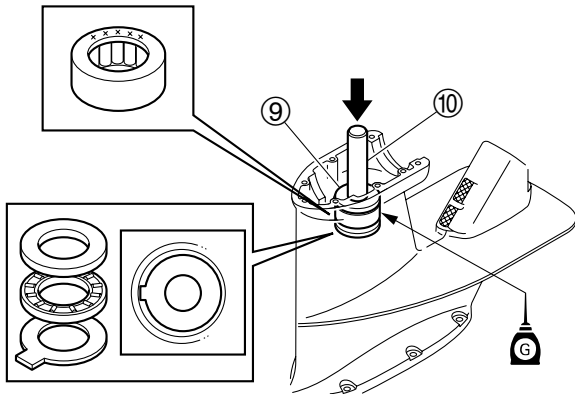
- Install the needle bearing with the manufacture identification mark © facing up.
- Be careful not to let the stopper © get out of position when using the driver rod SL.
- Apply gear oil to the inside and outside of the sleeve before installation.

	Driver rod SL ⑥ : 90890-06602
	Needle bearing attachment ⑦: 90890-06613
	Bearing depth plate ⑧: 90890-06603

	Depth ①d): 75.2—75.8 mm (2.96—2.98 in)
--	---



4. Install the thrust bearing and roller bearing assembly.



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**NOTE:**

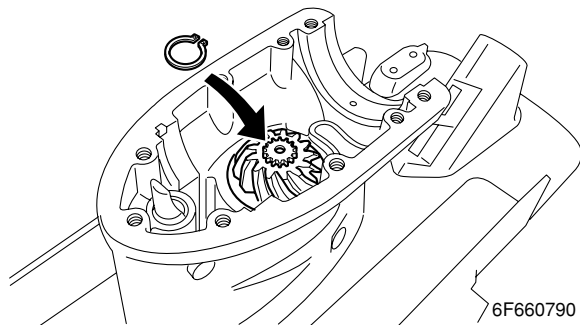
Apply gear oil to the inside and outside of the thrust washer and roller bearing outer race before installation.



Ball bearing attachment (9):  
90890-06631  
Driver rod LS (10):  
90890-06606

**Installing the drive shaft**

1. Install the roller bearing, then the drive shaft, original shim(s), pinion, and circlip.



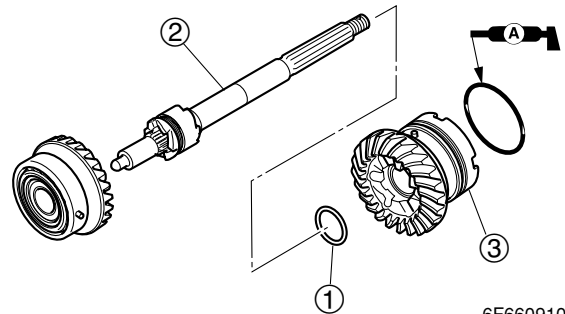
6F660790

**NOTE:**

Take care the rollers will not fall off.

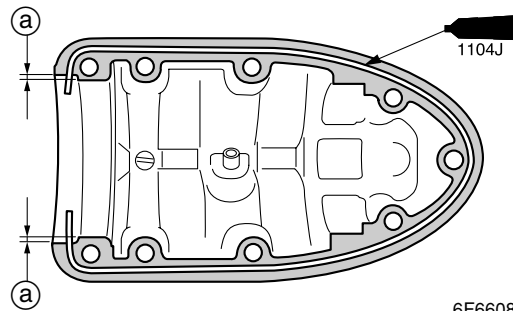
**Installing the propeller shaft housing**

1. Install the washer (1) and propeller shaft assembly (2) into the propeller shaft housing assembly (3).
2. Install the forward gear assembly to the propeller shaft housing assembly.
3. Apply grease to new O-rings.



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4. Fit the new seal into the lower case cap.



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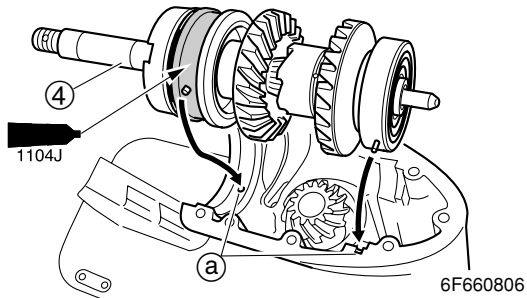
**NOTE:**

Cut the seal so that it projects out (a) about 0.8 mm (0.03 in) from the lower case cap.

**CAUTION:**

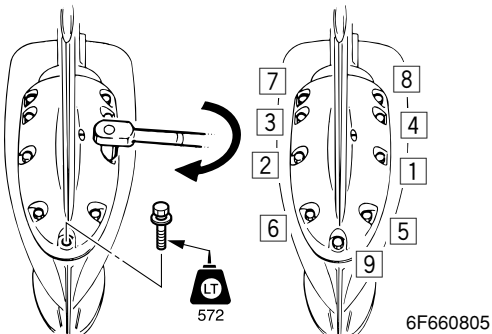
**Do not pull the seal.**


- Apply sealant to the mating surface of the lower case cap and propeller shaft cap.
- Install the propeller shaft housing assembly ④ on to the lower case.



**NOTE:** Insert the pins ① in the slot or hole of the lower case.

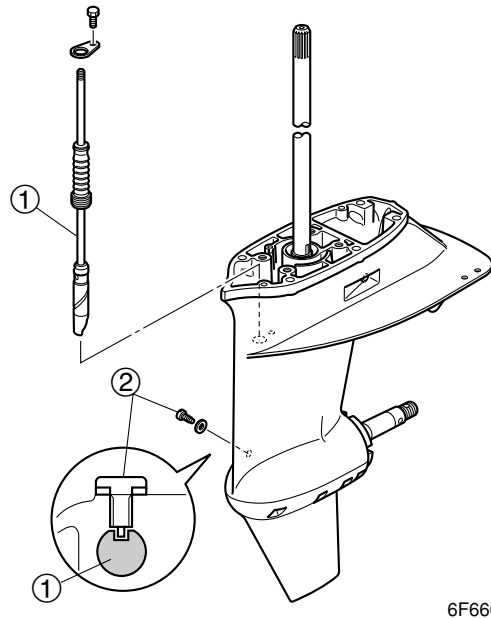
- Tighten the bolts in sequence as shown two stage.



	Lower case cap bolt : 1st: 4 N·m (0.4 kgf·m, 3.0 ft·lb) 2nd: 8 N·m (0.8 kgf·m, 5.8 ft·lb)
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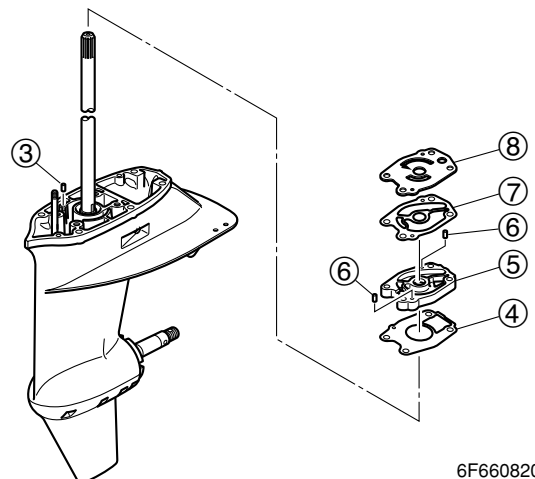
### Installing the water pump and shift rod

- Install the shift rod assembly ①.



**NOTE:** Align the slit on the shift cam ① with the hole in the lower case. Then install the screw ② as shown.

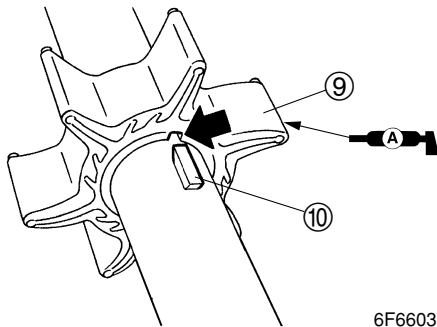
- Install the dowel ③, a new gasket ④, oil seal housing ⑤, dowels ⑥, a new gasket ⑦ and the outer plate cartridge ⑧.



- Install the Woodruff key into the drive shaft.

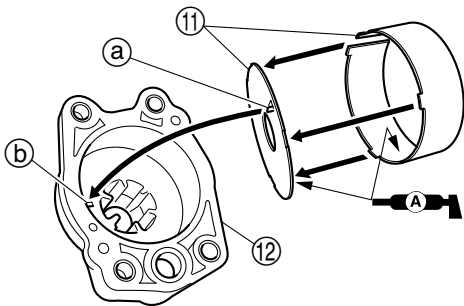


- Align the groove in the impeller ⑨ with the Woodruff key ⑩, and then install the impeller onto the drive shaft.



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- Install the insert cartridge ⑪ into the pump housing ⑫, and then apply grease to the inside of the insert cartridge.

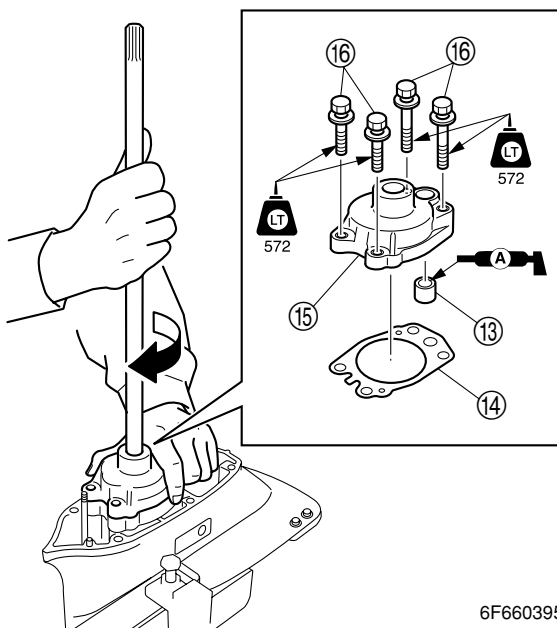


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**NOTE:**

Align the insert cartridge projection (a) with the hole (b) in the pump housing.

- Install the seal ⑬, a new gasket ⑭, and pump housing assembly ⑮ into the lower case, tighten the bolts ⑯.



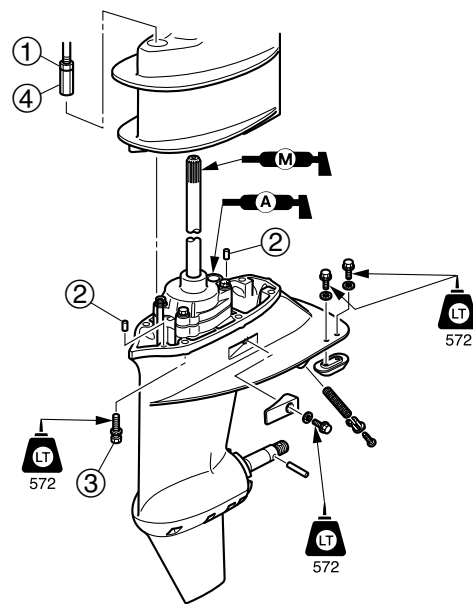
6F660395

**NOTE:**

When installing the pump housing, apply grease to the inside of the housing, and then turn the drive shaft clockwise while pushing down the pump housing.

**Installing the lower unit**

- Set the gear shift to the reverse position at the lower unit. Make sure that the shift rod is in the reverse position.
- Screw in the locknut ① completely.
- Install the two dowels ② into the lower unit.
- Install the lower unit into the upper case, and then tighten the lower case mounting bolts ③ to the specified torque.
- Connect the shift rod.



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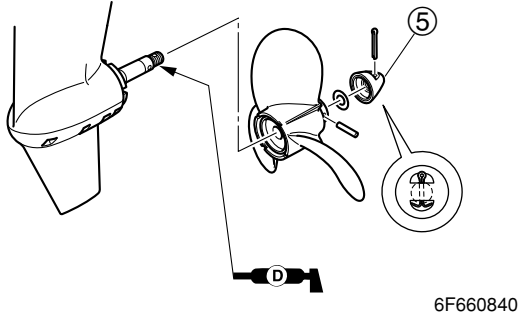
**NOTE:**

Screw the adjusting nut ④ down until it lightly seated, and then tighten the locknut.

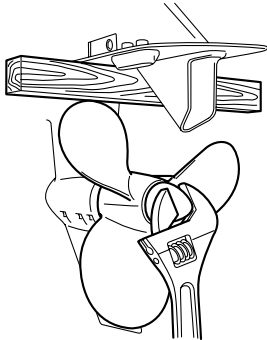


Lower case mounting bolt ③:  
21 N·m (2.1 kgf·m, 15.5 ft·lb)

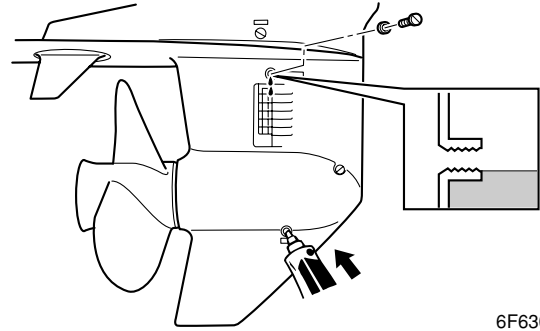
6. Install the propeller, shear pin and propeller nut, and then tighten the nut finger tight. Place a block of wood between the anti-cavitation plate and propeller to keep the propeller from turning, and then tighten the nut to the specified torque.




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6F660850



6F630210

	<p>Recommended gear oil:                  Hypoid gear oil                  API: GL-4                  SAE: 90                  Oil quantity:                  315 cm<sup>3</sup>                  (10.65 US oz, 11.11 Imp oz)</p>
---	---

8. Install the check screw and quickly install the drain screw.

**⚠WARNING**

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

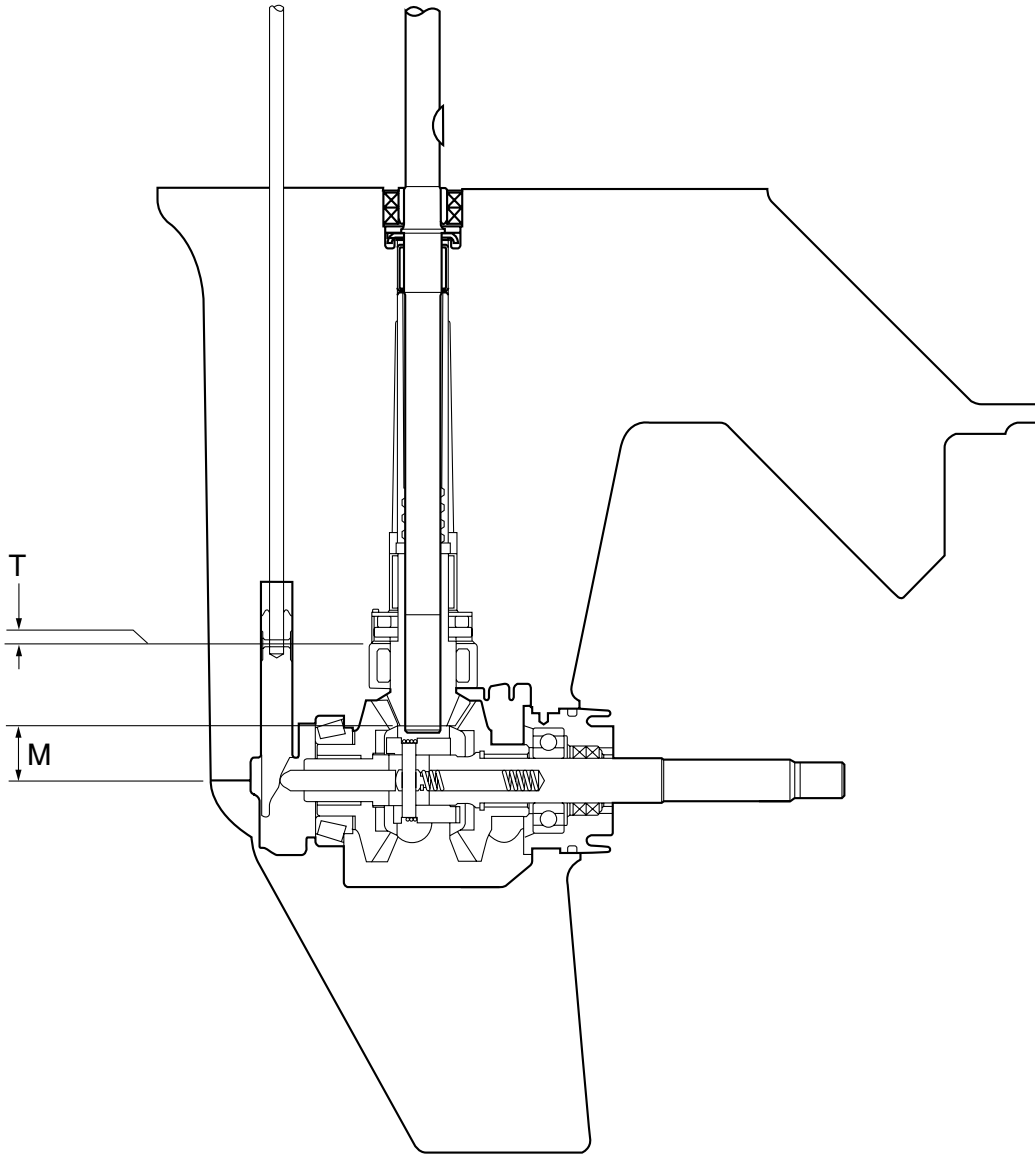
**NOTE:**

If the hole in the propeller nut ⑤ do not align with the cotter pin hole, tighten or loosen the nut until they are aligned.

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



# Shimming

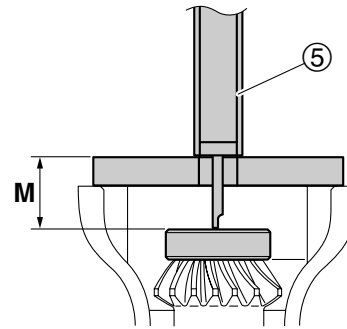


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## Shimming

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

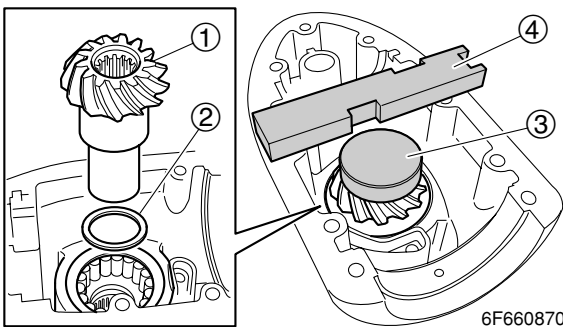
- Shimming is not required when assembling the original lower case and inner parts.
- Shimming is required when assembling the original inner parts and a new lower case.
- Shimming is required when replacing the inner part(s).



6F660880

### Selecting the pinion shims

1. Install the special service tools onto the pinion gear ①.



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

- Remove the shim(s) ② from pinion gear, then measuring.
- Attach the pinion height plate with its hollow facing to the pinion gear.
- Select the shim thickness (T) by using the specified measurement(s) and the calculation formula.



Pinion height plate ③:  
90890-06703

Shimming plate ④:  
90890-06701

2. Measure the distance (M) between the special service tool and the pinion as shown.

3. Calculate the pinion shim thickness (T) as shown in the examples below.



Digital caliper ⑤: 90890-06704

Calculation formula:

$$\text{Pinion shim thickness (T)} = M - 24.50$$

Example:

If "T" is 26.06 mm,

$$T = 26.06 - 24.50 = 1.56$$

4. Select the pinion shim(s) (T) as follows.

Calculated numeral at 1/100th place	Rounded numeral
1 to 5	0.0
6 to 10	0.5

Available shim thicknesses:  
0.70, 0.75, 0.80 and 0.85 mm

Example:

If "T" is 1.65 mm, then the pinion shim is 1.60 mm.

If "T" is 1.56 mm, then the pinion shim is 1.55 mm.

### Selecting the forward and reverse gear shims

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

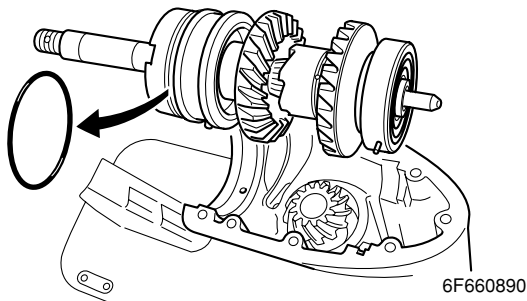
Select the forward and reverse gear shim thickness by measuring the backlash.



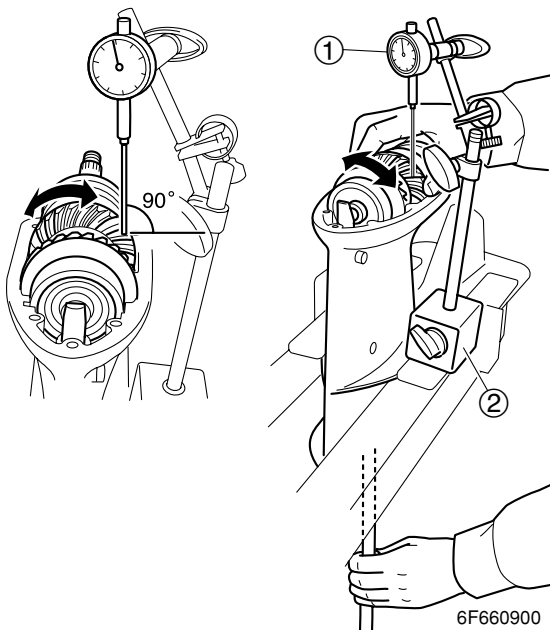
**Backlash**

**Measuring the forward and reverse gear backlash**

1. Remove the water pump assembly.
2. Set the lower unit upside down.
3. Remove the lower case cap, propeller shaft assembly from the lower unit.
4. Remove the O-ring, and then install the propeller shaft assembly onto the lower unit.



5. Set the gear shift to the neutral position at the lower unit.
6. Install the dial gauge onto the lower unit and set the dial gauge.



**NOTE:**

Set the dial gauge plunger vertical position from the center of gear teeth.



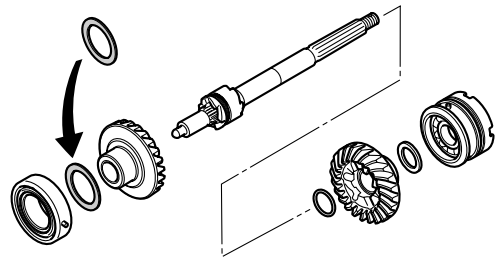
Dial gauge set ①: 90890-01252  
Magneto base B ②: 90890-06844

7. Hold the drive shaft and slowly turn the forward gear clockwise and counter-clockwise, then measure the backlash when the gear stops in each direction.



Forward gear backlash:  
0.05– 0.24mm (0.0020– 0.0094 in)

8. Adjust the shim(s) to specified thickness (Add or remove).



Available shim thicknesses:  
0.70, 0.80, 0.90, 1.00, and  
1.10, 1.20 mm

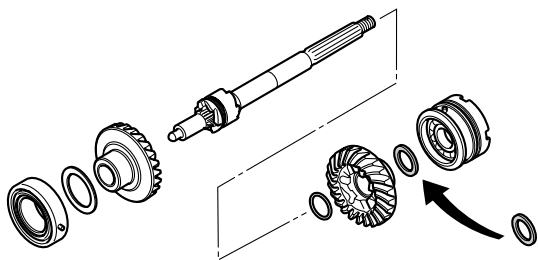
9. Hold the drive shaft and slowly turn the reverse gear clockwise and counter-clockwise, then measure the backlash when the gear stops in each direction.



Reverse gear backlash:  
0.40– 0.59mm (0.0157– 0.0232 in)



10. Adjust the shim(s) to specified thickness (Add or remove).

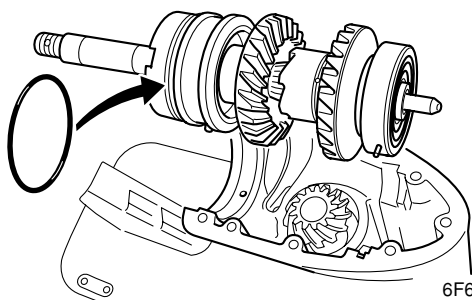


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Available shim thicknesses:

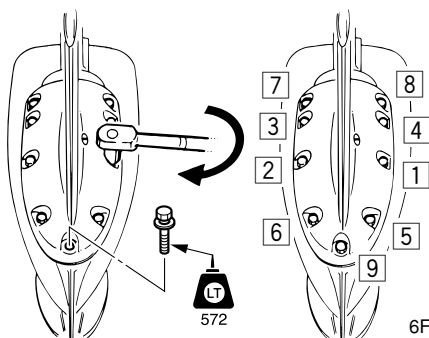
1.80, 1.90, 2.00, 2.10, 2.20, 2.30, 2.40, and 2.50 mm

11. Remove the special service tools. Then install the O-ring to the propeller shaft assembly and tighten the lower case cap to specified torque in two stage.



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12. Tighten the bolts in sequence as shown two stage, and then install the water pump assembly.



6F660805

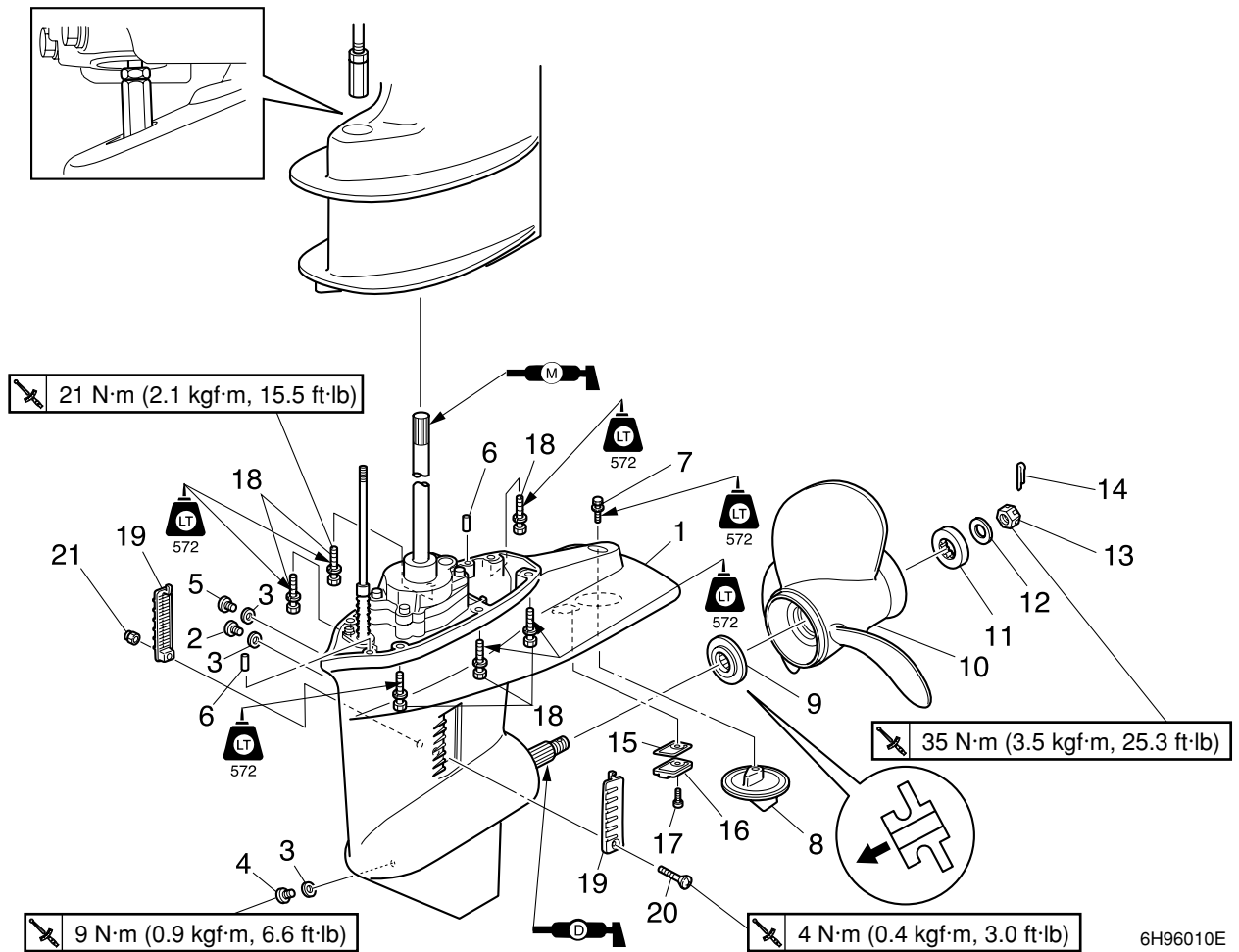


Lower case cap bolt :

1st: 4 N·m (0.4 kgf·m, 3.0 ft·lb)

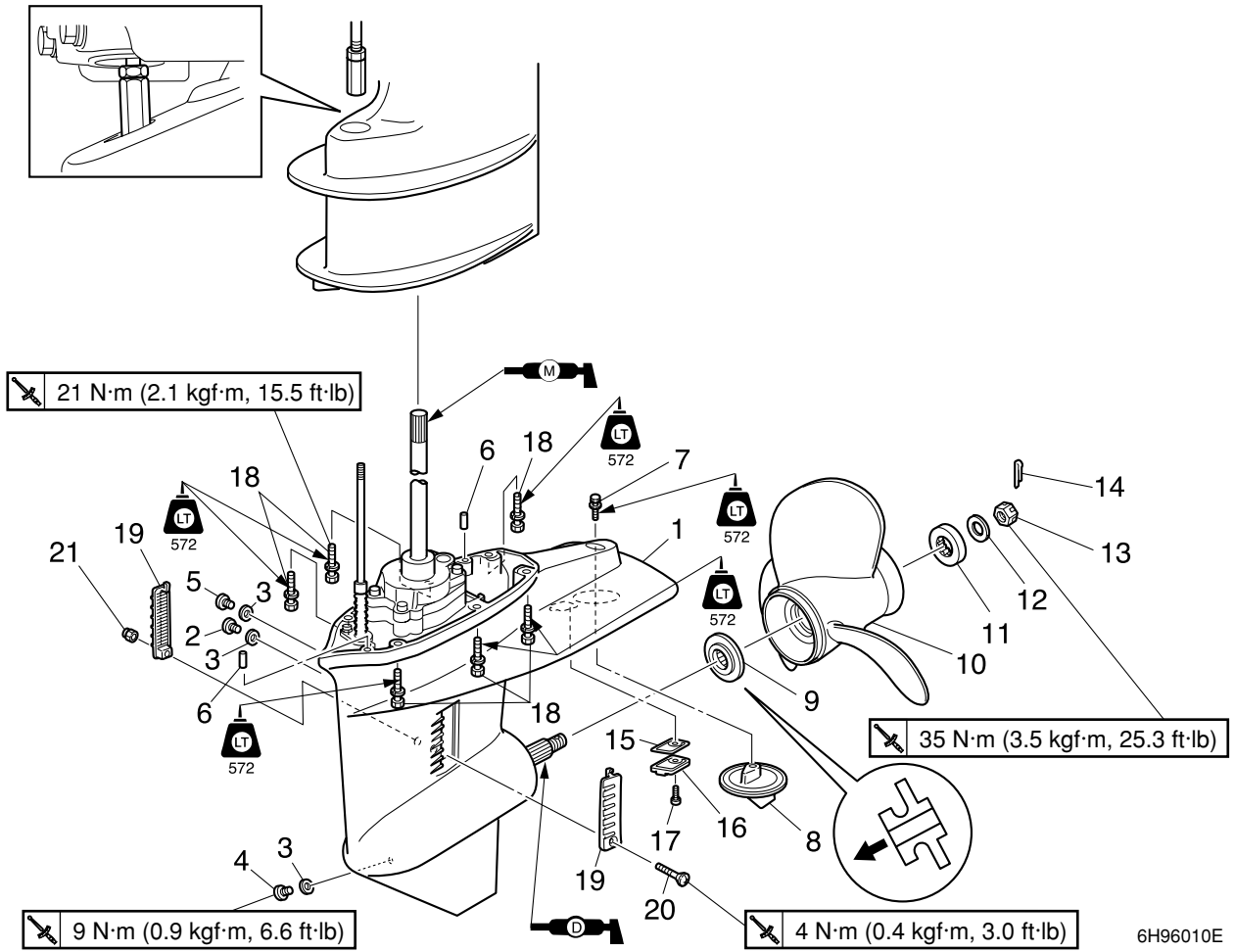
2nd: 8 N·m (0.8 kgf·m, 5.8 ft·lb)

**Lower unit (EK40J)**



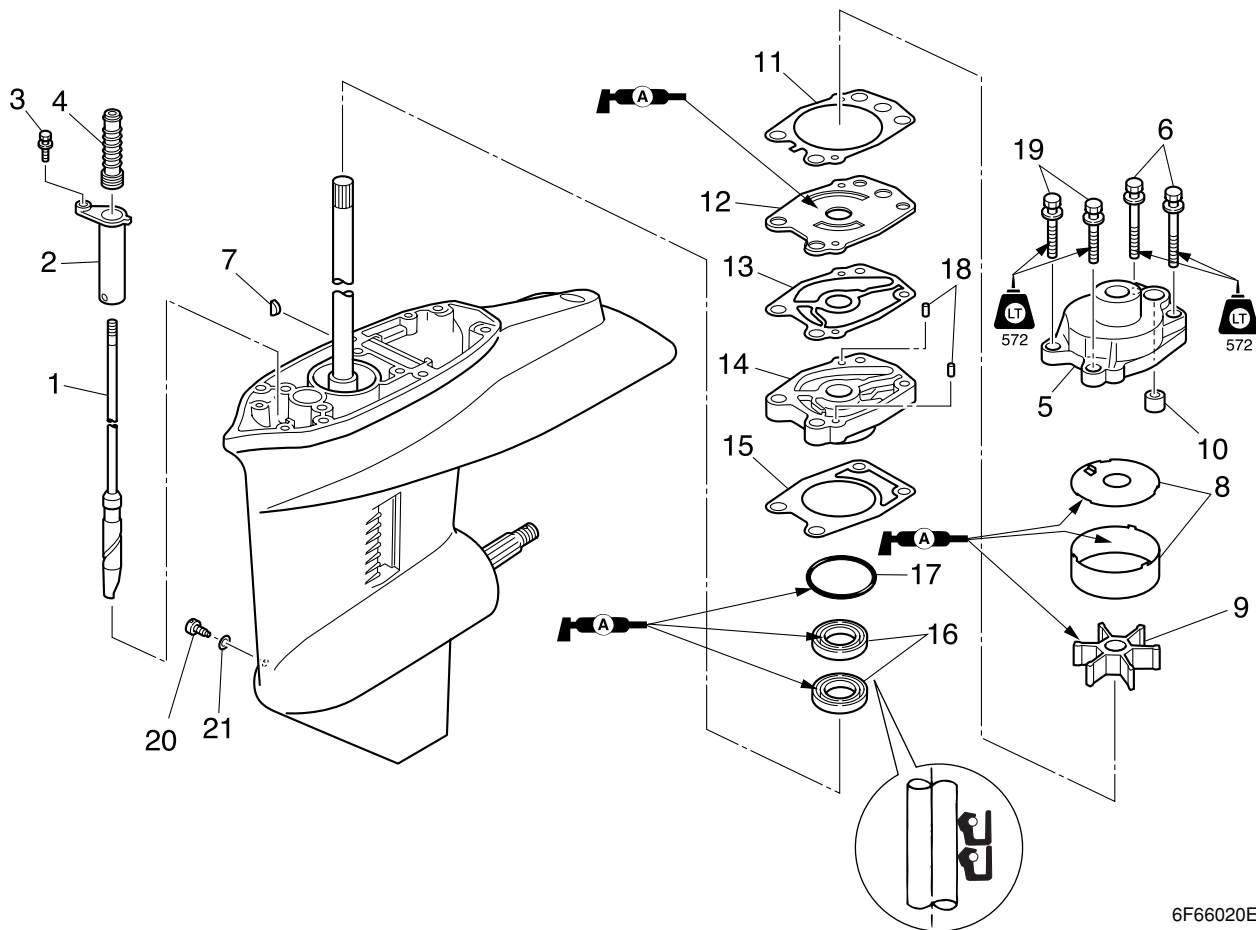
6H96010E

No.	Part name	Q'ty	Remarks
1	Lower unit	1	
2	Check screw	1	
3	Gasket	3	<b>Not reusable</b>
4	Drain screw	1	
5	Screw	1	
6	Dowel	2	
7	Bolt	1	M10 × 30 mm
8	Anode	1	
9	Washer	1	
10	Propeller	1	
11	Washer	1	
12	Washer	1	
13	Propeller nut	1	
14	Cotter pin	1	<b>Not reusable</b>
15	Gasket	1	<b>Not reusable</b>
16	Cooling water inlet cover	1	
17	Screw	1	



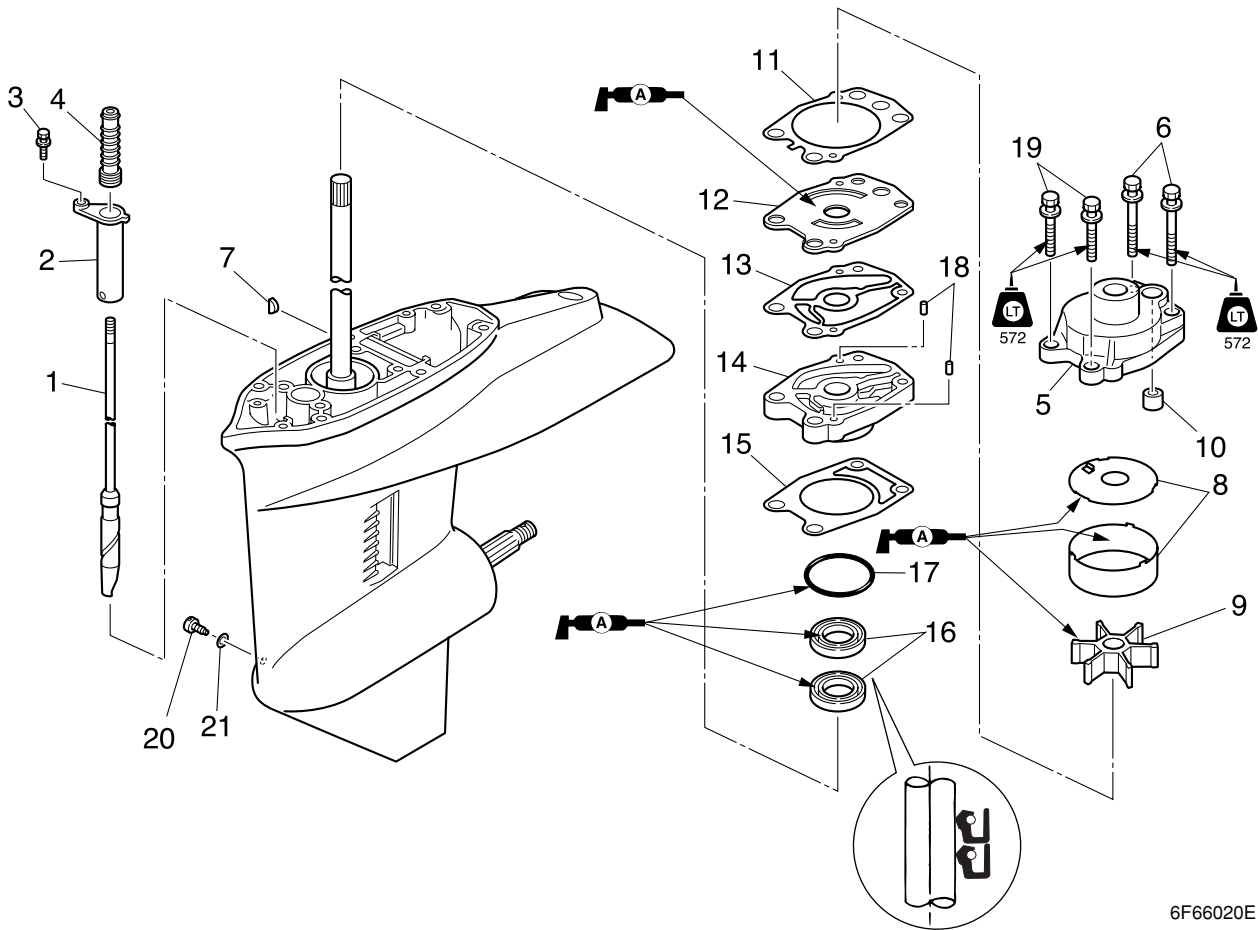
6

No.	Part name	Q'ty	Remarks
18	Bolt	6	M8 × 30 mm
19	Water inlet cover	2	
20	Screw	1	
21	Nut	1	



6F66020E

No.	Part name	Q'ty	Remarks
1	Shift rod	1	
2	Bushing	1	
3	Bolt	1	M6 × 18 mm
4	Boot	1	
5	Water pump housing	1	
6	Bolt	2	M8 × 55 mm
7	Woodruff key	1	
8	Insert cartridge	1	
9	Impeller	1	
10	Seal	1	
11	Gasket	1	Not reusable
12	Outer plate cartridge	1	
13	Gasket	1	Not reusable
14	Oil seal housing	1	
15	Gasket	1	Not reusable
16	Oil seal	2	Not reusable
17	O-ring	1	Not reusable



6F66020E

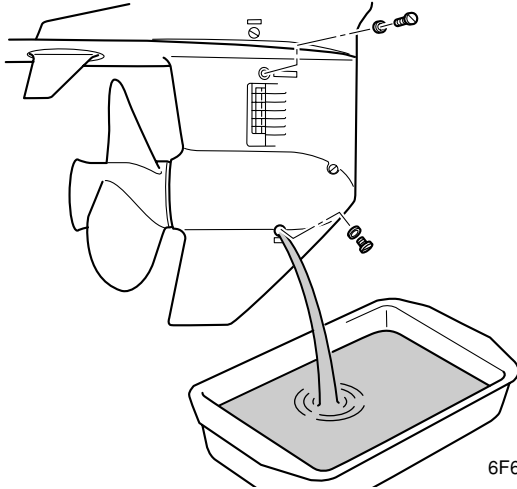
6

No.	Part name	Q'ty	Remarks
18	Dowel	2	
19	Bolt	2	M8 × 45 mm
20	Screw	1	
21	Gasket	1	Not reusable



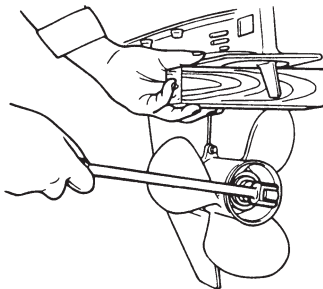
**Removing the lower unit**

1. Drain the gear oil.



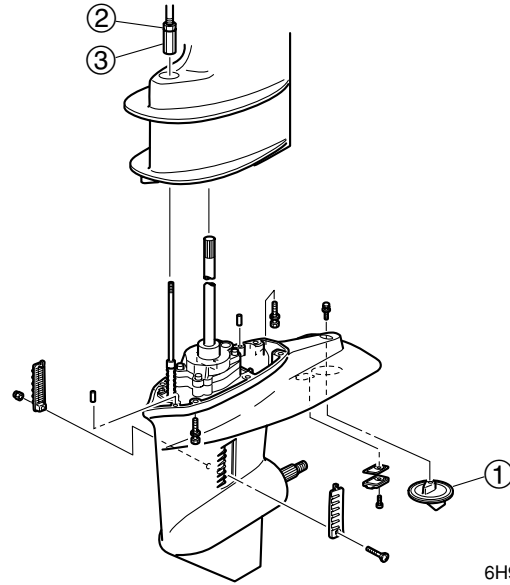
6F660010

2. Shift the shift lever or remote control lever to neutral, place a block of wood between the anti-cavitation plate and propeller to keep the propeller from turning, and then remove the propeller nut and propeller.



6F660020

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



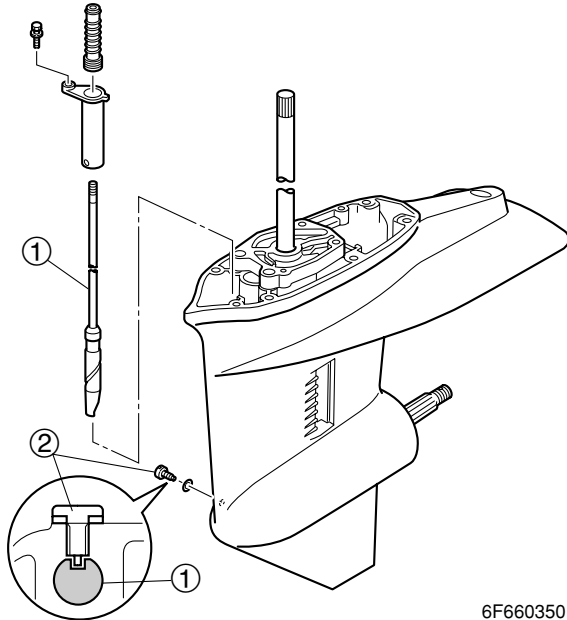
6H960030

**⚠WARNING**

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

### Removing the water pump and shift rod

1. Remove the water pump assembly and shift rod assembly ①.



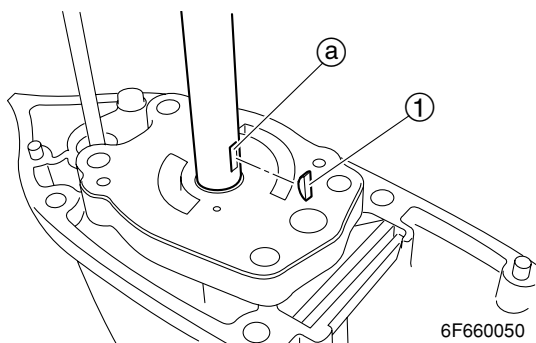
**NOTE:**

Before removing the shift rod assembly ①, remove the screw ②.

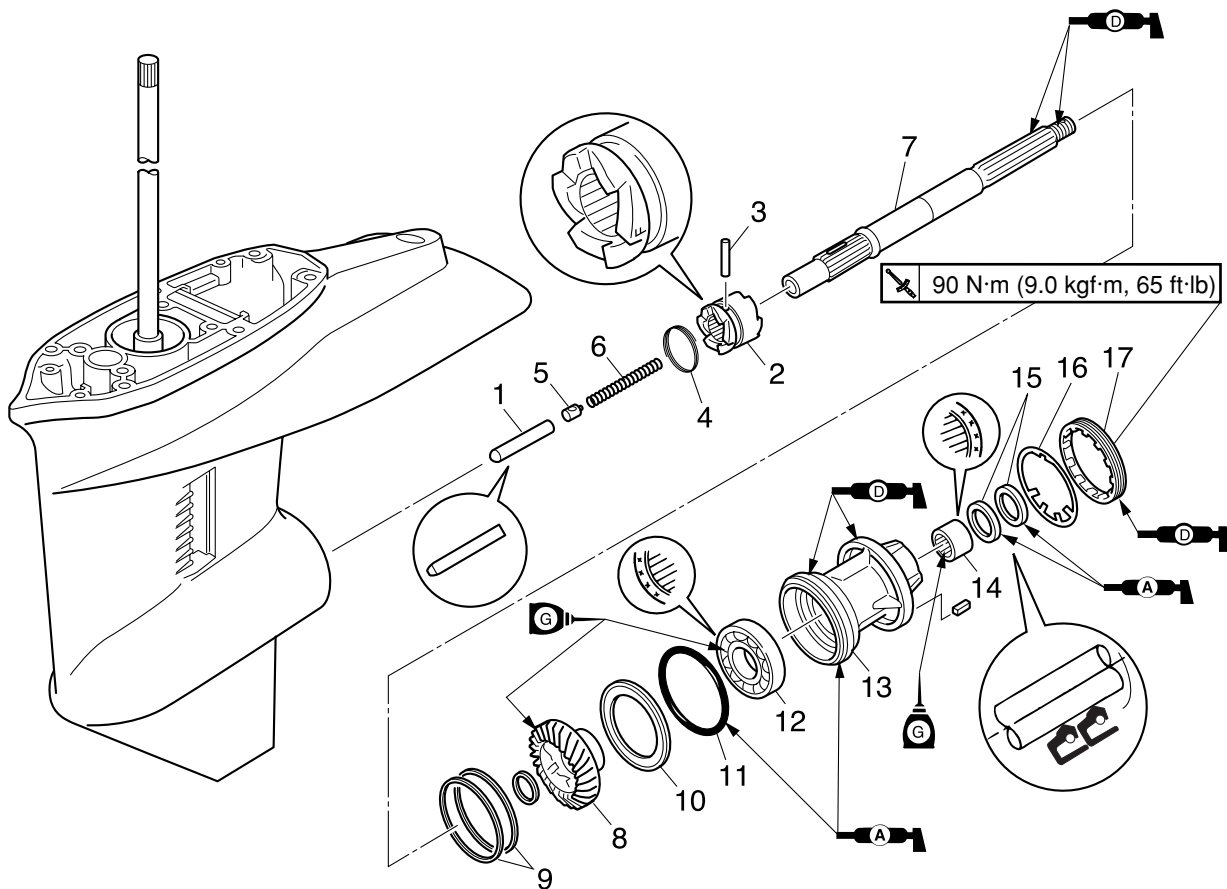
4. Check the shift rod for cracks or wear. Replace if necessary.

### Checking the water pump and shift rod

1. Check the water pump housing for deformation. Replace if necessary.
2. Check the impeller and insert cartridge for cracks or wear. Replace if necessary.
3. Check the Woodruff key ① and the keyway ② in the drive shaft for wear. Replace if necessary.



**Propeller shaft housing**



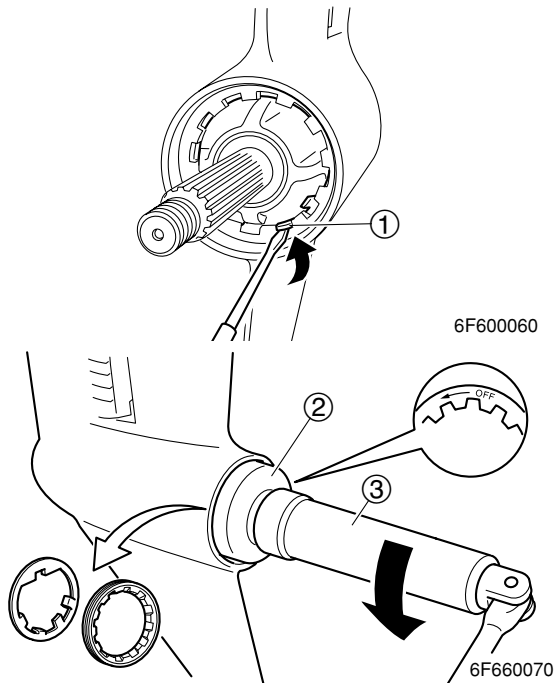
6F66030E

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



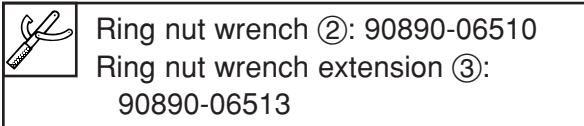
### Removing the propeller shaft housing assembly

1. Remove the ring nut from the propeller shaft housing, use the special service tools.

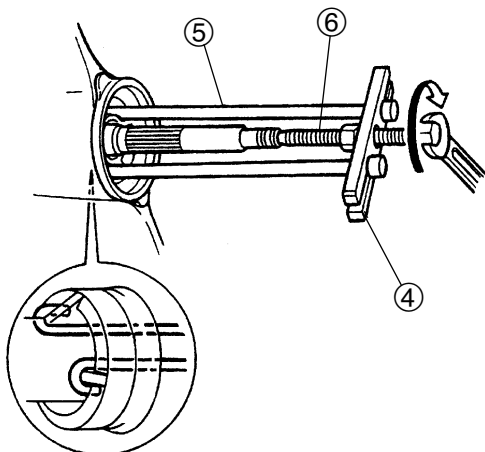


**NOTE:**

- Straighten the one tab ① of the lock washer, then turn the ring nut.
- When the ring nut toward to "OFF".



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



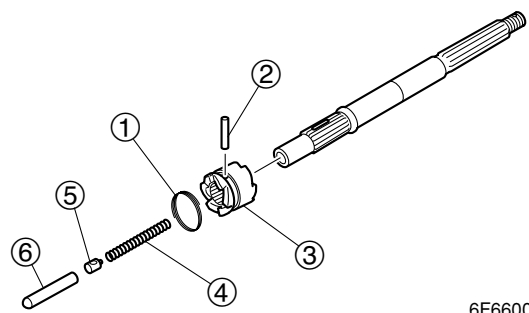
Stopper guide plate ④:  
90890-06501

Bearing housing puller crow M ⑤:  
90890-06503

Center bolt ⑥: 90890-06504

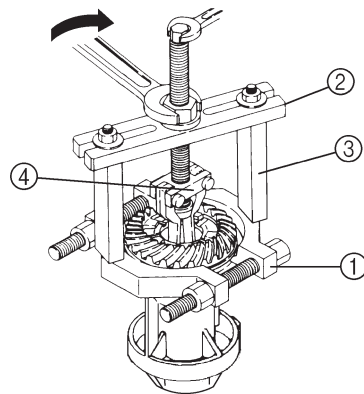
### Disassembling the propeller shaft assembly

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



### Disassembling the propeller shaft housing

1. Remove the reverse gear.



Bearing separator ①: 90890-06534

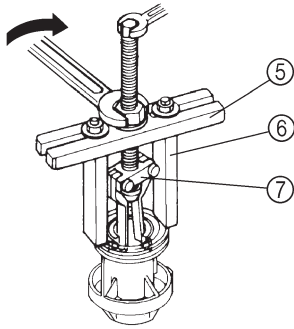
Stopper guide plate ②:  
90890-06501

Stopper guide stand ③:  
90890-06538

Bearing puller assembly ④:  
90890-06535



2. Remove the ball bearing.



6F660110

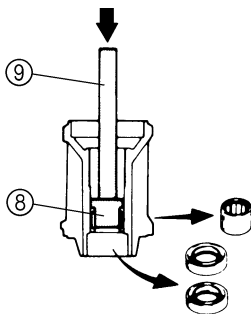
**CAUTION:**

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



- Stopper guide plate (5):  
90890-06501
- Stopper guide stand (6):  
90890-06538
- Bearing puller assembly (7):  
90890-06535

3. Remove the oil seals and needle bearing.



S68S6350



- Needle bearing attachment (8):  
90890-06614
- Driver rod L3 (9): 90890-06652

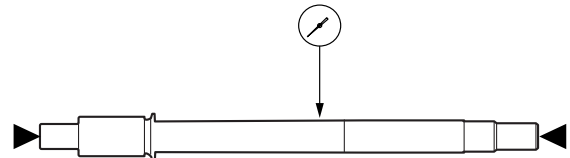
**Checking the propeller shaft housing**

1. Clean the propeller shaft housing using a soft brush and cleaning solvent, and then check it for cracks. Replace if necessary.
2. Check the teeth and dogs of the reverse gear for cracks or wear. Replace the gear if necessary.

3. Check the bearings for pitting or rumbling. Replace if necessary.

**Checking the propeller shaft**

1. Check the propeller shaft for bends or wear. Replace if necessary.
2. Measure the propeller shaft runout.



6F660130

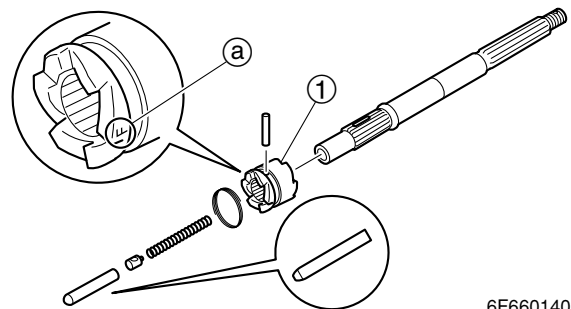


**Runout limit: 0.02 mm (0.0008 in)**

3. Check the dog clutch and shift plunger for cracks or wear. Replace if necessary.

**Assembling the propeller shaft assembly**

1. Install the dog clutch as shown.



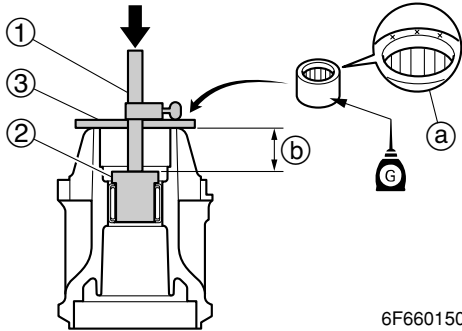
6F660140

**NOTE:**

Install the dog clutch (1) with the "F" mark (a) facing toward the shift plunger.

### Assembling the propeller shaft housing

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



6F660150

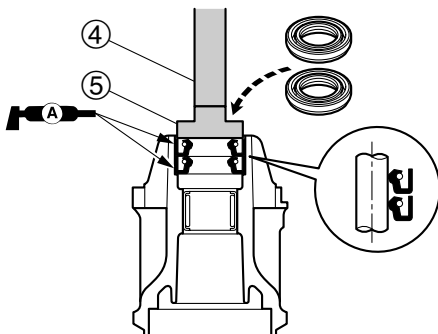
**NOTE:**

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

	Driver rod SS ①: 90890-06604 Needle bearing attachment ②: 90890-06614 Bearing depth plate ③ 90890-06603
--	---

	Depth (b): 25.5 mm (1.0039 in)
--	-----------------------------------

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



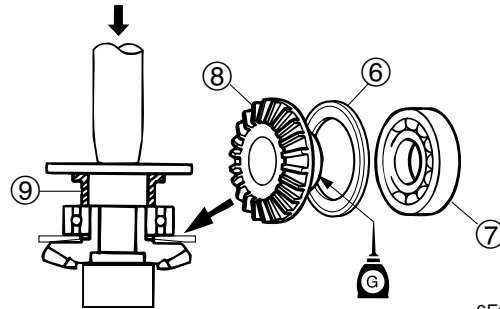
6F660160

**NOTE:**

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

	Driver rod LS ④: 90890-06606 Ball bearing attachment ⑤: 90890-06637
--	---

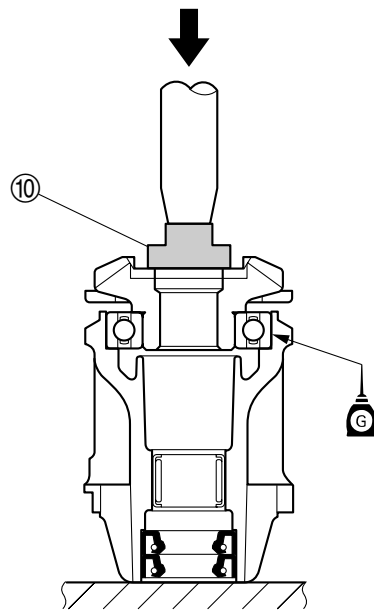
3. Install the washer (6) and new ball bearing (7) onto the reverse gear (8) using a press.



6F660170

	Bearing inner race attachment ⑨: 90890-06639
--	---

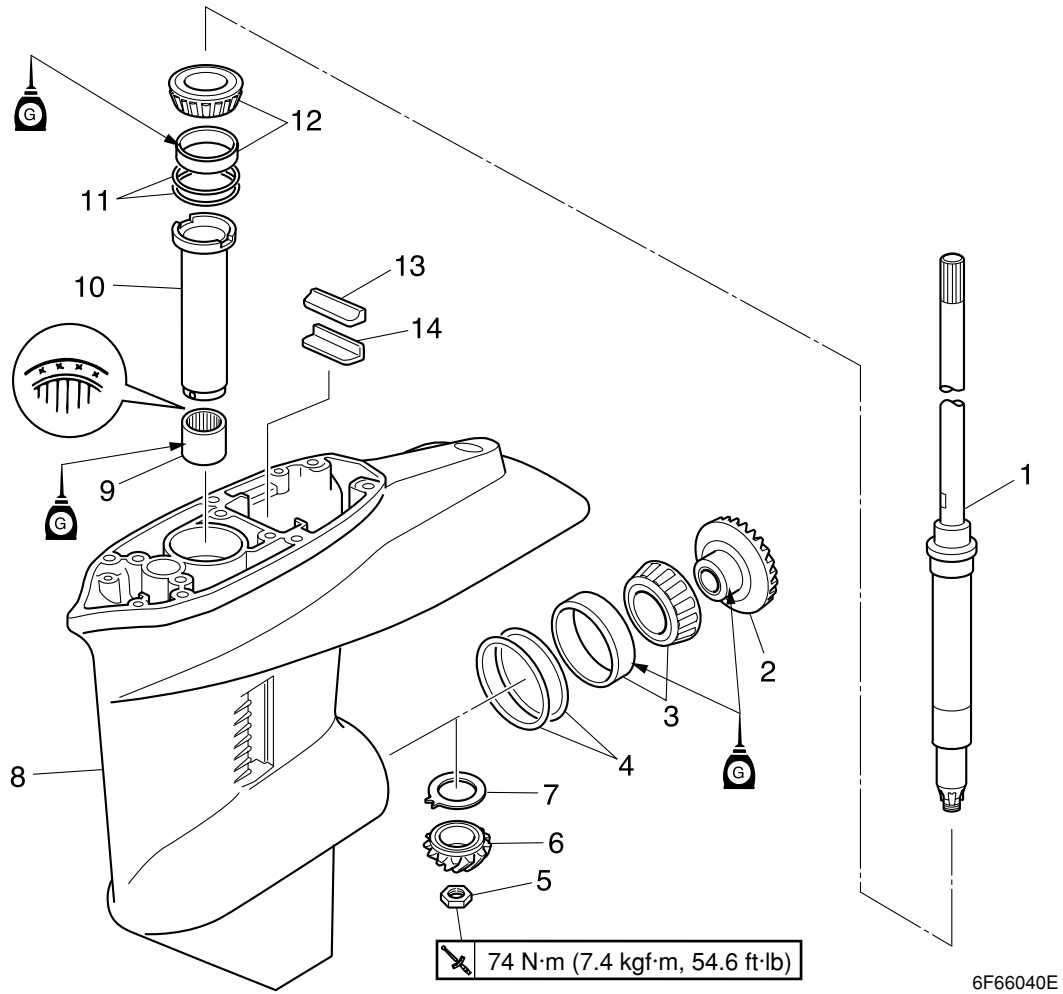
4. Install the reverse gear assembly into the propeller shaft housing using a press.



6F660180

	Needle bearing attachment ⑩: 90890-06608
--	---

**Drive shaft and lower case**

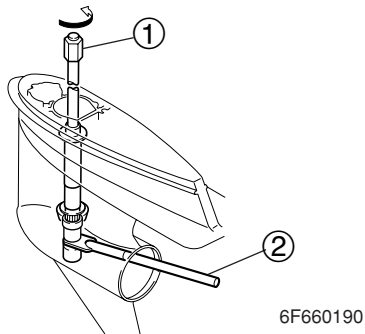



6F66040E

No.	Part name	Q'ty	Remarks
1	Drive shaft	1	
2	Forward gear	1	
3	Taper roller bearing assembly	1	Not reusable
4	Forward gear shim	—	
5	Nut	1	
6	Pinion gear	1	
7	Washer	1	
8	Lower case	1	
9	Needle bearing	1	
10	Sleeve	1	
11	Pinion gear shim	—	
12	Taper roller bearing assembly	1	Not reusable
13	Seal	1	
14	Guide	1	

### Removing the drive shaft

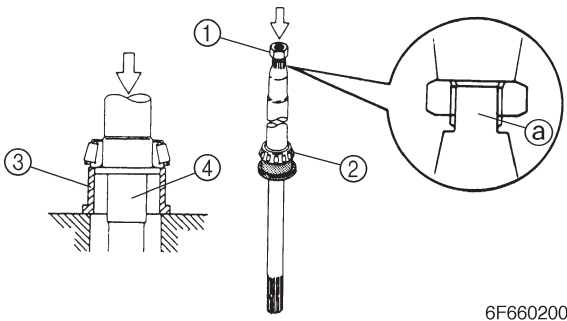
1. Remove the drive shaft assembly and pinion, and then pull out the forward gear.



	Drive shaft holder 3 (1): 90890-06517
	Pinion nut holder (2): New: 90890-06715 Current: 90890-06505


### Disassembling the drive shaft

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



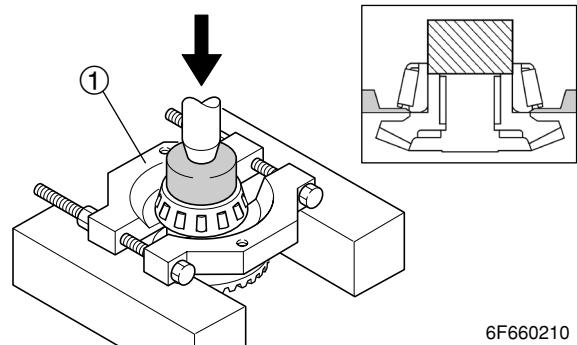
#### CAUTION:

- Do not press the drive shaft threads (a) directly.
- When removing the drive shaft bearing, do not damage the drive shaft collar (4).
- Do not reuse the bearing, always replace it with a new one.

	Bearing inner race attachment (3): 90890-06641
---	---

### Disassembling the forward gear

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



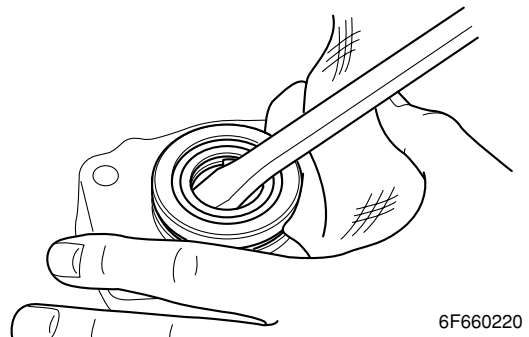
#### CAUTION:

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

	Bearing separator (1): 90890-06534
---	------------------------------------

### Disassembling the oil seal housing

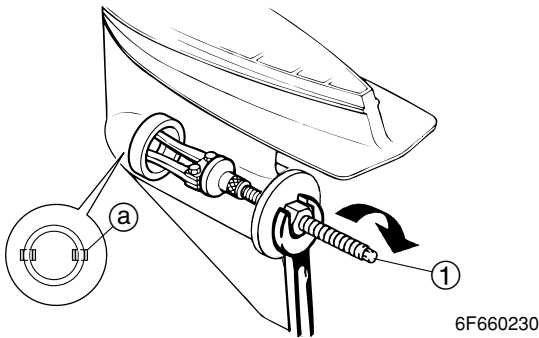
1. Remove the oil seals using a flat head screwdriver.





**Disassembling the lower case**

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



6F660230

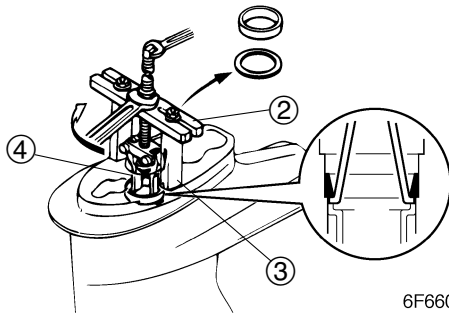
**NOTE:**

Install the claws (a) as shown.



Bearing outer race puller assembly (1): 90890-06523

2. Remove the drive shaft bearing outer race, shim(s), and drive shaft sleeve.



6F660240

**NOTE:**

Install the claws as shown.

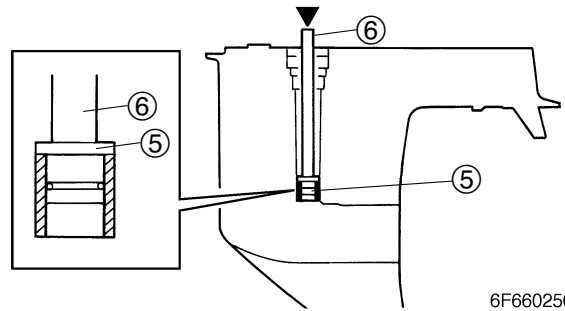


Stopper guide plate (2) : 90890-06501

Stopper guide stand (3) : 90890-06538

Bearing puller assembly (4) : 90890-06535

3. Remove the needle bearing.



6F660250



Needle bearing attachment (5) : 90890-06614

Driver rod L3 (6) : 90890-06652

**Checking the pinion and forward gear**

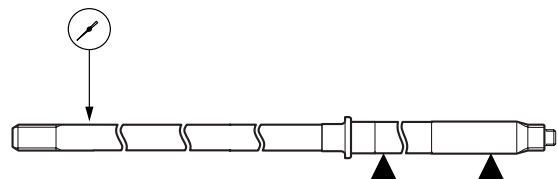
1. Check the teeth of the pinion, and the teeth and dogs of the forward gear for cracks or wear. Replace if necessary.

**Checking the bearings**

1. Check the bearings for pitting or rumbling. Replace if necessary.

**Checking the drive shaft**

1. Check the drive shaft for bends or wear. Replace if necessary.
2. Measure the drive shaft runout.



6F660260



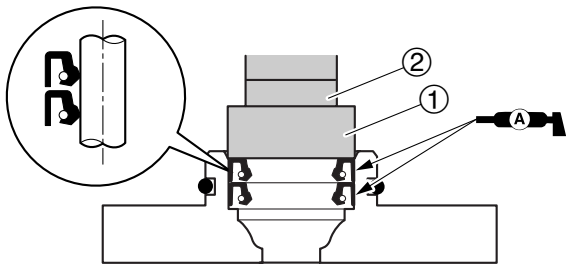
Runout limit: 0.5 mm (0.020 in)

**Checking the lower case**


1. Check the skeg and torpedo for cracks or damage. Replace the lower case if necessary.

### Assembling the oil seal housing

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

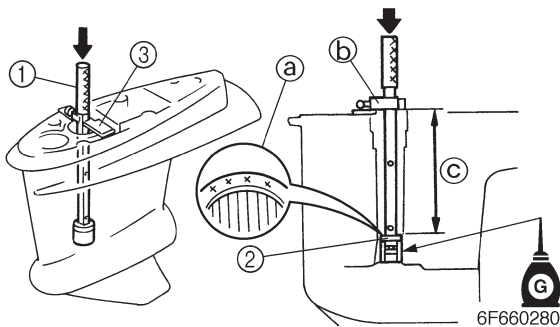


6F660270

	Ball bearing attachment ①: 90890-06653
	Driver rod L3 ②: 90890-06652


### Assembling the lower case


1. Install the needle bearing into the lower case to the specified depth.



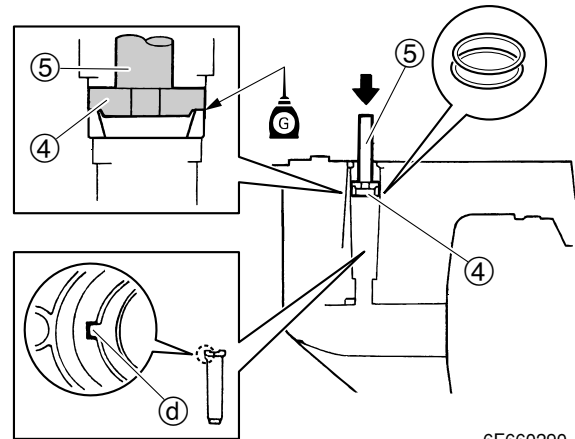
6F660280

- NOTE:**
- Install the needle bearing with the manufacture identification mark (a) facing up.
  - Be careful not to let the stopper (b) get out of position when using the driver rod SL.

	Driver rod SL ① : 90890-06602
	Needle bearing attachment ② : 90890-06614
	Bearing depth plate ③ : 90890-06603

	Depth (C) : 182.5 — 183.0 mm (7.19 — 7.20 in)
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2. Install the sleeve, original shim(s), and drive shaft bearing outer race.



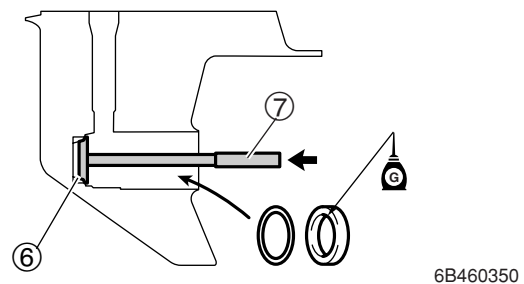
6F660290

- CAUTION:**
- Add or remove shim(s), if necessary, if replacing the pinion or lower case.

- NOTE:**
- Apply gear oil to the inside and outside of the sleeve before installation.
  - Install the sleeve with the projection (d) facing forward.


	Bearing outer race attachment ④: 90890-06627
	Driver rod LS ⑤: 90890-06606

3. Install the original shim(s) and taper roller bearing outer race.



6B460350

- CAUTION:**
- Add or remove shim(s), if necessary, if replacing the forward gear or lower case.

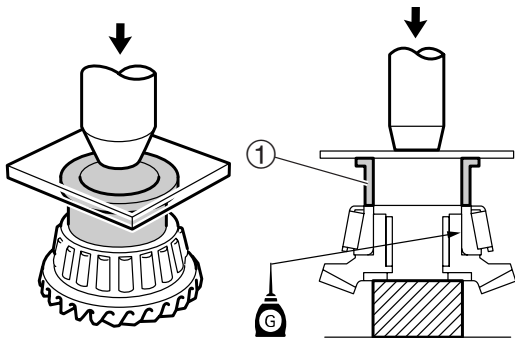
	Bearing outer race attachment ⑥: 90890-06622
	Driver rod LL ⑦: 90890-06605





**Assembling the forward gear**

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



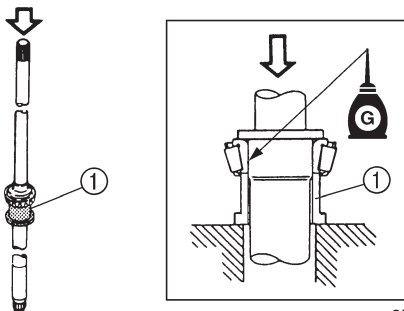
6B460310



Bearing inner race attachment ①:  
90890-06640

**Assembling the drive shaft**

1. Install a new drive shaft bearing onto the drive shaft using a press.



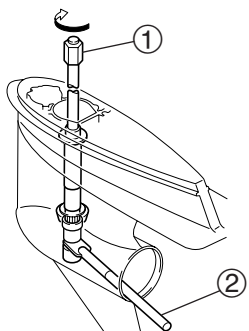
6F660300



Bearing inner race attachment ①:  
90890-06644

**Installing the drive shaft**

1. Install the forward gear, then the drive shaft assembly, spacer, pinion, and pinion nut.
2. Tighten the nut to the specified torque.



6F60300



Drive shaft holder 3 ①:  
90890-06517

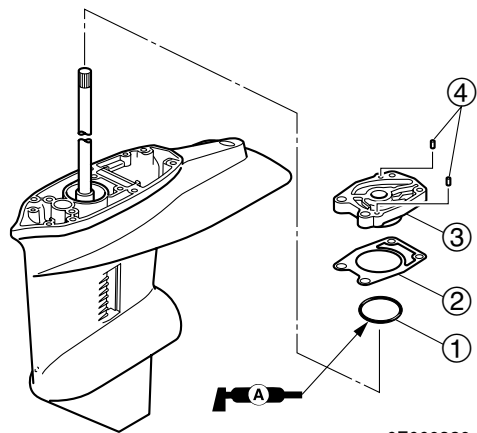
Pinion nut holder ②:  
New: 90890-06715  
Current: 90890-06505



Pinion nut:  
74 N·m (7.4 kgf·m, 54.6 ft·lb)

**Installing the oil seal housing**

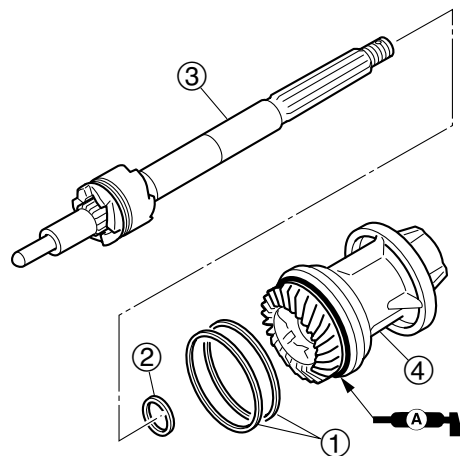
1. Install a new O-ring ①, new gasket ②, oil seal housing ③, and the dowels ④.



6F660320

**Installing the propeller shaft housing**

1. Install the original shim(s) ①, washer ② and propeller shaft assembly ③ into the propeller shaft housing assembly ④.
2. Apply grease to new O-rings.



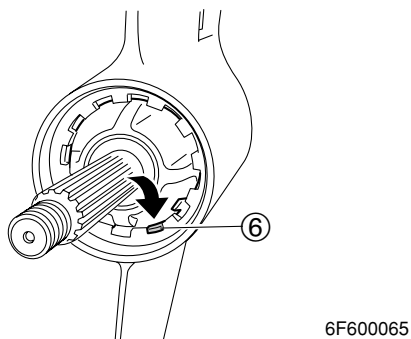
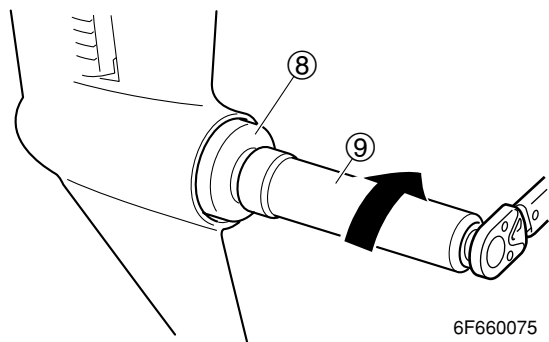
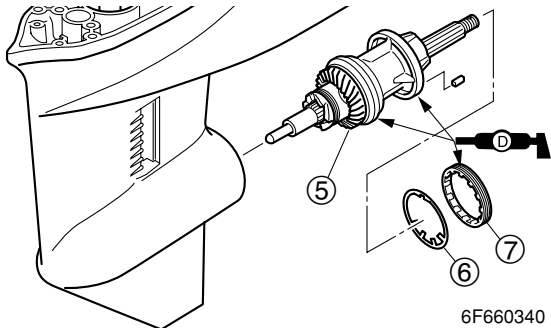
6F660330

**CAUTION:**


Add or remove shim(s), if necessary, if replacing the reverse gear, propeller shaft housing, or lower case.




3. Install the propeller shaft housing assembly ⑤ and lock washer ⑥ into the lower case, and then tighten the ring nut ⑦ to the specified torque.



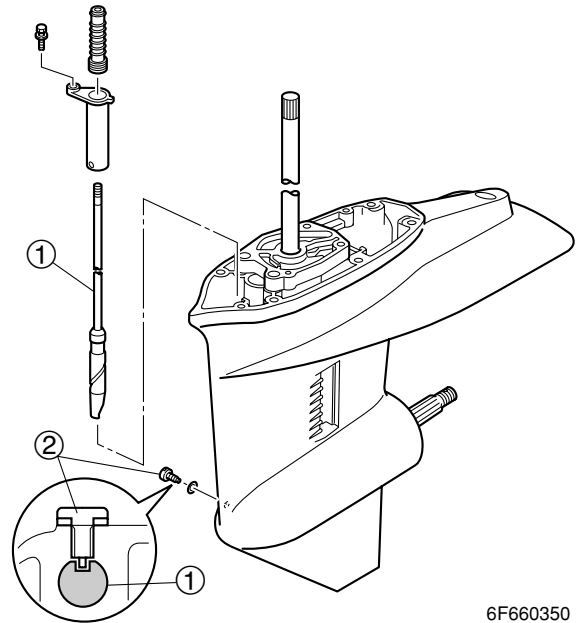
**NOTE:** To secure the ring nut, and lock washer ⑥ bend one lobe into the ring nut slot, and the other towards the gear side.

	Ring nut wrench ⑧: 90890-06510
	Ring nut wrench extension ⑨: 90890-06513

	Ring nut : 90 N·m (9.0 kgf·m, 65 ft·lb)
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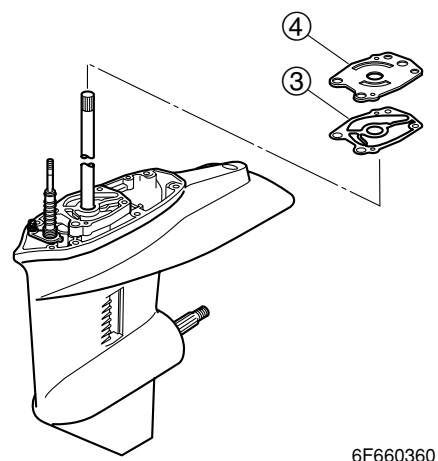
### Installing the water pump and shift rod

1. Install the shift rod assembly ①.



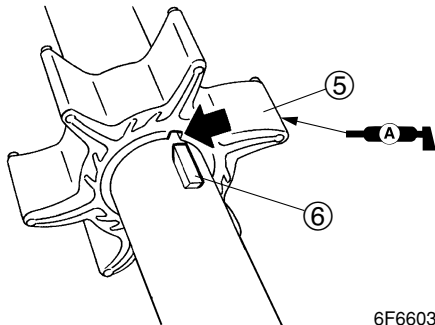
**NOTE:** Align the slit on the shift cam ① with the hole in the lower case. Then install the screw ② as shown.

2. Install a new gasket ③, the outer plate cartridge ④.



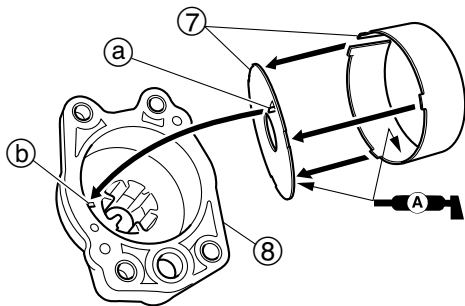


3. Install the Woodruff key into the drive shaft.
4. Align the groove in the impeller ⑤ with the Woodruff key ⑥, and then install the impeller onto the drive shaft.



6F660375

5. Install the insert cartridge ⑦ into the pump housing ⑧, and then apply grease to the inside of the insert cartridge.



6F660385

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

6. Install the seal ⑨, a new gasket ⑩ and pump housing assembly ⑪ into the lower case, tighten the bolts ⑫.



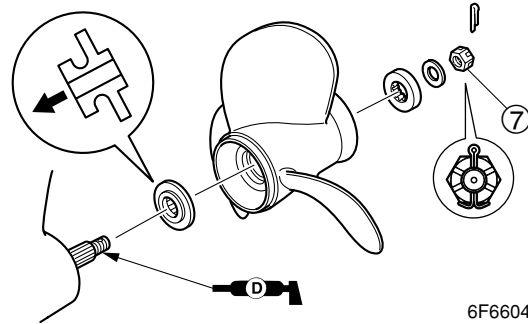
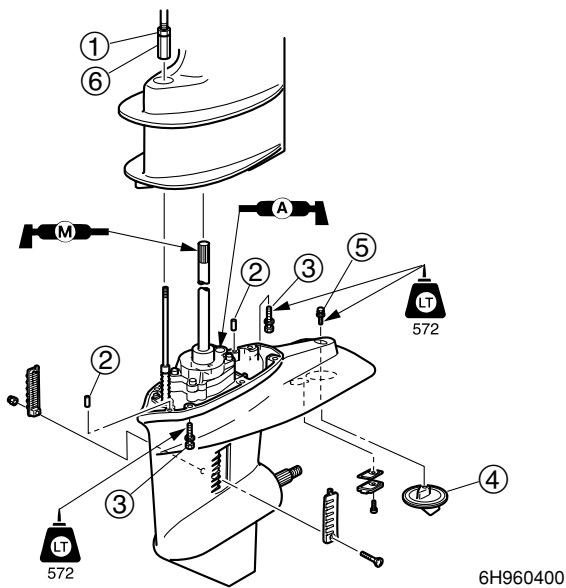
6F660390

**NOTE:** \_\_\_\_\_  
When installing the pump housing, apply grease to the inside of the housing, and then turn the drive shaft clockwise while pushing down the pump housing.

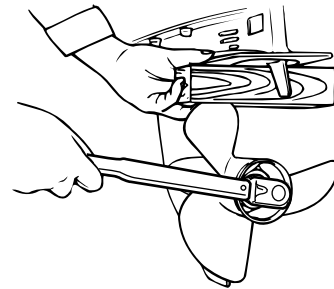
**Installing the lower unit**

1. Set the gear shift to the reverse position at the lower unit. Make sure that the shift rod is in the reverse position.
2. Screw in the locknut ① completely.
3. Install the two dowels ② into the lower unit.
4. Install the lower unit into the upper case, and then tighten the lower case mounting bolts ③ to the specified torque.
5. Connect the shift rod.
6. Install the trim tab ④ to its original position, and then tighten the trim tab bolt ⑤.

7. Install the propeller and propeller nut, and then tighten the nut finger tight. 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.



6F660410




6F660420

**NOTE:** \_\_\_\_\_  
Screw the adjusting nut ⑥ down until it lightly seated, and then tighten the locknut.


**⚠WARNING** \_\_\_\_\_  

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

6

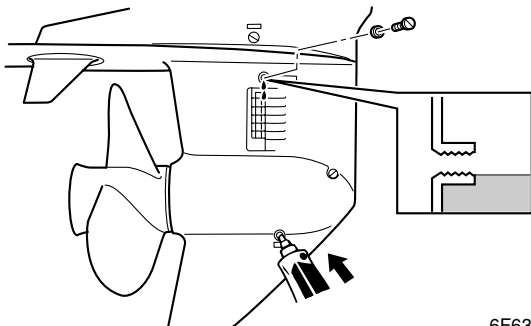
 Lower case mounting bolt ③:  
21 N·m (2.1 kgf·m, 15.5 ft·lb)

**NOTE:** \_\_\_\_\_  
If the grooves in the propeller nut ⑦ do not align with the cotter pin hole, tighten the nut until they are aligned.

 Propeller nut ⑦:  
35 N·m (3.5 kgf·m, 25.3 ft·lb)



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



6F630210

**Recommended gear oil:**

Hypoid gear oil

API: GL-4

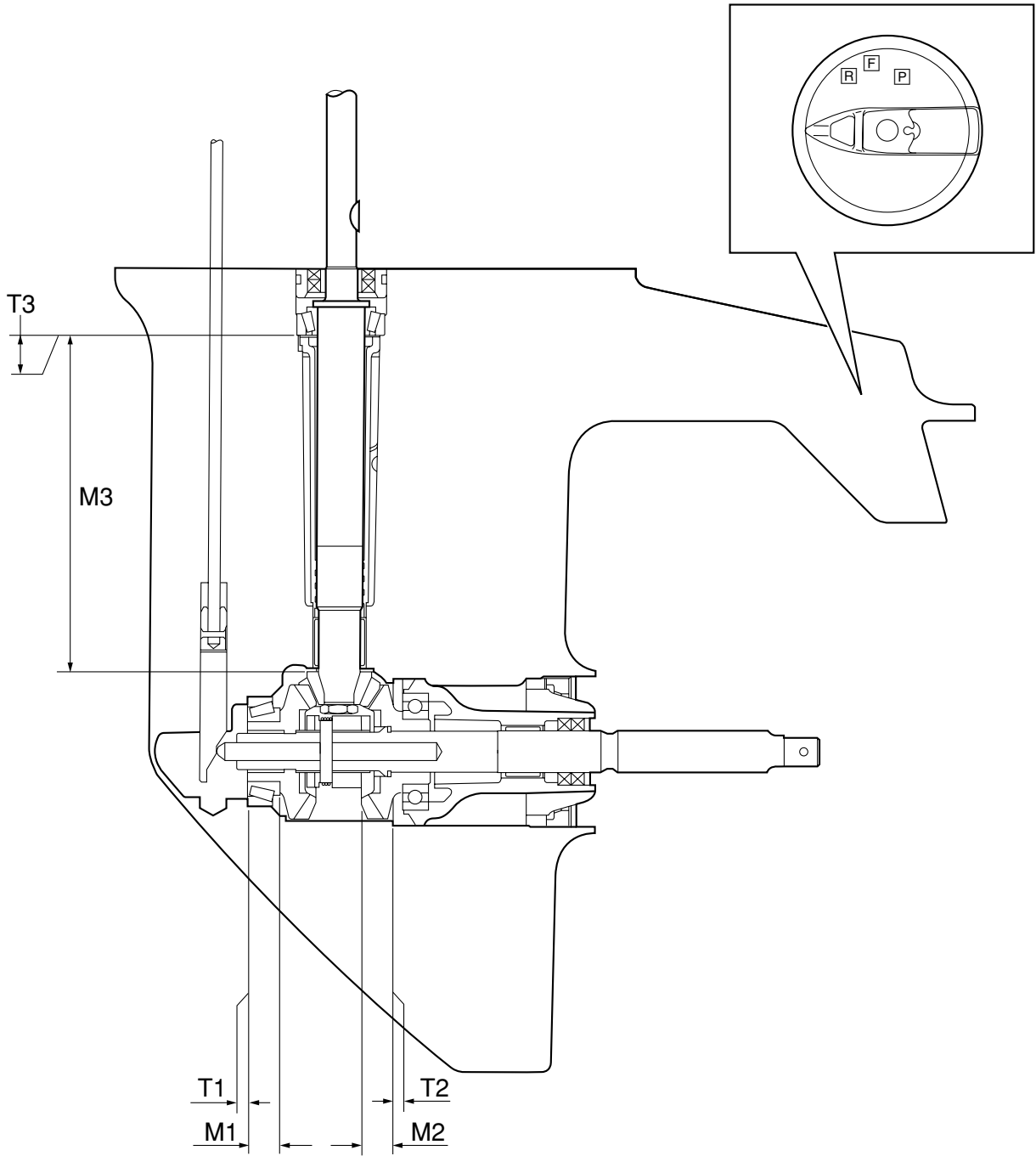
SAE: 90

**Oil quantity:**315 cm<sup>3</sup>

(10.65 US oz, 11.11 Imp oz)

9. Install the check screw and quickly install the drain screw.

# Shimming



6

6F660440



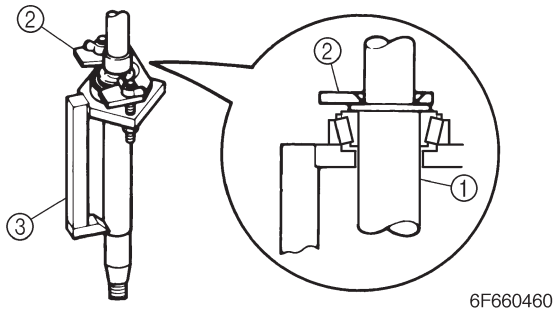
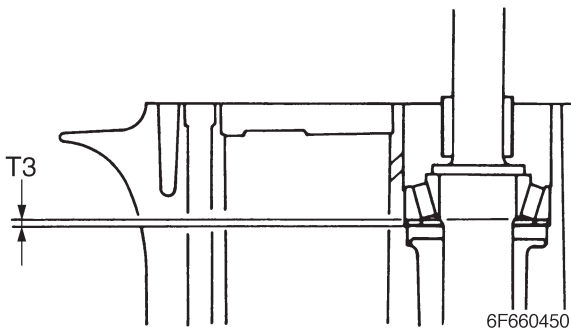
**Shimming**

**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 shims**

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



**NOTE:**

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



Pinion height gauge plate B ②:  
90890-06712

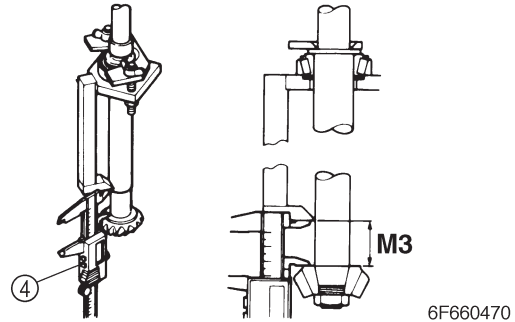
Pinion height gauge ③:  
90890-06710

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



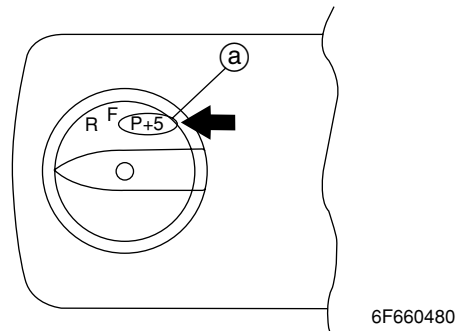
Pinion nut:  
74 N·m (7.4 kgf·m, 54.6 ft·lb)

3. Measure the distance (M3) between the special service tool and the pinion as shown.



Digital caliper ④: 90890-06704

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



**NOTE:**

“P” is the deviation of the lower case dimension from standard. The “P” mark ① is stamped on the trim tab mounting surface of the lower case in 0.01 mm units. If the “P” mark is unreadable, assume that “P” is zero and check the backlash when the unit is assembled.

Calculation formula:

$$\text{Pinion shim thickness (T3)} = M3 - 25.5 - P/100$$

Example:

If "M3" is 26.05 mm and "P" is (+5), then  
 $T3 = 26.05 - 25.5 - (+5)/100 \text{ mm}$   
 $= 0.55 - 0.05 \text{ mm}$   
 $= 0.60 \text{ mm}$

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

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

Available shim thicknesses:  
 0.05, 0.08, 0.12, 0.30, and  
 0.50 mm

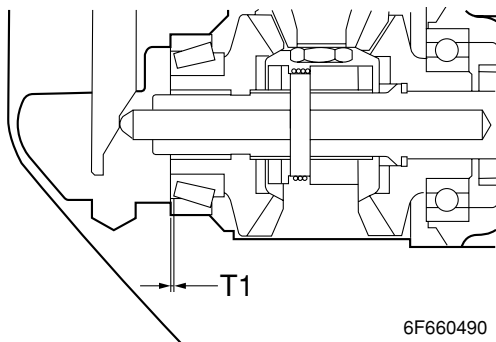
Example:

If "T3" is 0.43 mm, then the pinion shim is 0.45 mm.

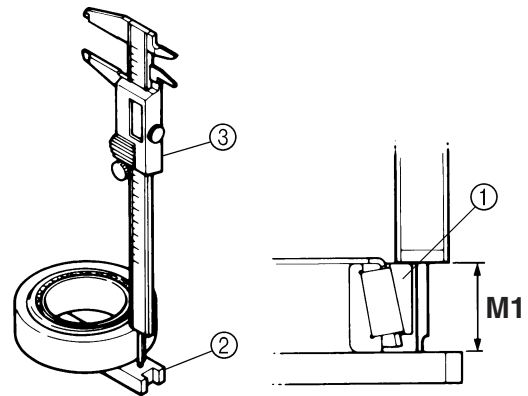
If "T3" is 0.38 mm, then the pinion shim is 0.38 mm.

### Selecting the forward gear shims

1. Turn the taper roller bearing outer race ① two or three times to seat the rollers, and then measure the bearing height (M1) as shown.



6F660490



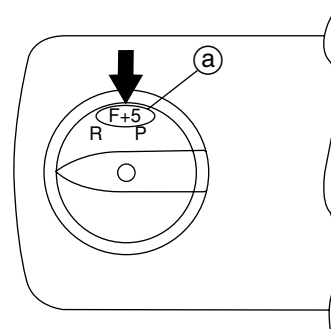
6B460550

**NOTE:**

- Select the shim thickness (T1) by using the specified measurement(s) and the calculation formula.
- Measure the bearing outer race at three points to find the height average.

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

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



6F660500

**NOTE:**

"F" is the deviation of the lower case dimension from standard. The "F" mark ① is stamped on the trim tab mounting surface of the lower case in 0.01 mm units. If the "F" mark is unreadable, assume that "F" is zero and check the backlash when the unit is assembled.



Calculation formula:

$$\text{Forward gear shim thickness (T1)} = 25.70 + F/100 - M1$$

Example:

If "M1" is 25.30 mm and "F" is (+4), then

$$T1 = 25.70 + (+4)/100 - 25.30 \text{ mm}$$

$$= 25.70 + 0.04 - 25.30 \text{ mm}$$

$$= 0.44 \text{ mm}$$

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

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

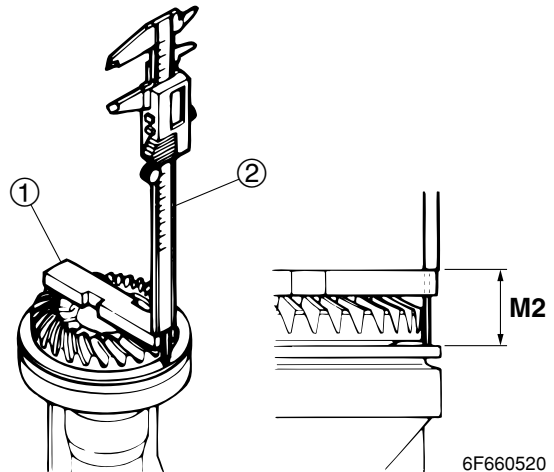
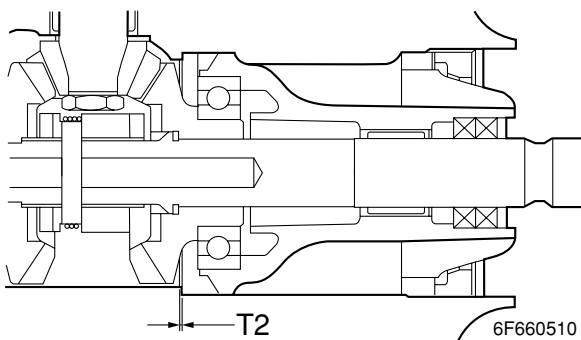
Available shim thicknesses:  
0.05, 0.08, 0.12, 0.30, and 0.50 mm

Example:

If "T1" is 0.44 mm, then the forward gear shim is 0.42 mm.  
If "T1" is 0.50 mm, then the forward gear shim is 0.48 mm.

### Selecting the reverse gear shims

1. Install the ball bearing onto the propeller shaft housing.
2. Measure the bearing housing height (M2) as shown.



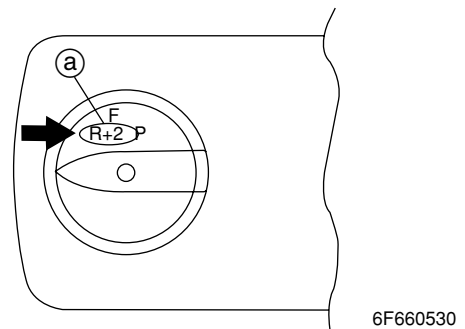
**NOTE:**

- Select the shim thickness (T2) by using the specified measurement(s) and the calculation formula.
- Measure the bearing housing at three points to find the height average.



Shimming plate ①: 90890-06701  
Digital caliper ②: 90890-06704

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



**NOTE:**

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



Calculation formula:  
Reverse gear shim thickness (T2) =  
 $M2 - 26.90 - R/100$

Example:  
If "M2" is 27.32 mm and "R" is (+5), then  
 $T2 = 27.32 \text{ mm} - 26.90 \text{ mm} - (+5)/100$   
 $= 27.32 - 26.90 + 0.05$   
 $= 0.47 \text{ mm}$

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

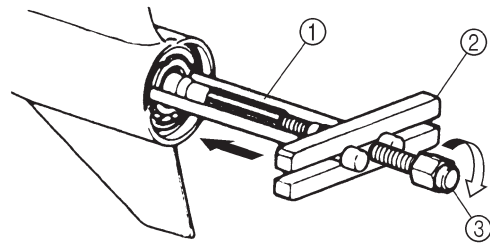
Calculated numeral at 1/100th place	Rounded numeral
1, 2	2
3, 4, 5	5
6, 7, 8	8
9, 10	10

Available shim thicknesses:  
0.05, 0.08, 0.12, 0.30, and  
0.50 mm

Example:  
If "T2" is 0.47 mm, then the reverse gear shim is 0.48 mm.  
If "T2" is 0.41 mm, then the reverse gear shim is 0.42 mm.

### Backlash Measuring the forward and reverse gear backlash

1. Remove the water pump assembly.
2. Set the gear shift to the neutral position at the lower unit.
3. Install the special service tools so that it pushes against the propeller shaft.



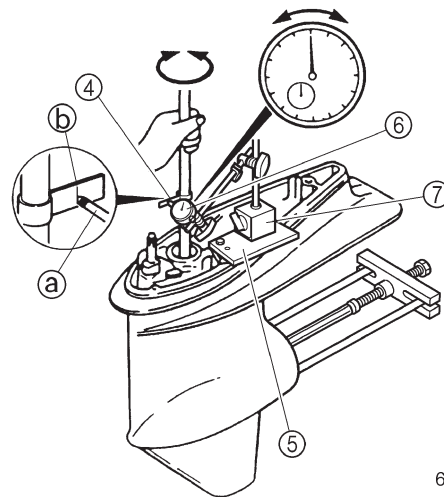
6F660540

**NOTE:** Tighten the center bolt while turning the drive shaft until the drive shaft can no longer be turned.



Bearing housing puller claw M (1):  
90890-06503  
Stopper guide plate (2):  
90890-06501  
Center bolt (3): 90890-06504

4. Install the backlash indicator onto the drive shaft (16.0 mm [0.63 in] in diameter), then the dial gauge onto the lower unit.



6F660550

**NOTE:** Install the dial gauge so that the plunger (a) contacts the mark (b) on the backlash indicator.



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



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



Forward gear backlash:  
0.19– 0.47 mm (0.0075– 0.0185 in)

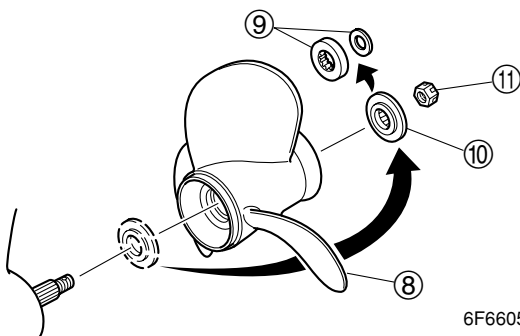
- Add or remove shim(s) if out of specification.

Forward gear backlash	Shim thickness
Less than 0.19 mm (0.0075 in)	To be decreased by $(0.33 - M) \times 0.53$
More than 0.47 mm (0.0185 in)	To be increased by $(M - 0.33) \times 0.53$

M: Measurement

Available shim thicknesses:  
0.05, 0.08, 0.12, 0.30, and  
0.50 mm

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

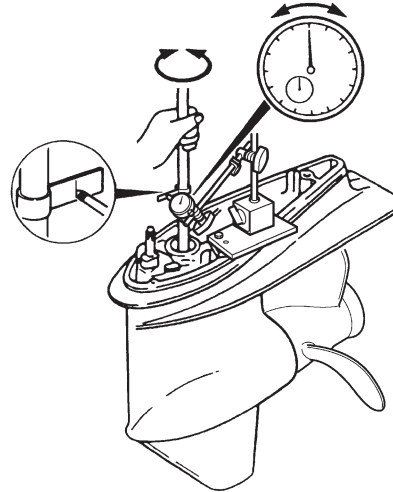


6F660560

**NOTE:**

Tighten the propeller nut ⑪ while turning the drive shaft until the drive shaft can no longer be turned.

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



6F660570



Reverse gear backlash:  
0.76– 1.04 mm  
(0.0299– 0.0409 in)

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

Reverse gear backlash	Shim thickness
Less than 0.76 mm (0.0299 in)	To be increased by $(0.9 - M) \times 0.53$
More than 1.04 mm (0.0409 in)	To be decreased by $(M - 0.9) \times 0.53$

M: Measurement

Available shim thicknesses:  
0.05, 0.08, 0.12, 0.30, and  
0.50 mm

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

## Bracket unit

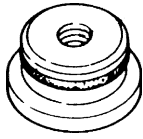
<b>Special service tools</b> .....	<b>7-1</b>
<b>Tiller handle (MH)</b> .....	<b>7-2</b>
Assembling the tiller handle .....	7-4
<b>Bottom cowling</b> .....	<b>7-5</b>
<b>Upper case, pivot shaft</b> .....	<b>7-7</b>
Disassembling the upper case .....	7-11
Checking the upper case .....	7-11
Assembling the upper case .....	7-12
Removing the pivot shaft .....	7-13
<b>Clamp brackets, swivel bracket</b> .....	<b>7-14</b>
Removing the clamp brackets .....	7-18
Disassembling the swivel bracket .....	7-18
Assembling the swivel bracket .....	7-18
Installing the clamp brackets .....	7-18
Installing the pivot shaft .....	7-19



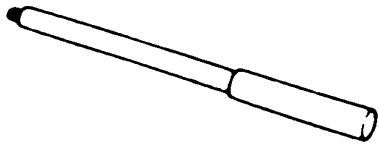
Bracket unit

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## Special service tools

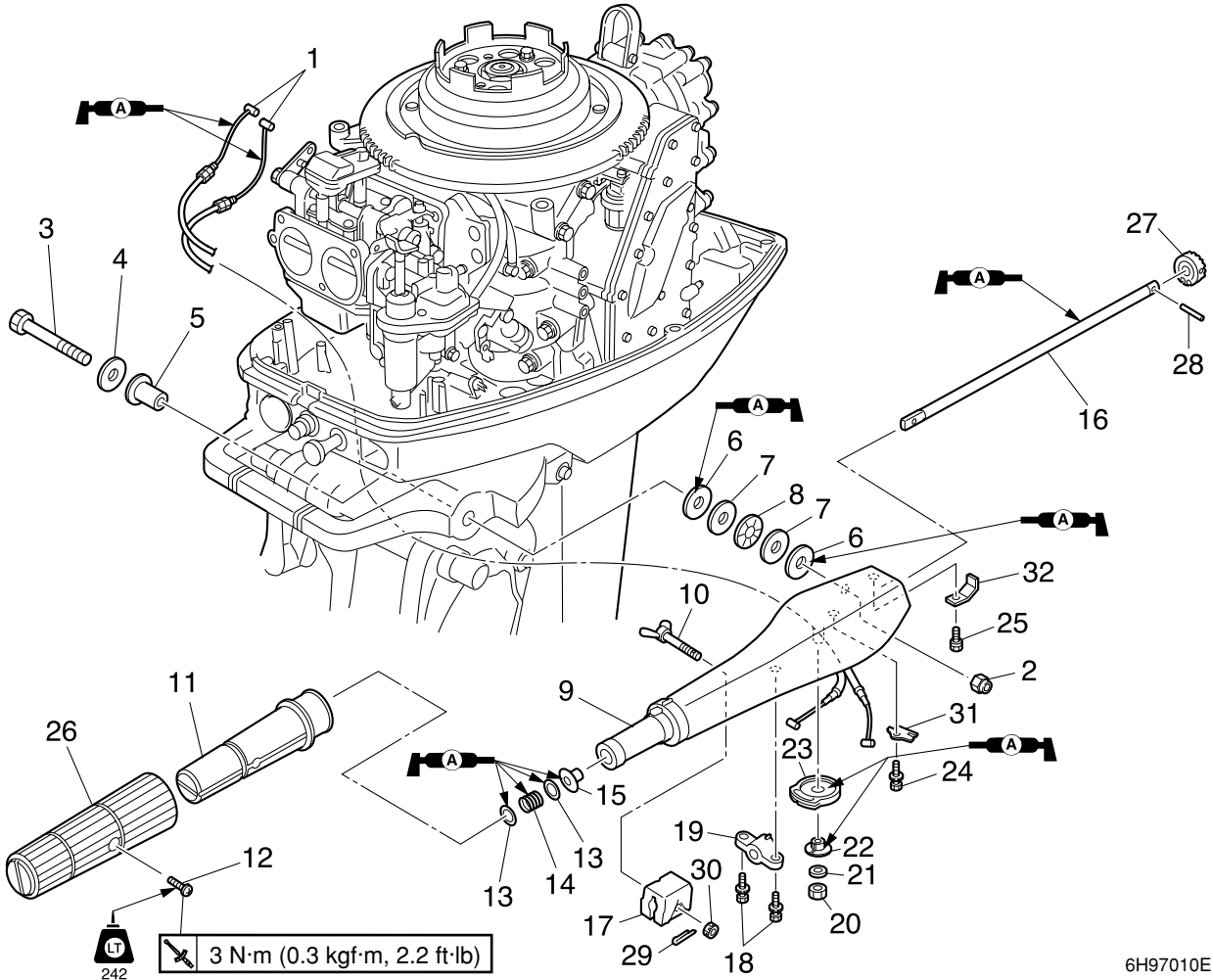


**Needle bearing attachment**  
90890-06613



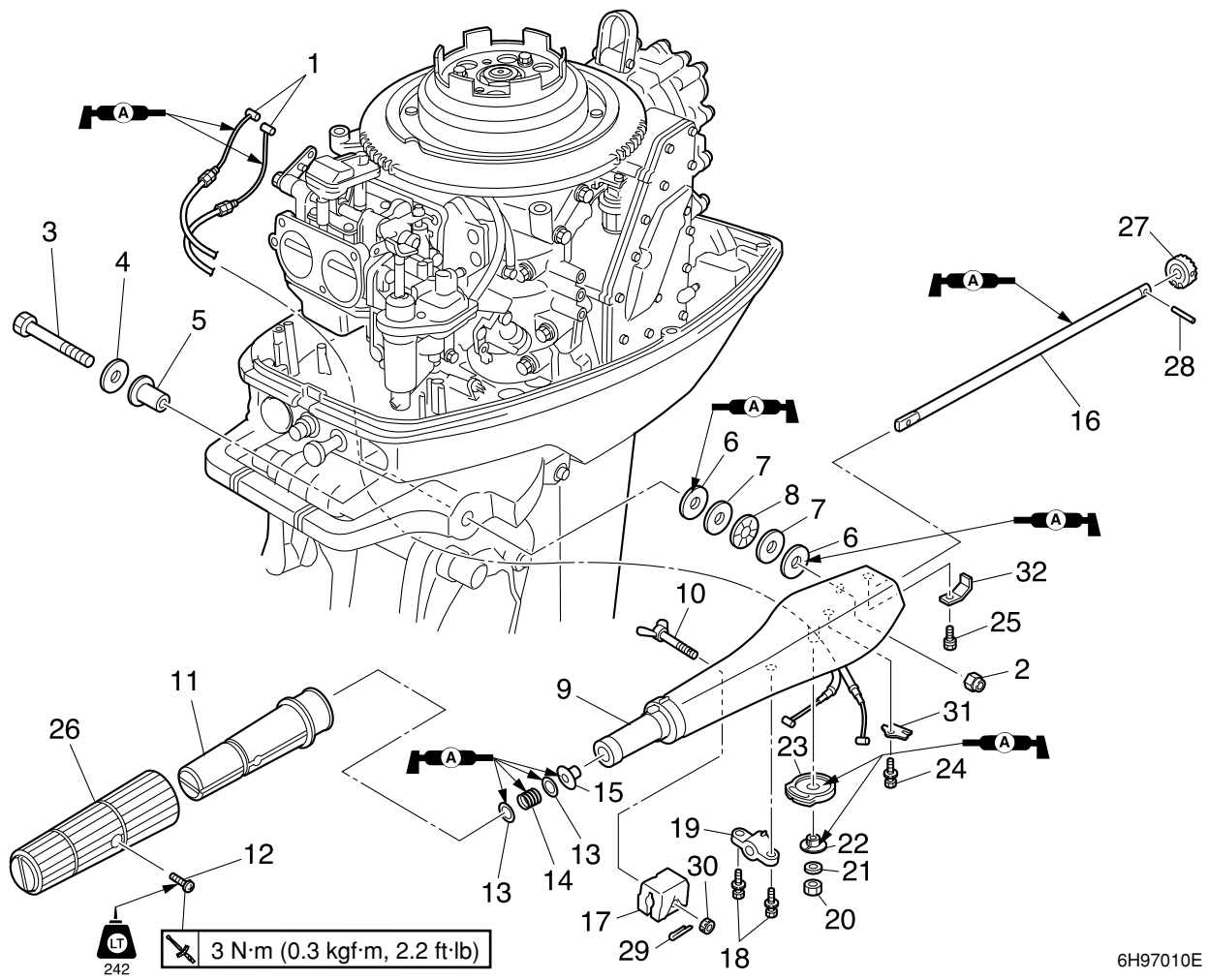
**Driver rod L3**  
90890-06652

Tiller handle (MH)



6H97010E

No.	Part name	Q'ty	Remarks
1	Throttle cable	2	
2	Self locking nut	1	
3	Bolt	1	M12 × 68 mm
4	Washer	1	
5	Collar	1	
6	Plastic washer	2	
7	Metal washer	2	
8	Wave washer	1	
9	Tiller handle bracket	1	
10	Throttle friction adjuster	1	
11	Throttle grip	1	
12	Screw	1	
13	Washer	2	
14	Spring	1	
15	Bushing	1	
16	Throttle shaft	1	
17	Friction piece	1	

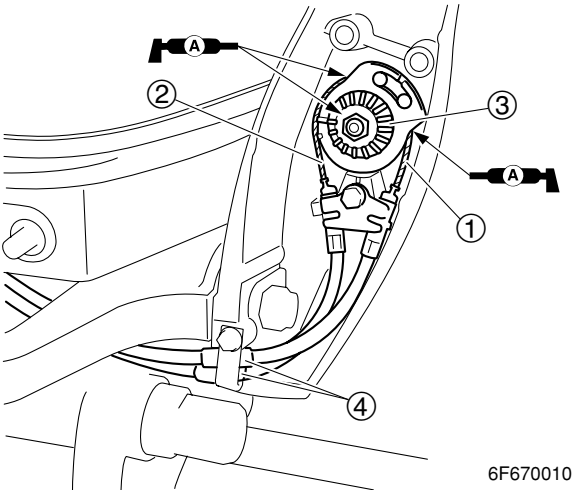


6H97010E

No.	Part name	Q'ty	Remarks
18	Bolt	2	M6 × 20 mm
19	Stay	1	
20	Nut	1	
21	Washer	1	
22	Bushing	1	
23	Pinion	1	
24	Bolt	1	M5 × 10 mm
25	Bolt	1	M5 × 10 mm
26	Rubber grip	1	
27	Pinion	1	
28	Pin	1	
29	Cotter pin	1	<b>Not reusable</b>
30	Nut	1	
31	Stay	1	
32	Wire clip	1	

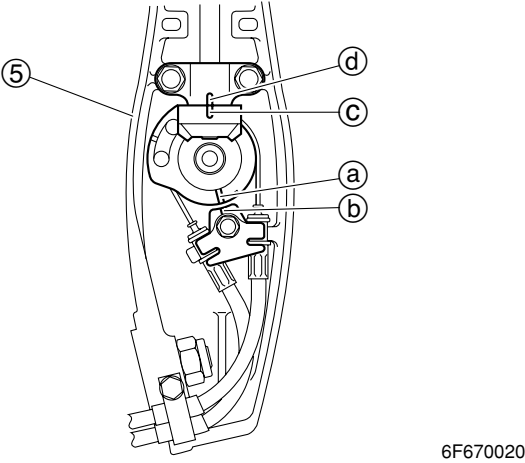
**Assembling the tiller handle**

- 1. Install the throttle cables ① and ② to the pinion ③.



**NOTE:** Route the throttle cable as shown and clamp the cable protector ④.

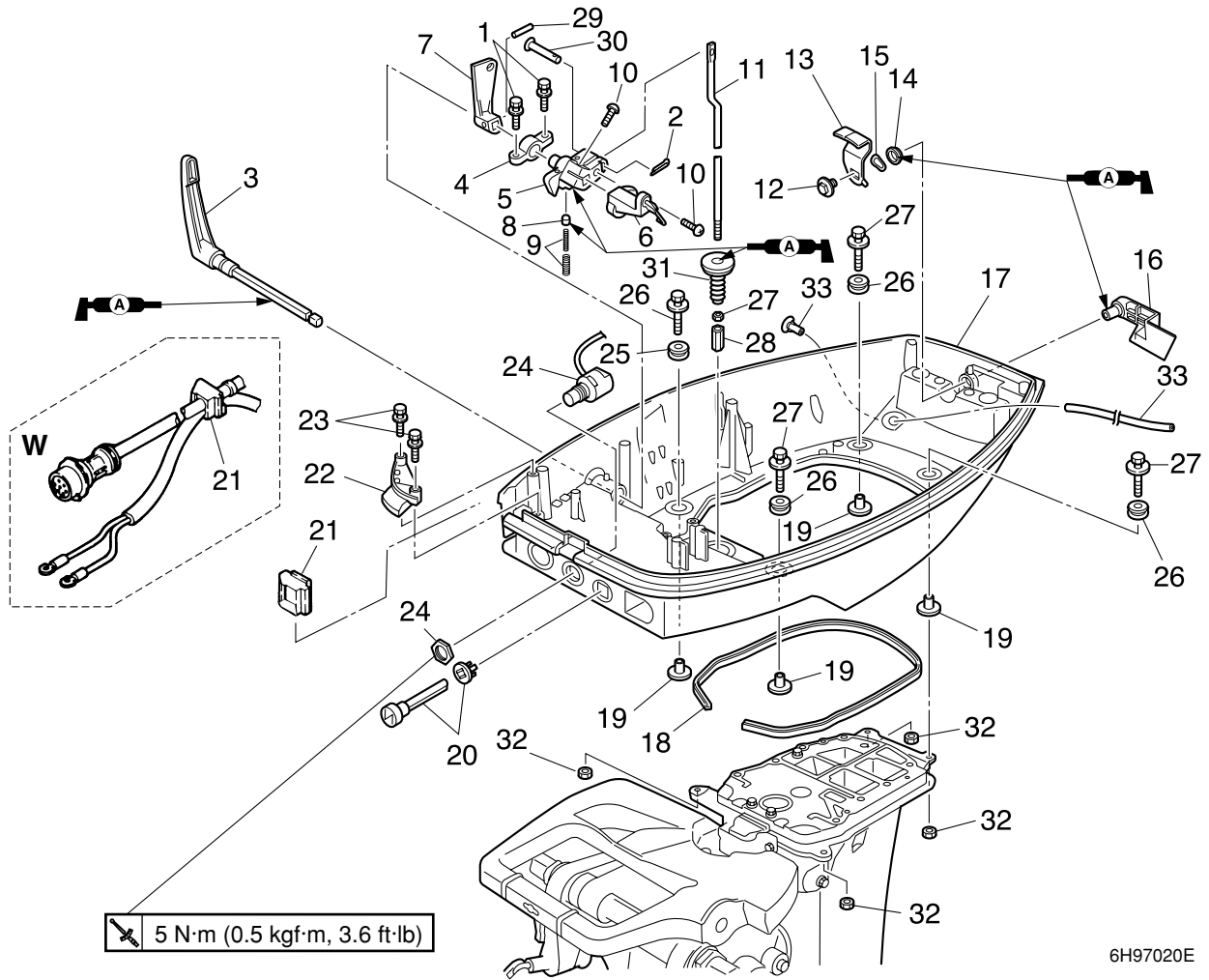
- 2. Install the throttle shaft ⑤ to the tiller handle bracket.



**NOTE:** When install the throttle shaft, align the marks on the pinion ① with tiller handle bracket ② and throttle shaft ③ with stay ④.



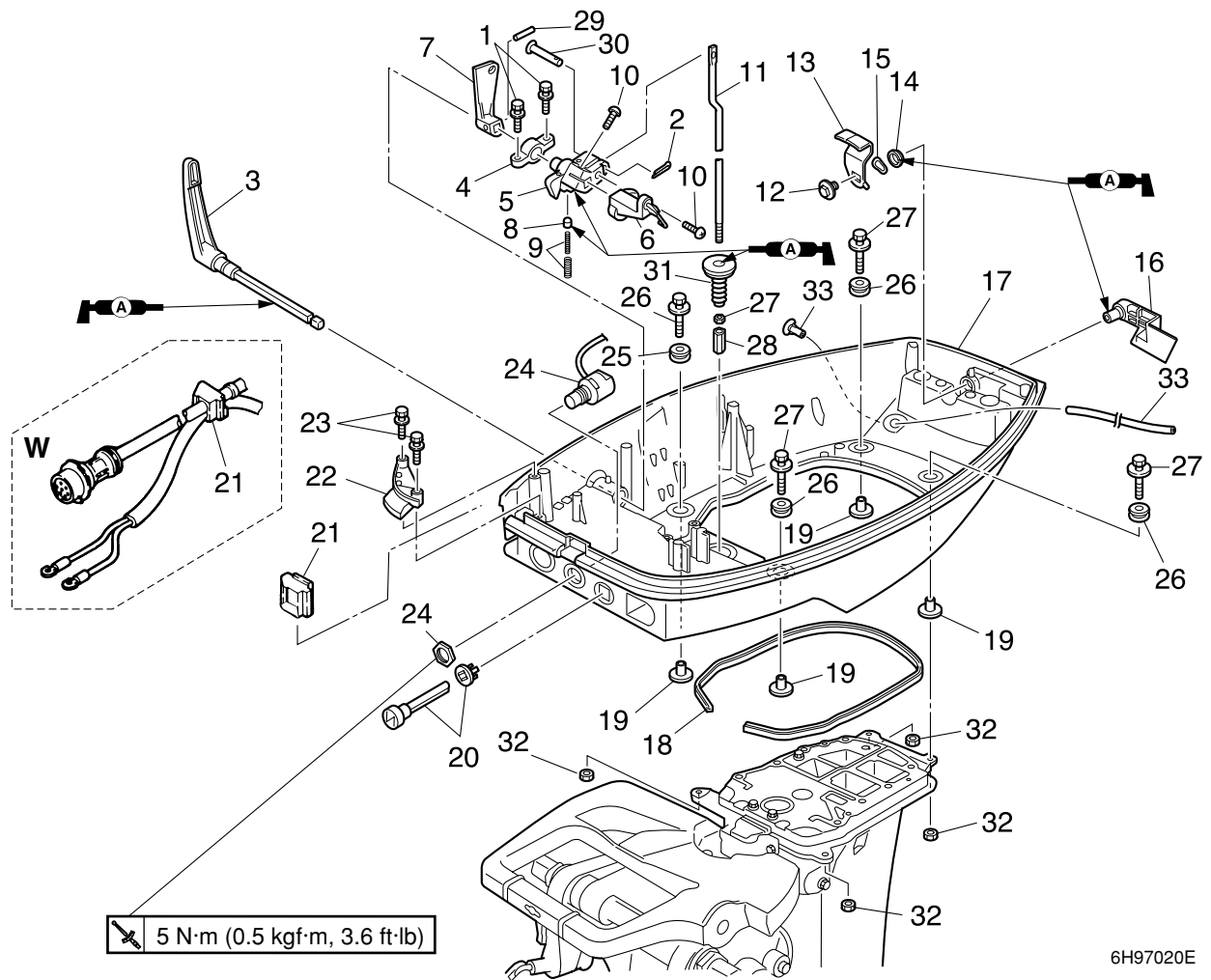
**Bottom cowling**



6H97020E

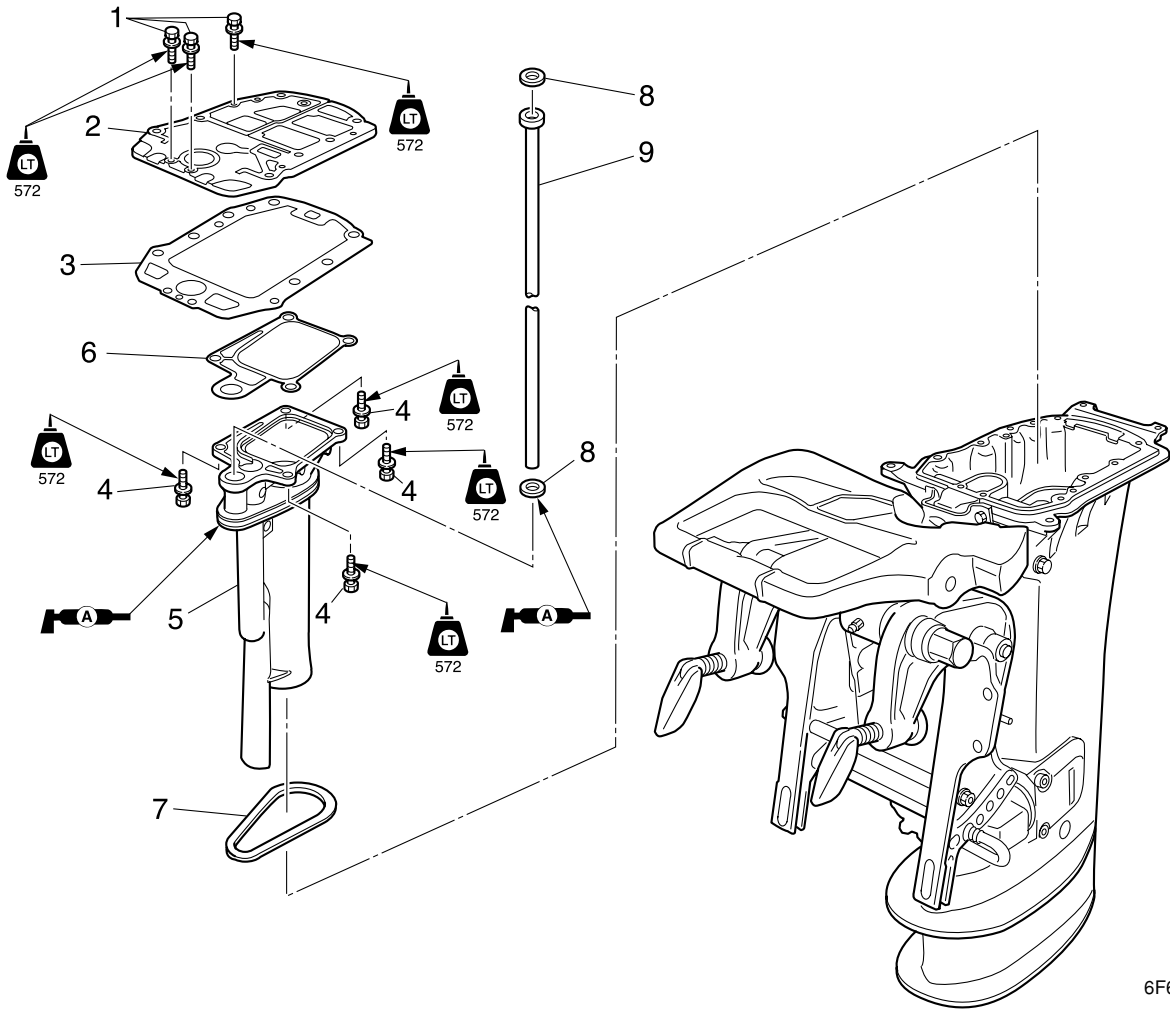
No.	Part name	Q'ty	Remarks
1	Bolt	2	M6 × 25 mm
2	Cotter pin	1	<b>Not reusable</b>
3	Shift lever	1	
4	Bracket	1	
5	Shift rod lever 1	1	
6	Shift control lever	1	
7	Shift rod lever 2	1	
8	Bushing	1	
9	Spring	2	
10	Screw	2	
11	Shift rod	1	
12	Bolt	1	M6 × 10 mm
13	Lever	1	
14	Bushing	1	
15	Wave washer	1	
16	Cowling lock lever	1	
17	Bottom cowling	1	



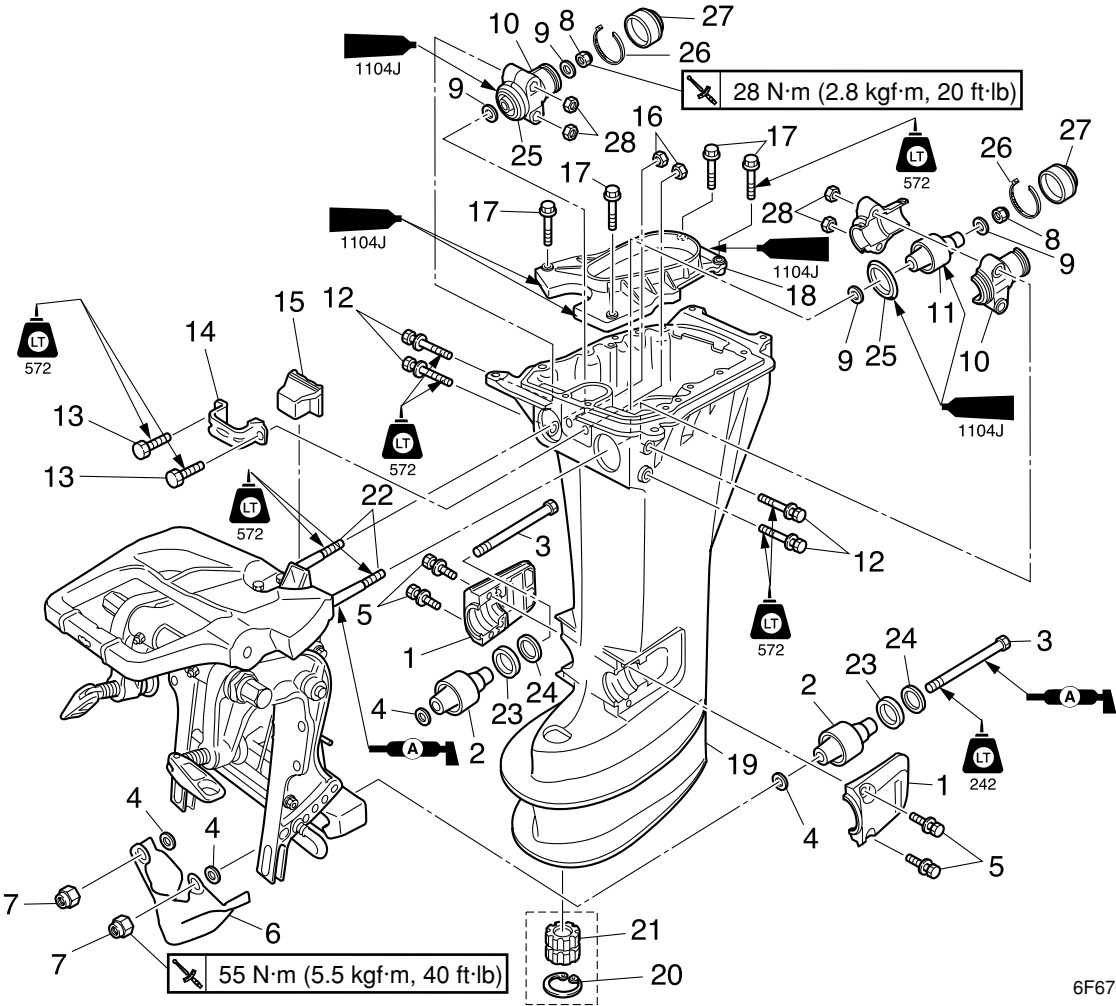


No.	Part name	Q'ty	Remarks
18	Rubber seal	1	
19	Collar	4	
20	Choke knob	1	
21	Grommet	1	
22	Retaining plate	1	
23	Bolt	2	M6 × 20 mm
24	Engine stop lanyard switch	1	MH model
25	Grommet	4	
26	Bolt	4	M6 × 30 mm
27	Locknut	1	
28	Adjusting nut	1	
29	Pin	1	
30	Shaft	1	
31	Boot	1	
32	Nut	4	
33	Hose	1	

**Upper case, pivot shaft**

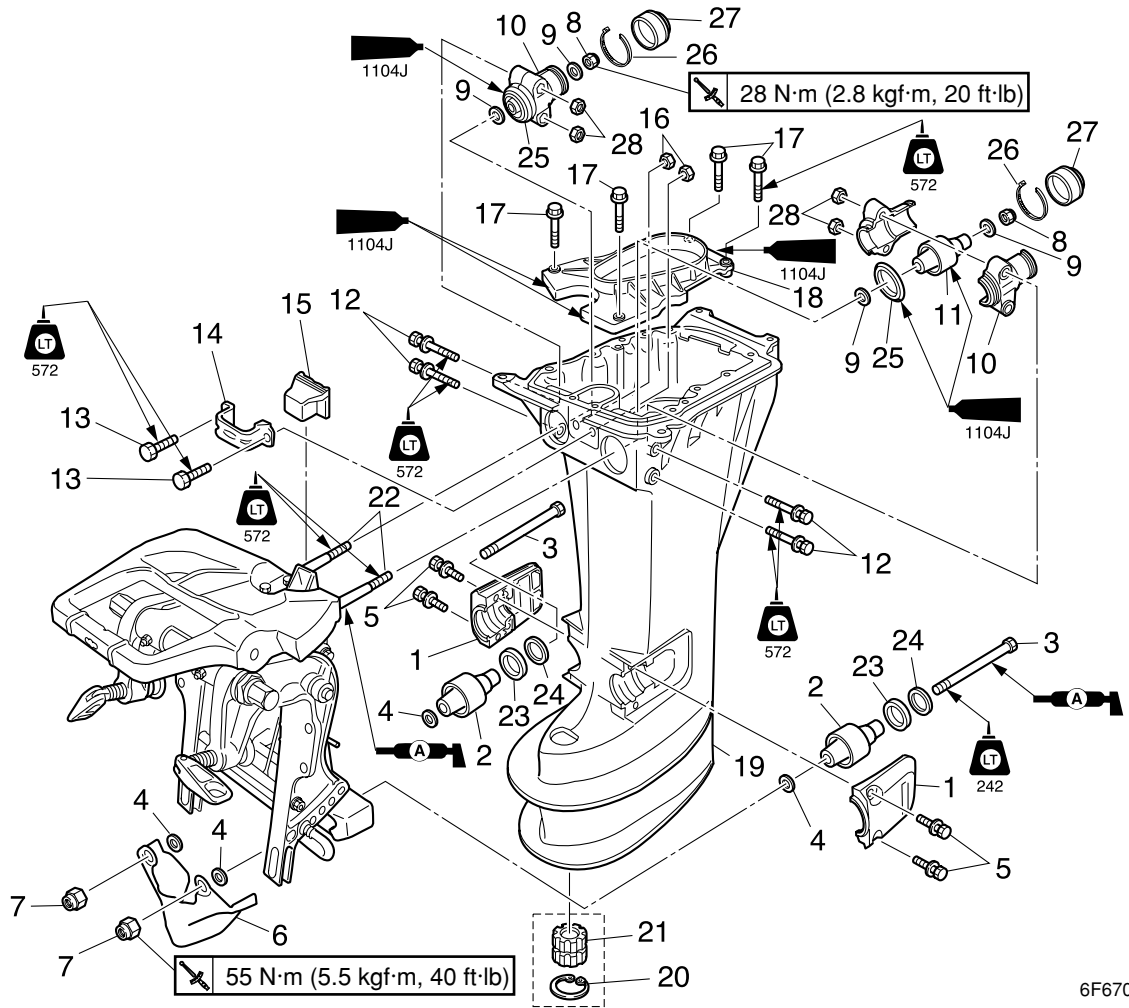


No.	Part name	Q'ty	Remarks
1	Bolt	3	M6 × 25 mm
2	Exhaust guide	1	
3	Gasket	1	<b>Not reusable</b>
4	Bolt	4	M6 × 20 mm
5	Exhaust manifold	1	
6	Gasket	1	<b>Not reusable</b>
7	Seal	1	<b>Not reusable</b>
8	Rubber seal	2	<b>Not reusable</b>
9	Pipe	1	



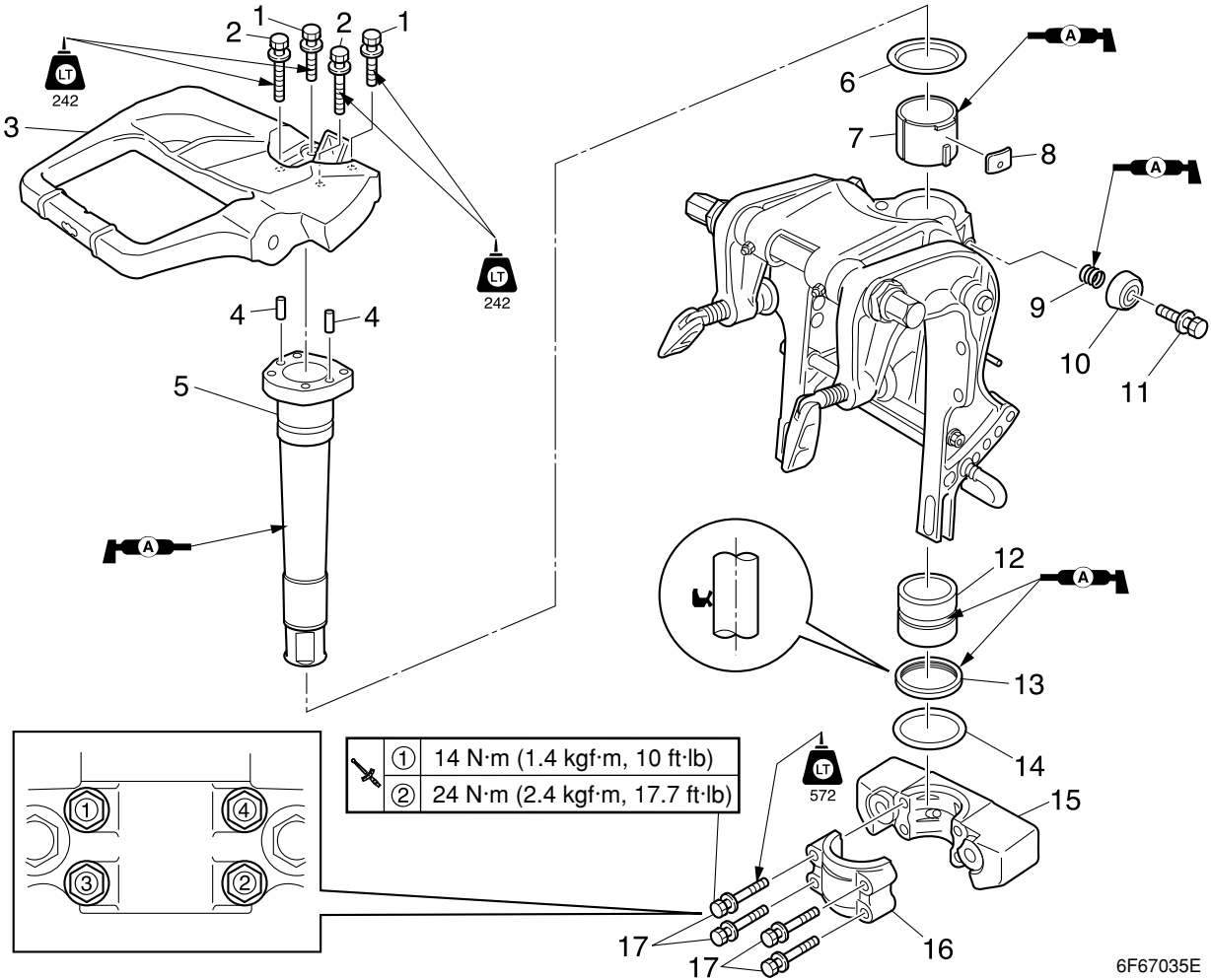
6F67030E

No.	Part name	Q'ty	Remarks
1	Cover	2	
2	Lower mount	2	
3	Bolt	2	M12 × 130 mm
4	Washer	4	
5	Bolt	4	M6 × 25 mm
6	Cover	1	
7	Nut	2	
8	Nut	2	
9	Washer	4	
10	Bracket	2	
11	Upper mount	2	
12	Bolt	4	M8 × 50 mm
13	Bolt	2	M6 × 25 mm
14	Bracket	1	
15	Damper	1	
16	Nut	2	
17	Bolt	4	M6 × 25 mm



6F67030E

No.	Part name	Q'ty	Remarks
18	Protector	1	
19	Upper case assembly	1	
20	Circlip	1	
21	Bushing	1	EK40J: L transom model
22	Bolt	2	M8 × 130 mm
23	Washer	2	
24	Washer	2	
25	Seal	2	
26	Lock tie	2	
27	Seal	2	
28	Nut	4	

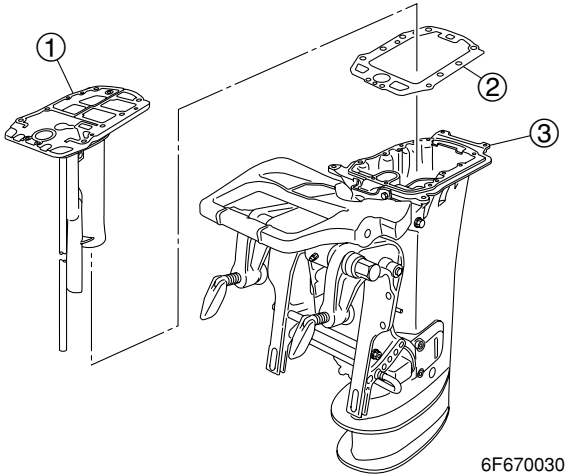


6F67035E

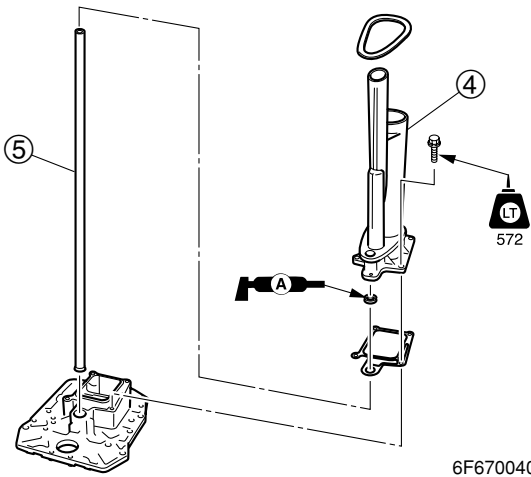
No.	Part name	Q'ty	Remarks
1	Bolt	2	M8 × 30 mm
2	Bolt	2	M8 × 35 mm
3	Steering bracket	1	
4	Dowel	2	
5	Pivot shaft	1	
6	Washer	1	
7	Bushing	1	
8	Straight key	1	
9	Spring	1	
10	Rubber seal	1	
11	Bolt	1	M8 × 25 mm
12	Bushing	1	
13	Oil seal	1	<b>Not reusable</b>
14	Washer	1	
15	Mount housing	1	
16	Clamp	1	
17	Bolt	4	M8 × 45 mm

**Disassembling the upper case**

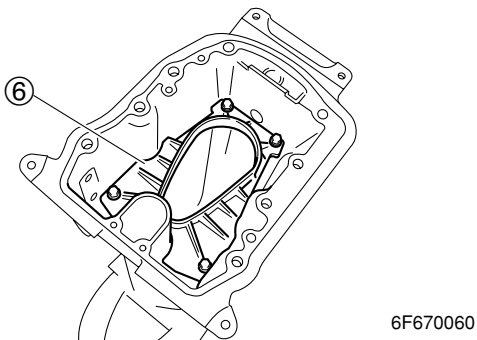
1. Remove the muffler assembly ① and gasket ② from the upper case ③.



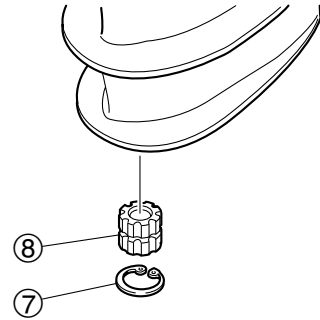
2. Remove the exhaust manifold ④ and cooling water pipe ⑤.



3. Remove the nuts and upper mount, and then remove the protector ⑥ from the upper case.



4. Remove the circlip ⑦ and the drive shaft bushing ⑧ from the upper case. (EK40J: L transom model)

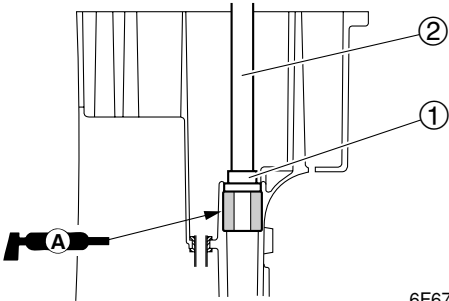


**Checking the upper case**


1. Check the drive shaft bushing for wear or cracks. Replace if necessary.
2. Check the cooling water pipe for deformation or corrosion. Replace if necessary.
3. Check the exhaust guide and exhaust manifold for damage or corrosion. Replace if necessary.

**Assembling the upper case**

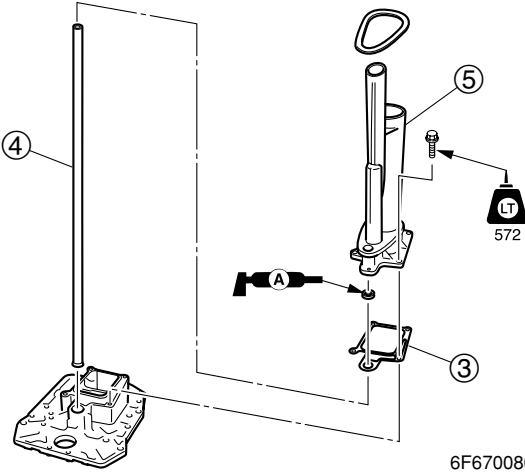
1. Install the drive shaft bushing and the circlip to the upper case. (EK40J: L transom model)



6F670070

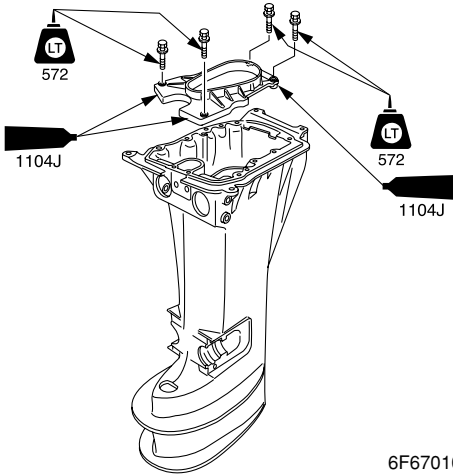
	Needle bearing attachment ① : 90890-06613
	Driver rod L3 ② : 90890-06652

2. Install a new gasket (3), the cooling water pipe (4), the exhaust manifold (5), and the bolts, and then tighten the bolts.



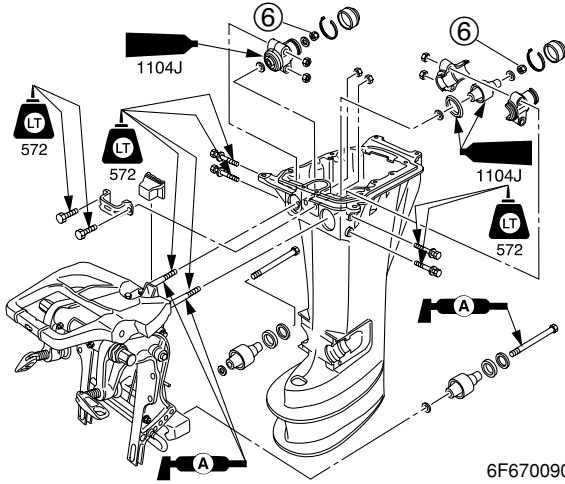
6F670080

3. Install the protector, and then install the muffler assembly into the uppercase.




6F670100

4. Install the upper mount, bolts and nuts into the upper case.

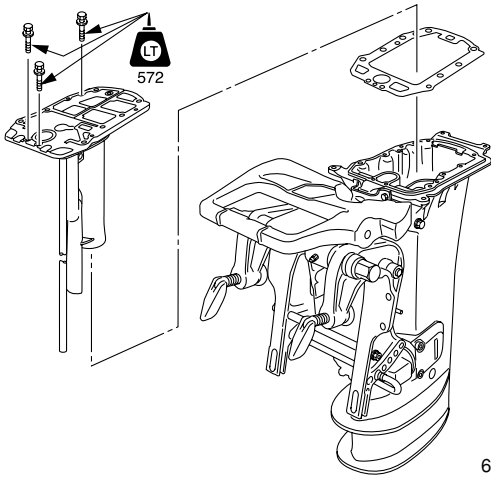


6F670090

	Upper mount nuts ⑥: 28 N·m (2.8 kgf·m, 20 ft·lb)
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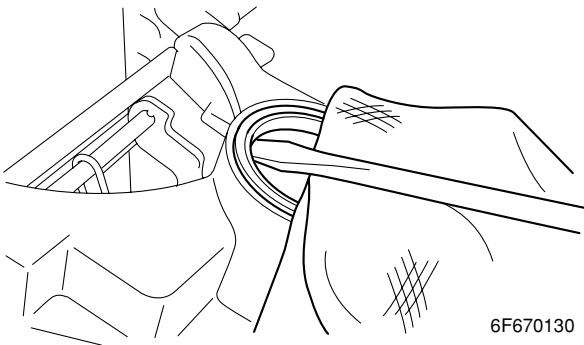
5. Install a new gasket and the muffler assembly into the upper case.



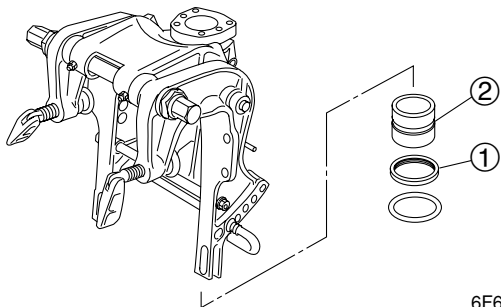
6F670035

### Removing the pivot shaft

1. Remove the pivot shaft from the swivel bracket by pulling the shaft off the bracket.
2. Remove the oil seal ① and then remove the bushing ②.



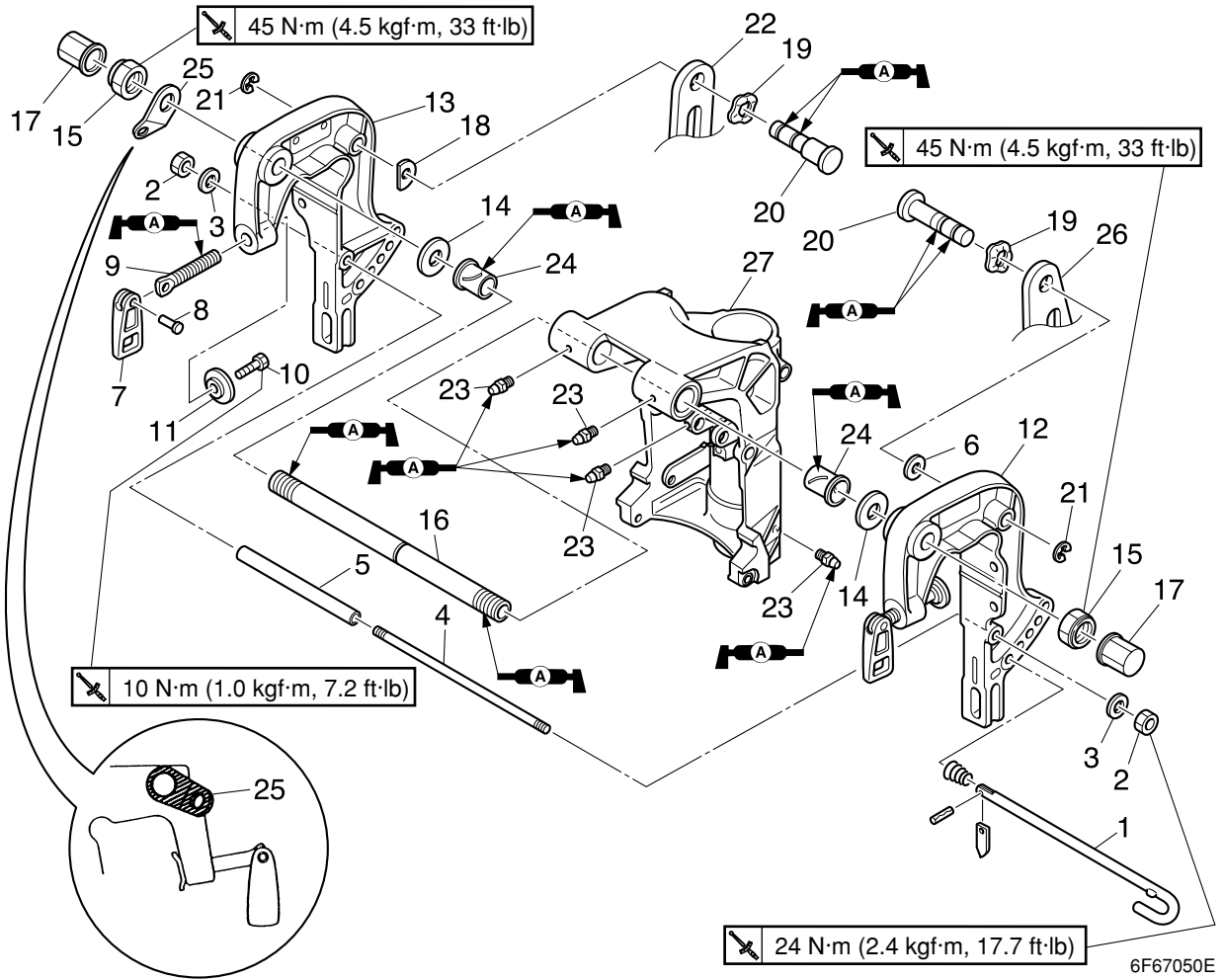
6F670130



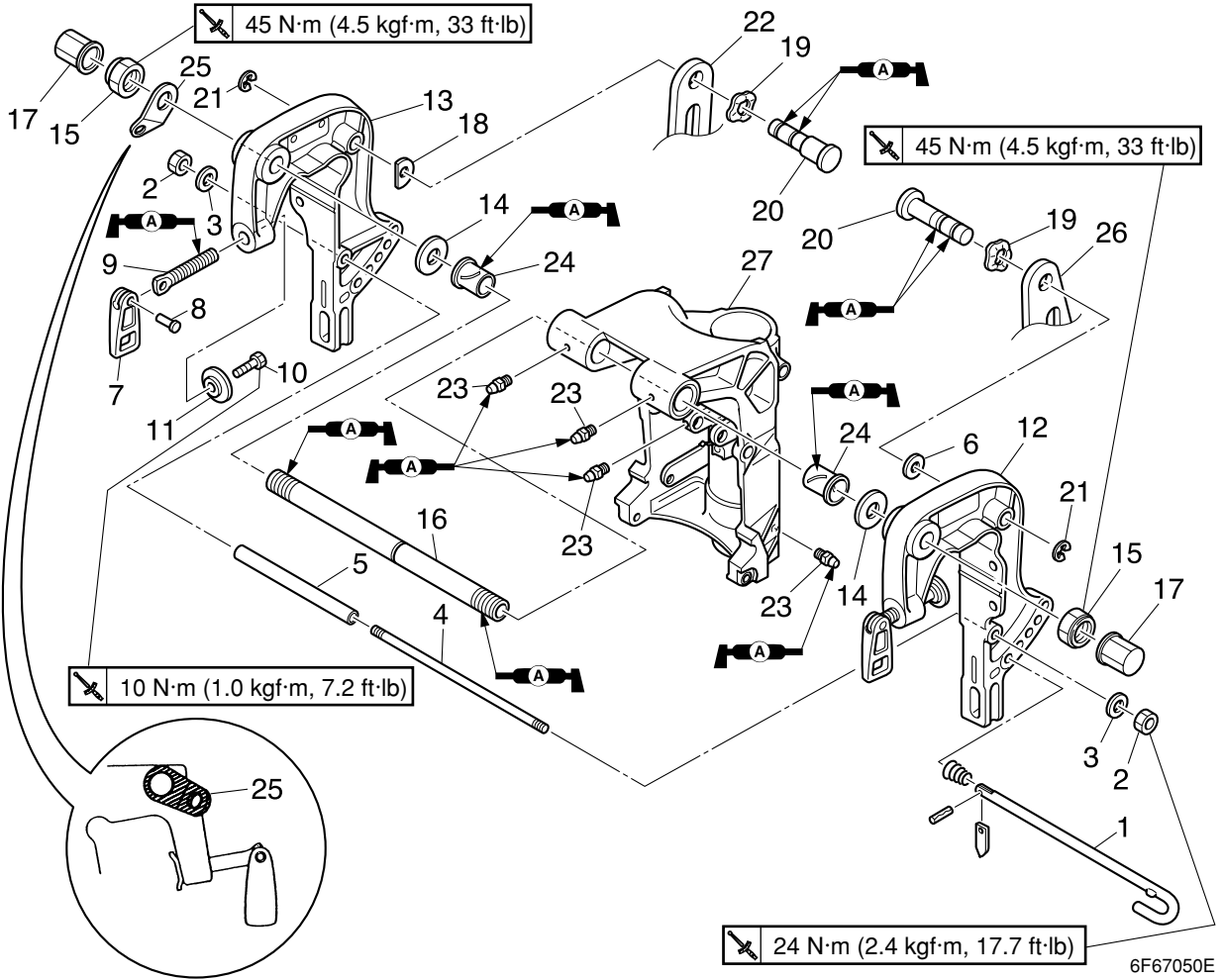
6F670135



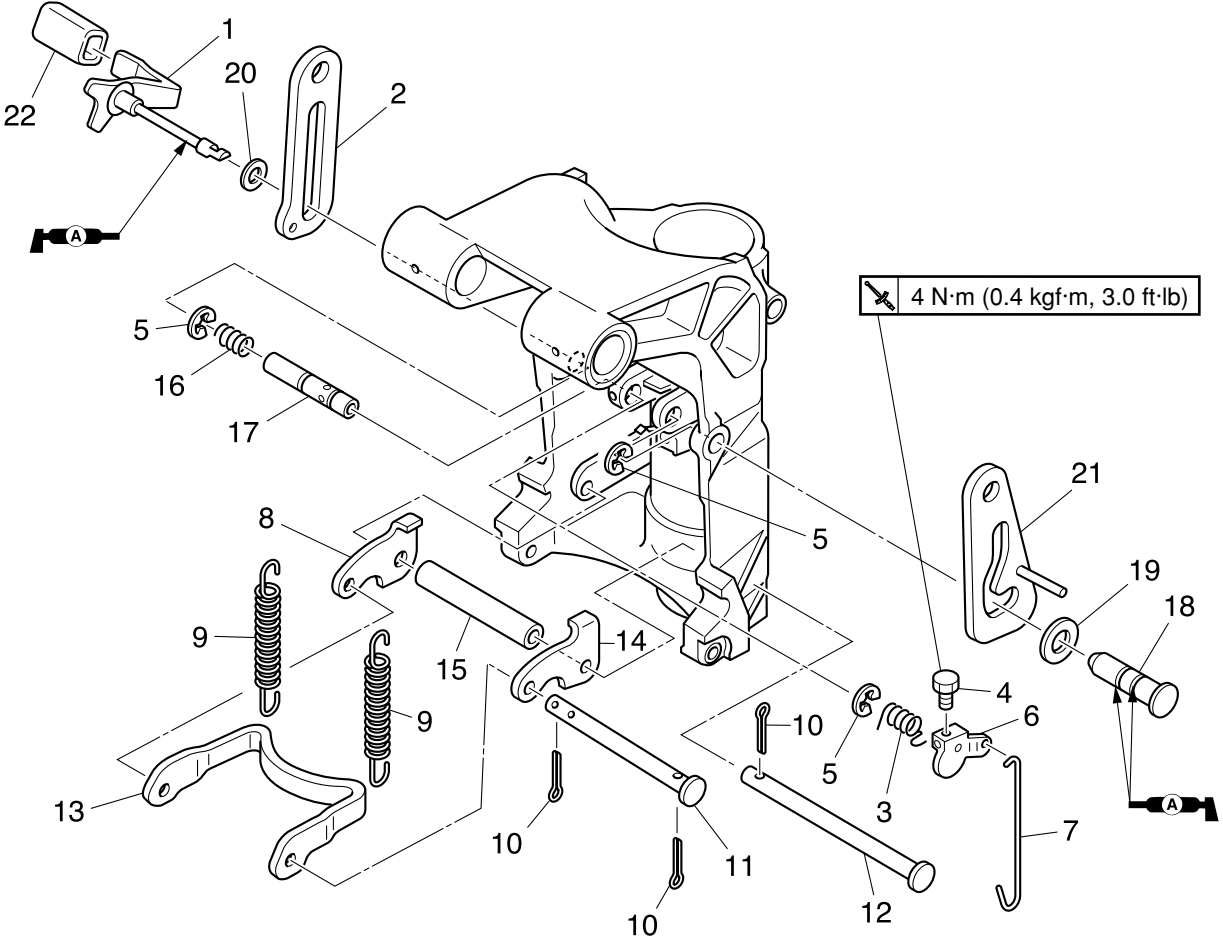
Clamp brackets, swivel bracket



No.	Part name	Q'ty	Remarks
1	Tilt pin	1	
2	Nut	2	
3	Washer	2	
4	Bolt	1	M8 × 230 mm
5	Tube	1	
6	Washer	1	
7	Clamp handle	2	
8	Pin	2	
9	Clamp screw	2	
10	Bolt	2	M6 × 12 mm
11	Clamp pad	2	
12	Clamp bracket	1	
13	Clamp bracket	1	
14	Washer	2	
15	Nut	2	
16	Through tube	1	
17	Cap	2	



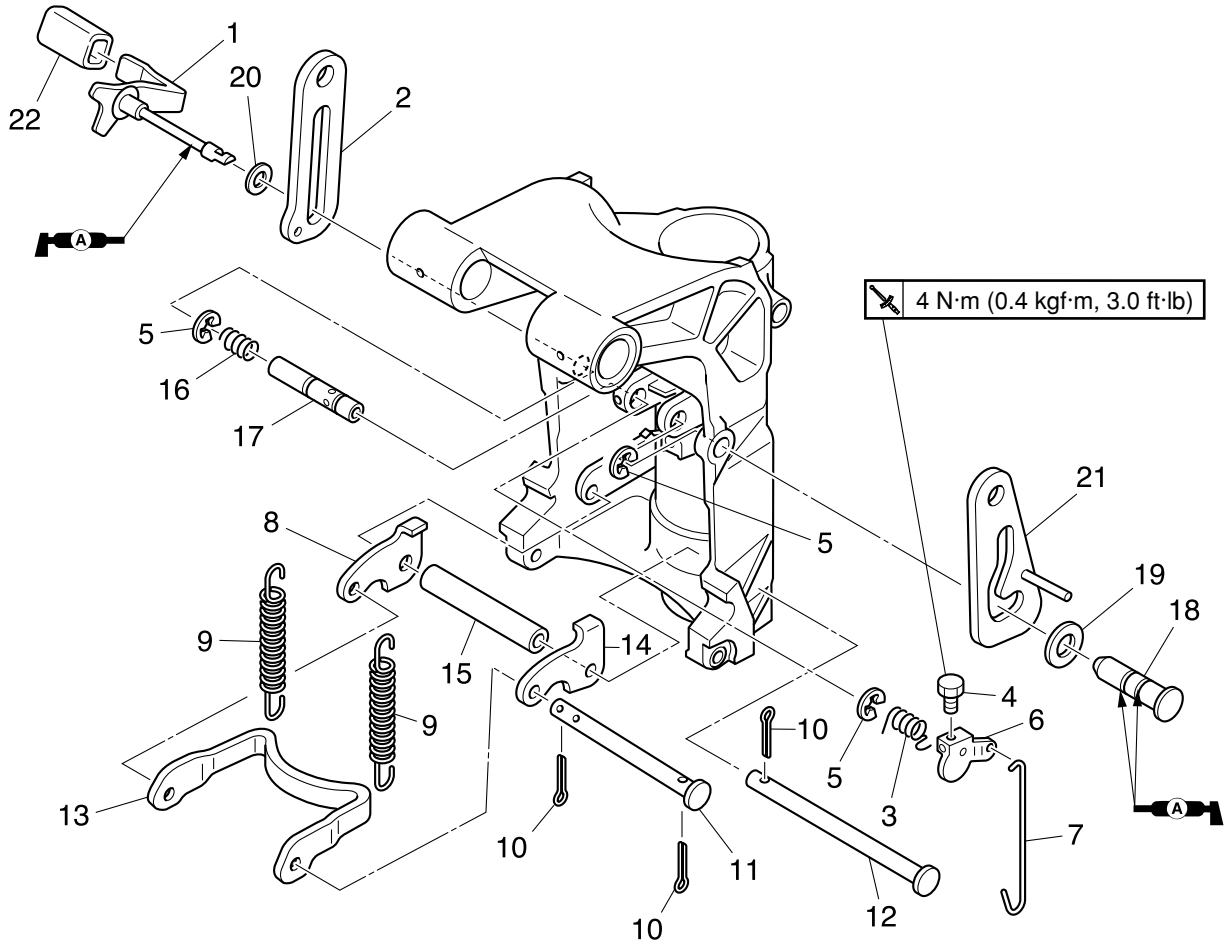
No.	Part name	Q'ty	Remarks
18	Washer	1	
19	Wave washer	2	
20	Pin	2	
21	Circlip	2	
22	Tilt stopper plate (starboard side)	1	
23	Grease nipple	4	
24	Bushing	2	
25	Plate	1	
26	Tilt stopper plate (port side)	1	
27	Swivel bracket	1	



6F67060E

No.	Part name	Q'ty	Remarks
1	Tilt lock lever	1	
2	Stopper plate (starboard side)	1	
3	Spring	1	
4	Bolt	1	M5 × 10 mm
5	Circlip	3	
6	Tilt lever	1	
7	Tilt lock rod	1	
8	Tilt lock plate	1	
9	Spring	2	
10	Cotter pin	3	
11	Pin	1	
12	Pin	1	
13	Tilt lock arm	1	
14	Tilt lock plate	1	
15	Collar	1	
16	Spring	1	
17	Stopper shaft	1	





6F67060E

No.	Part name	Q'ty	Remarks
18	Pin	1	
19	Washer	1	
20	Washer	1	
21	Stopper plate (port side)	1	
22	Cover	1	

### Removing the clamp brackets

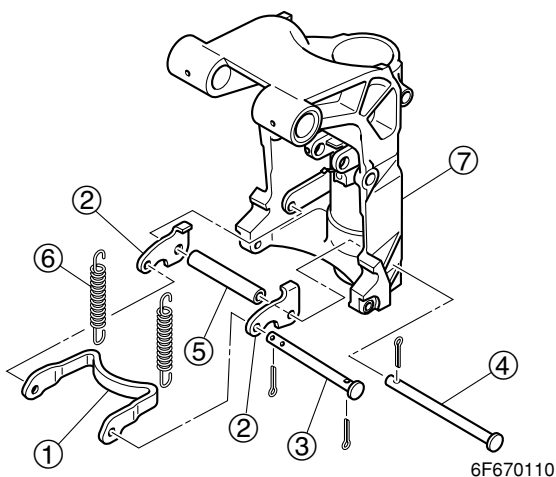
1. Remove the tilt pin, and then remove the clamp bracket bolt, clamp bracket nut and collar.
2. Remove the cap nuts, then the self-locking nuts and plate.
3. Remove the tilt both stopper plate, circlips and tilt stopper plate shafts.
4. Remove the clamp bracket bolt, then disassemble the clamp brackets.
5. Remove the pins and tilt stopper plates.

### Disassembling the swivel bracket

1. Loosen the bolts, and then remove the spring, stopper and tilt lock lever.
2. Remove the circlips, tilt lock lever, tilt lock rod and tilt lock plate.
3. Remove the bushings and collar.
4. Remove the pin 1, pin 2, collar, tilt lock plates, tilt lock arm, and springs.

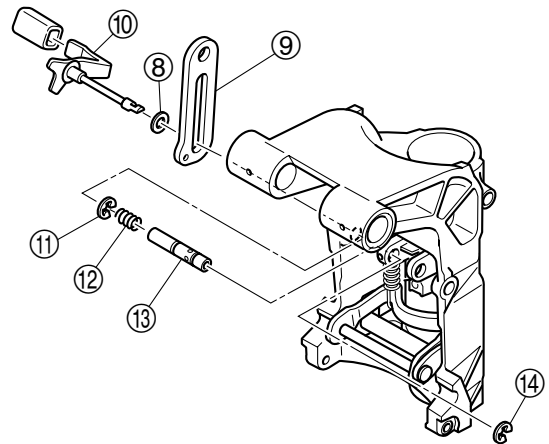
### Assembling the swivel bracket

1. Install the tilt lock arm ①, tilt lock plates ②, pin 2 ③, pin 1 ④, collar ⑤, springs ⑥ to the swivel bracket ⑦.

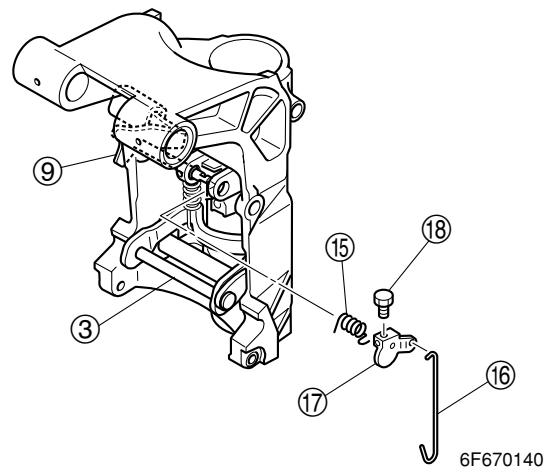


2. Install the plastic washer ⑧, tilt stopper plate ⑨ and then install the tilt lock lever ⑩ partially into the swivel bracket.


3. Install the circlip ⑪, spring ⑫ and collar ⑬, then install the circlip ⑭.



4. Install the tilt spring ⑮ and hook the tilt lock rod ⑯ onto the tilt lever ⑰ and the pin 2 ③, and then insert the tilt lever ⑰ into the tilt lock lever ⑨ completely.
5. Install the bolt ⑱ to the tilt lever ⑰.



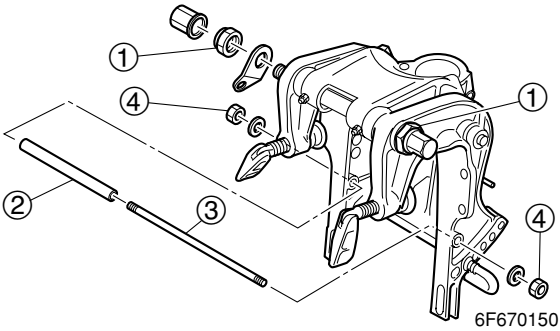
**NOTE:** \_\_\_\_\_  
After installation, check the tilt lock lever for proper operation.


	Tilt lock lever bolt ⑱ : 4 N·m (0.4 kgf·m, 3.0 ft·lb)
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### Installing the clamp brackets

1. Install the bushings, tilt stopper plates, and pins to the swivel bracket assembly.

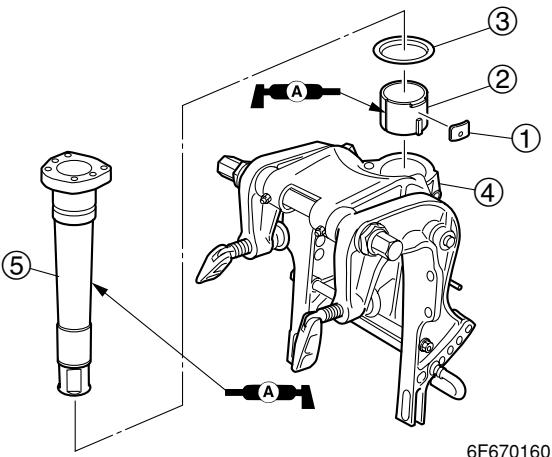
- Assemble the clamp brackets, washers, and swivel bracket, and then install the clamp bracket bolt.
- Install the plate, tighten the self-locking nuts ① to the specified torque, and then tighten the cap nuts.
- Install the tilt stopper plate bolts and circlips.
- Install the collar ②, and clamp bracket bolt ③, and then tighten the clamp bracket nuts ④ to the specified torque.



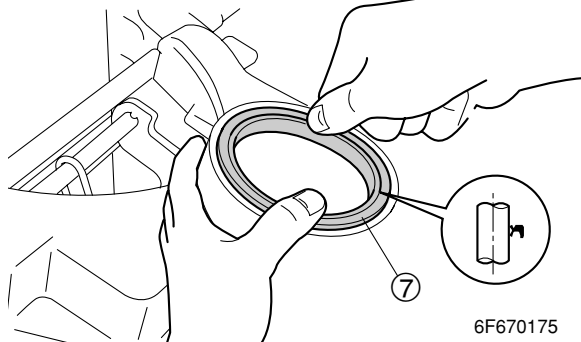
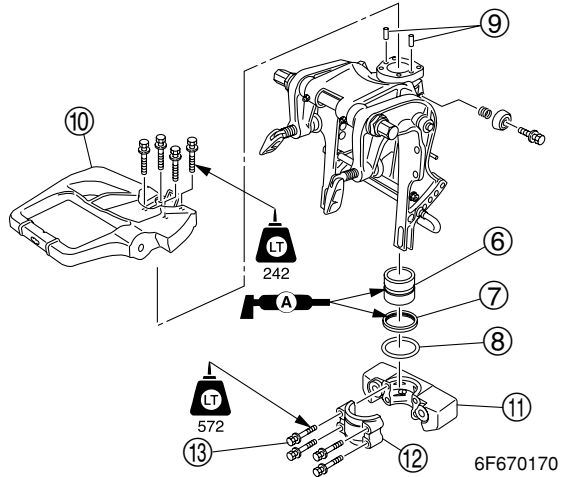
	Self-locking nut ① :
	45 N·m (4.5 kgf·m, 33 ft·lb)
	Clamp bracket nut ④:
	24 N·m (2.4 kgf·m, 17.7 ft·lb)


**Installing the pivot shaft**

- Install the straight key ①, bushing ②, and washer ③ onto the swivel bracket ④.
- Place the swivel bracket ④ in an upright position, and then install the pivot shaft ⑤ onto the swivel bracket.



- Install the bushing ⑥, a new oil seal ⑦, and the washer ⑧ onto the swivel bracket.
- Install the dowels ⑨, steering bracket ⑩, lower mount clamp ⑪ and lower mount case ⑫ onto the swivel bracket. Then tighten the bolt ⑬ to specified torque.



	Lower mount clamp bolt ⑬:
	1st:14 N·m (1.4 kgf·m, 10.4 ft·lb) 2nd:24 N·m (2.4 kgf·m, 17.7 ft·lb)

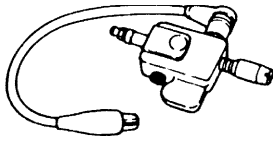
- Apply water resistant grease to the grease nipples.

**NOTE:** \_\_\_\_\_  
Apply the grease until it comes out of the bushings.  
\_\_\_\_\_

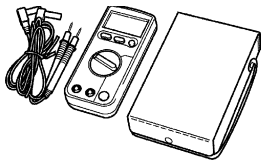
# Electrical systems

- Special service tools ..... 8-1**
  
- Checking the electrical components ..... 8-2**
  - Measuring the peak voltage ..... 8-2
  - Measuring low resistance ..... 8-2
  
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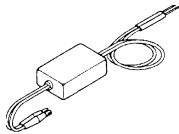
## Special service tools



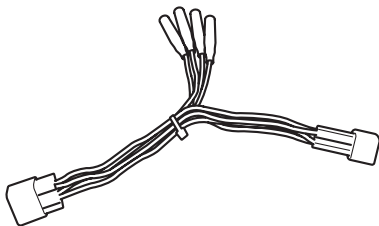
**Ignition tester**  
**90890-06754**



**Digital circuit tester**  
**90890-03174**



**Peak voltage adaptor B**  
**90890-03172**



**Test harness (4 pins)**  
**New: 90890-06871**  
**Current: 90890-06771**

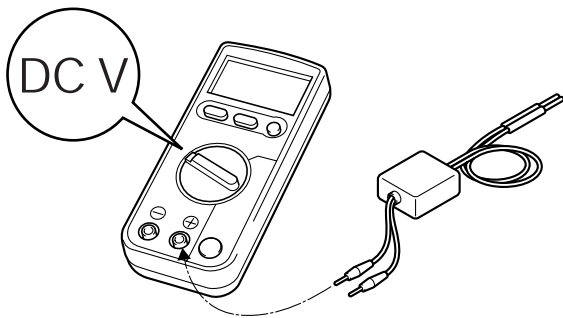


## Checking the electrical components

### Measuring the peak voltage

**NOTE:** \_\_\_\_\_  
Before troubleshooting the peak voltage, check that all electrical connections are tight and free from corrosion.

The condition of the ignition system can be determined by measuring the peak voltage. Cranking speed is affected by many factors, such as fouled or weak spark plug. If one of these factors is present, the peak voltage will be lower than specification. In addition, if the peak voltage is lower than specification the engine will not operate properly.



6B480010

### **⚠ WARNING** \_\_\_\_\_

When checking the peak voltage, do not touch any of the connections of the digital circuit tester leads.

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

- Use the peak voltage adaptor with the digital circuit tester.
- When measuring the peak voltage, set the selector on the digital circuit tester to the **DC voltage mode**.
- Connect the positive pin on the peak voltage adaptor to the positive terminal of the digital circuit tester.

### Measuring low resistance

When measuring a resistance of 10 or less with the digital circuit tester, the correct measurement cannot be obtained because of the internal resistance of the tester. To obtain the correct value, subtract the internal resistance from the displayed measurement.

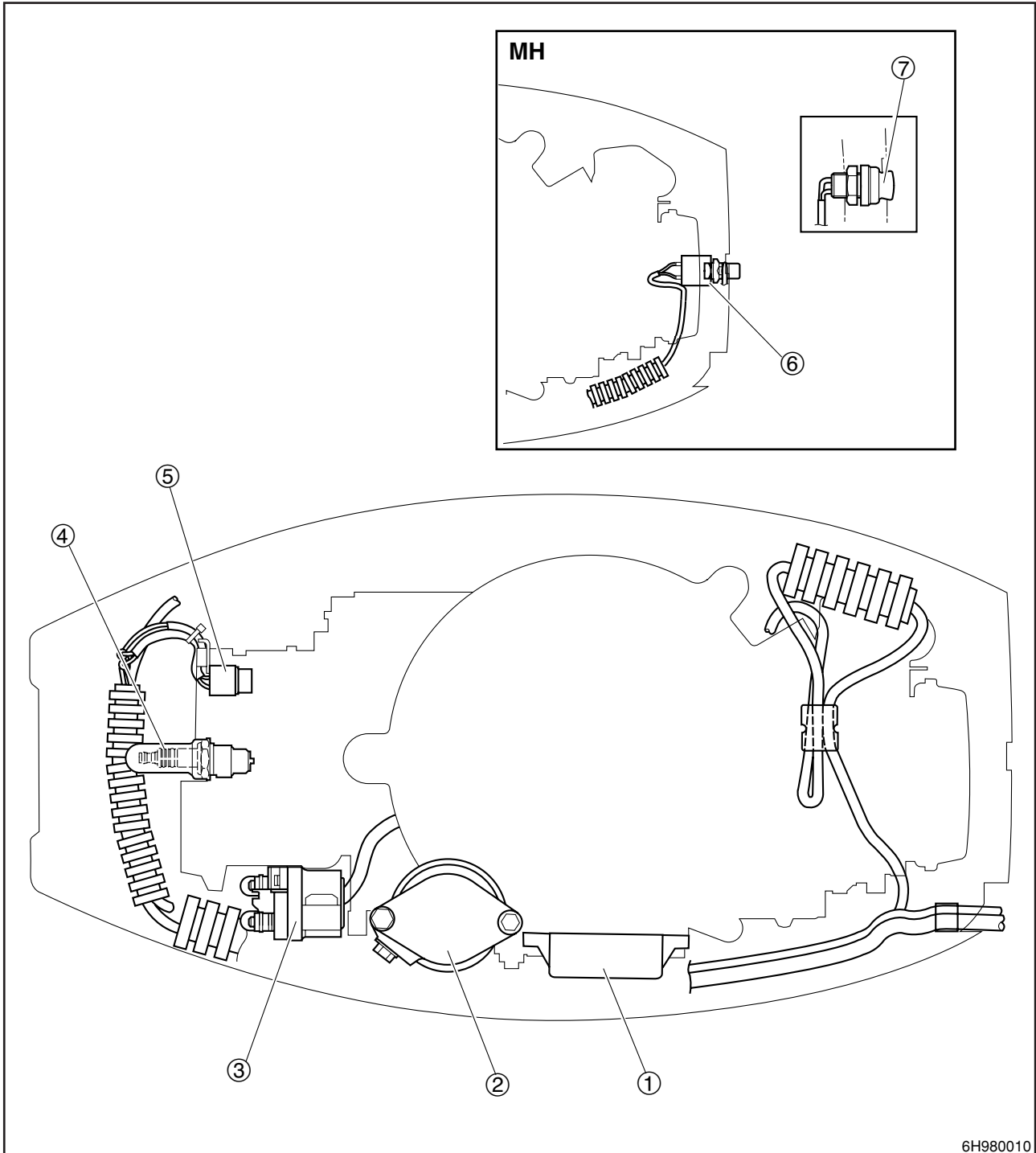
Correct value = displayed measurement - internal resistance
---

**NOTE:** \_\_\_\_\_  
Obtain the internal resistance of the digital circuit tester by connecting both of its probes and checking the display.



Electrical components

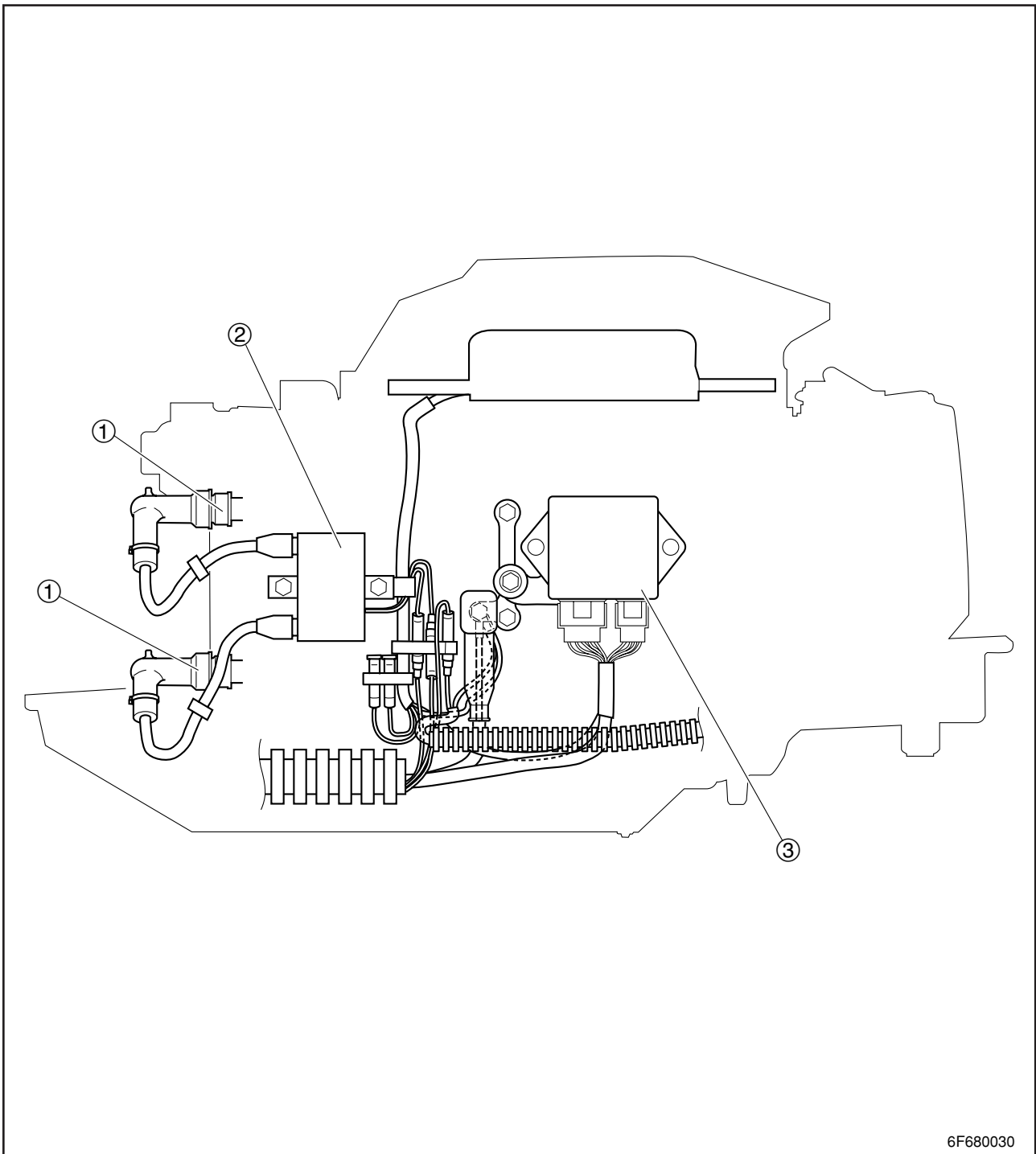
Top view



6H980010

- ① CDI unit
- ② Starter motor (W)
- ③ Starter relay (W)
- ④ Spark plug
- ⑤ Thermoswitch
- ⑥ Engine stop lanyard switch (WH)
- ⑦ Engine stop button (MH: if equipped)

Starboard view (MH)

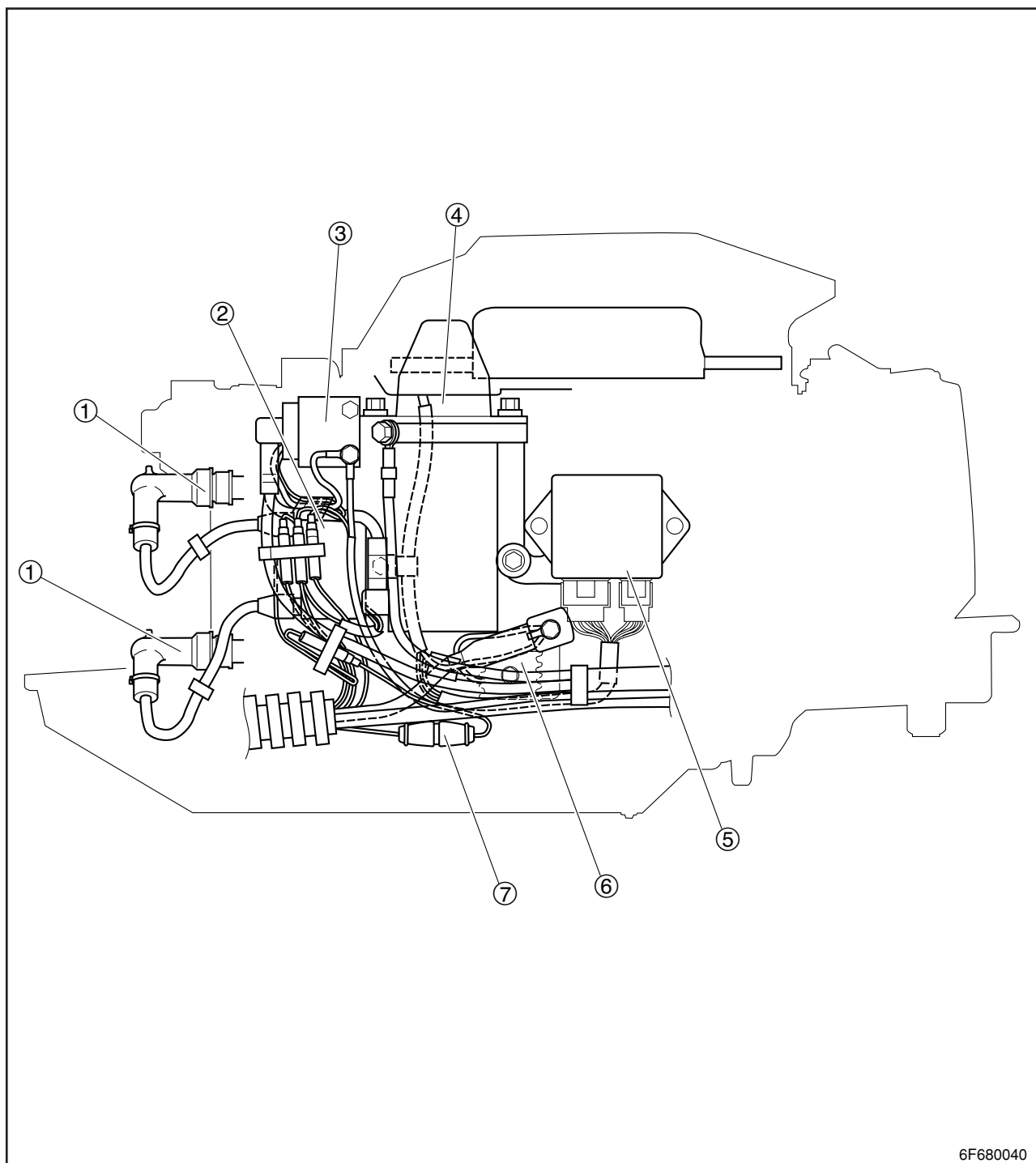


6F680030

- ① Spark plug
- ② Ignition coil
- ③ CDI unit



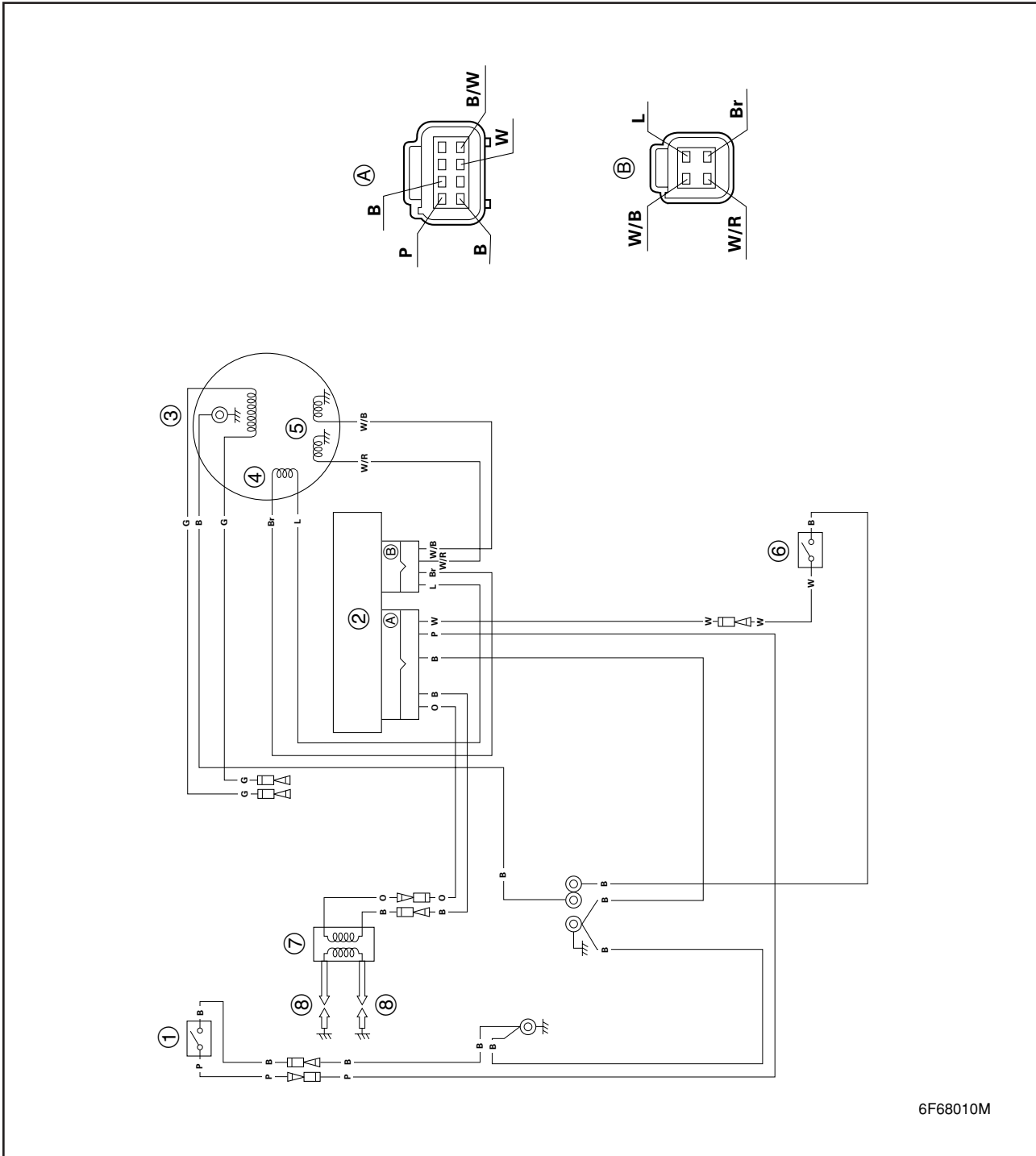
## Starboard view (W)



6F680040

- ① Spark plug
- ② Ignition coil
- ③ Starter relay
- ④ Starter motor
- ⑤ CDI unit
- ⑥ Rectifier
- ⑦ Fuse

Wiring diagram (MH)



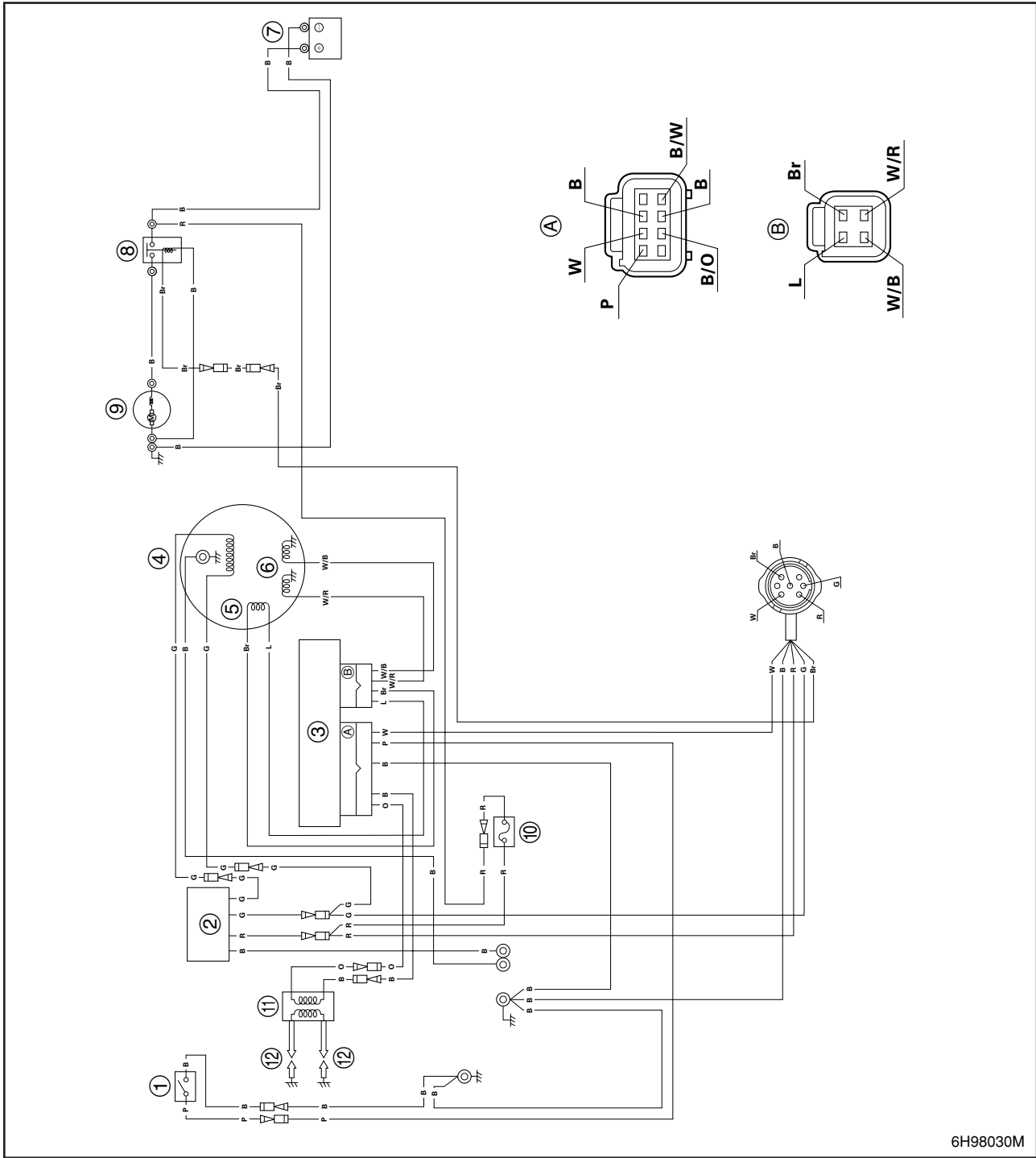
6F68010M

- ① Thermoswitch
- ② CDI unit
- ③ Lighting coil
- ④ Charge coil
- ⑤ Pulser coil
- ⑥ Engine stop lanyard switch
- ⑦ Ignition coil
- ⑧ Spark plug

- B : Black
- Br : Brown
- G : Green
- L : Blue
- O : Orange
- P : Pink
- W : White
- B/W: Black/White
- W/B: White/Black

W/R: White/Red

**Wiring diagram (W)**



6H98030M

- ① Thermoswitch
- ② Rectifier
- ③ CDI unit
- ④ Lighting coil
- ⑤ Charge coil
- ⑥ Pulser coil
- ⑦ Battery
- ⑧ Starter relay
- ⑨ Starter motor
- ⑩ Fuse

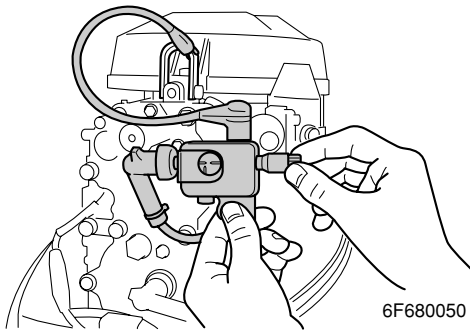
- ⑪ Ignition coil
- ⑫ Spark plug
- B : Black
- Br : Brown
- G : Green
- L : Blue
- O : Orange
- P : Pink
- W : White

- Y : Yellow
- B/W : Black/White
- W/B : White/Black
- W/R : White/Red

## Ignition and ignition control system

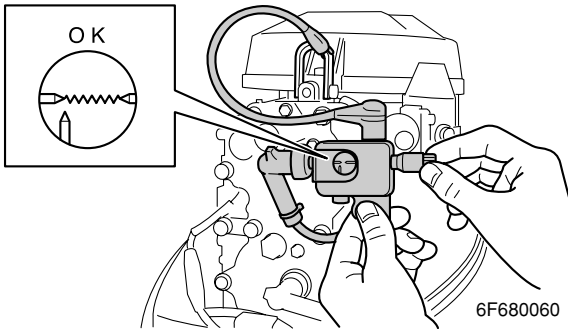
### Checking the ignition spark gap

1. Disconnect the spark plug caps from the spark plugs.
2. Connect a spark plug cap to the special service tool.



Ignition tester: 90890-06754

3. Crank the engine and observe the spark through the discharge window of the spark gap tester. Check the ignition system if the spark is weak.



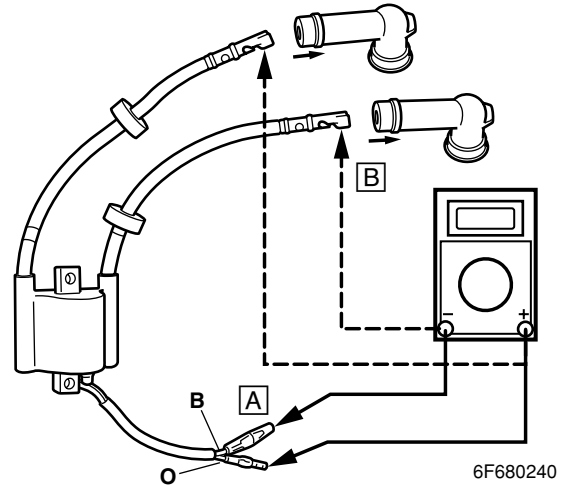
### ⚠ WARNING

- Do not touch any of the connections of the spark gap tester leads.
- Do not let sparks leak out of the removed spark plug caps.
- Keep flammable gas or liquids away, since this test can produce sparks.

### Checking the ignition coil

1. Remove the spark plug cap from the spark plug.
2. Disconnect the ignition coil connector.

3. Measure the ignition coil resistance. Replace if out of specification.



Ignition coil resistance:

**A** Primary coil:

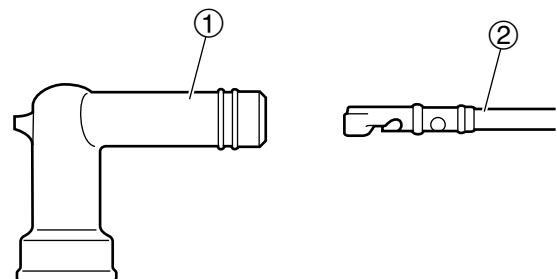
Orange (O) — Black (B)  
0.26 — 0.35Ω at 20°C (68°F)

**B** Secondary coil:

Spark plug wire —  
Spark plug wire  
6.8 — 10.2 kΩ at 20°C (68°F)

### Checking the spark plug caps

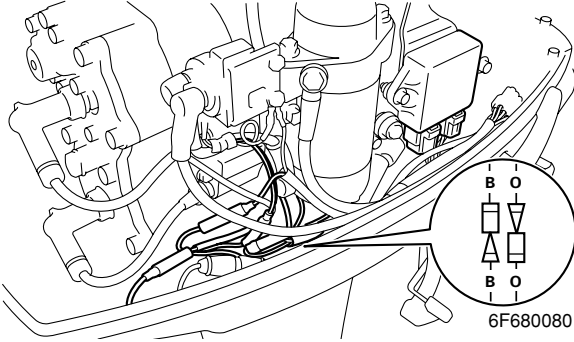
1. Check the spark plug caps for cracks or damage. Replace if necessary.
2. Remove the spark plug cap ① from the spark plug wire ②.
3. Check the spark plug wire for damage or cracks. Replace if necessary.





6B480070

**Checking the CDI unit**

1. Measure the CDI unit output peak voltage. If below specification, measure the pulser coil output peak voltage. Replace the pulser coil if the output peak voltage of the pulser coil is above specification.



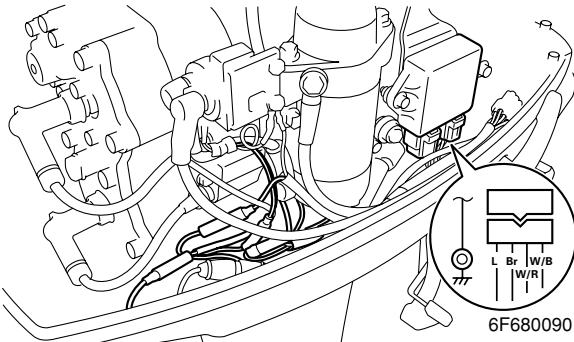
 Digital circuit tester: 90890-3174  
Peak voltage adaptor B: 90890-03172


 CDI unit output peak voltage:  
Orange (O)-ground (B)


r/min	Loaded		
	Cranking	1,500	3,500
DC V	160	185	170

**Checking the pulser coils**


1. Disconnect the CDI unit coupler.
2. Connect the test harness (4 pins) to the pulser coil.
3. Measure the pulser coil output peak voltage. Replace the pulser coil if below specification.



 Digital circuit tester: 90890-3174  
Peak voltage adaptor B: 90890-03172  
Test harness (4-pins):  
New: 90890-06871  
Current: 90890-06771

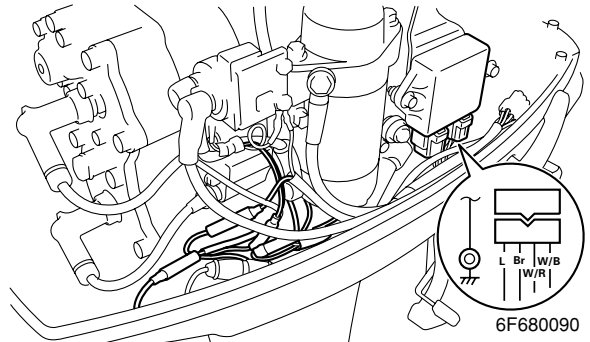
 Pulser coil output peak voltage:  
White/red (W/R) — Ground (B)  
White/Black (W/B) — Ground (B)


r/min	Unloaded	Loaded		
	Cranking	1,500	3,500	
DC V	10.0	10.0	30.0	70.0


 Pulser coil resistance  
(reference data):  
White/red (W/R) — Ground (B)  
White/Black (W/B) — Ground (B)  
16.2 — 19.8 Ω  
at 20°C (68°F)

**Checking the charge coil**


1. Disconnect the CDI unit coupler.
2. Connect the test harness (4 pins) to the charge coil.
3. Measure the charge coil output peak voltage. Replace the charge coil if below specification.



 Digital circuit tester: 90890-3174  
Peak voltage adaptor B: 90890-03172  
Test harness (4-pins):  
New: 90890-06871  
Current: 90890-06771

 Charge coil output peak voltage:  
Positive side: Brown (Br) —  
Negative side: Blue (L)

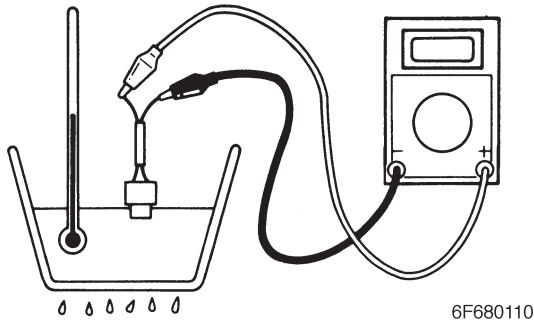
r/min	Unloaded	Loaded		
	Cranking	1,500	3,500	
DC V	150	140	190	180

 Charge coil resistance  
(reference data):  
Brown (Br) — Blue (L)  
243 — 297 Ω at 20°C (68°F)

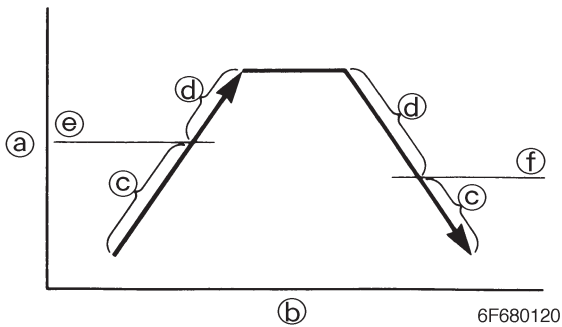


### Checking the thermostwitch

- Place the thermostwitch in a container of water and slowly heat the water.



- Check the switch for continuity at the specified temperatures. Replace if out of specification.

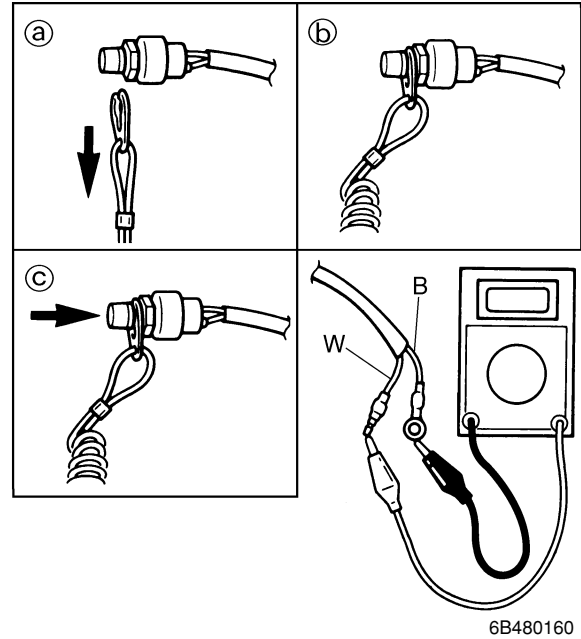


- (a) Temperature
- (b) Time
- (c) No continuity
- (d) Continuity

	Thermostwitch continuity temperature:
	Pink (P) — Black (B)
	(e): 84 — 90 °C (183 — 194°F)
	(f): 60 — 74 °C (140 — 165°F)

### Checking the engine stop lanyard switch (MH)

- Check the engine stop lanyard switch for continuity. Replace if there is no continuity.



	Switch position	Lead color	
		White (W)	Black (B)
	Clip removed (a)	○—○	○—○
	Clip installed (b)	○—○	○—○
	Engine shut-off button pushed (c)	○—○	○—○

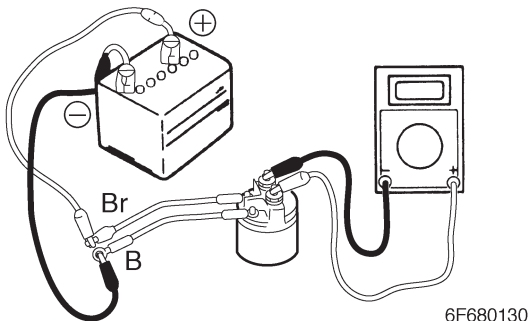
## Starting system

### Checking the fuse (W)

1. Check the fuse for continuity. Replace if there is no continuity.

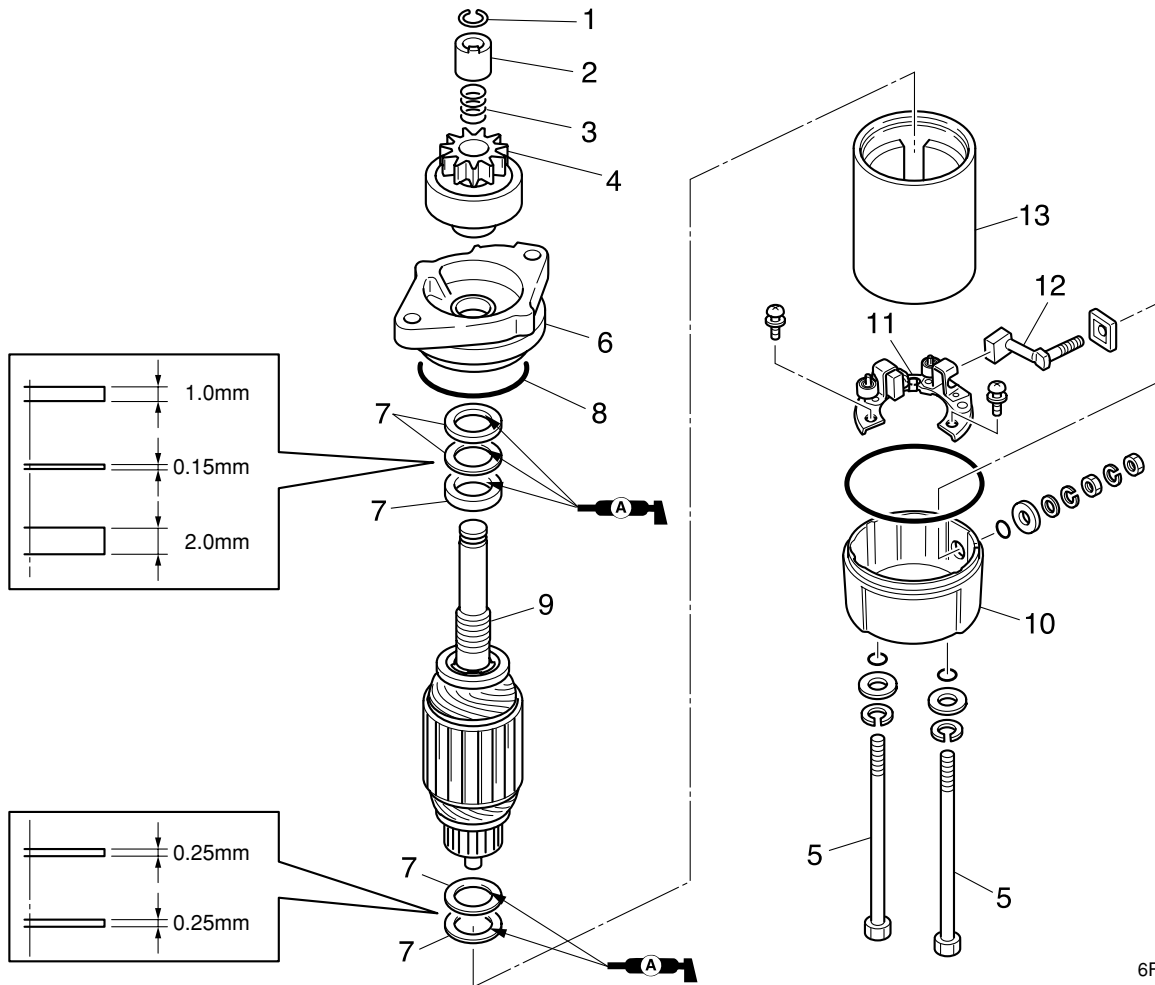
### Checking the starter relay (W)

1. Connect the digital circuit tester leads to the starter relay terminals.
2. Connect the positive battery terminal to the brown (Br) lead.
3. Connect the negative battery terminal to the black (B) lead.
4. Check for continuity between the starter relay terminals. Replace if there is no continuity.
5. Check that there is no continuity between the starter relay terminals after disconnecting a battery terminal from the brown or black lead. Replace if there is continuity.



6F680130

Starter motor (W)

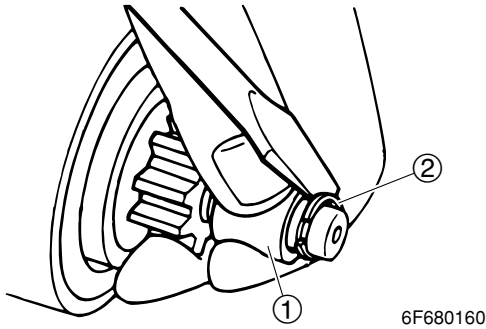


6F68010E

No.	Part name	Q'ty	Remarks
1	Clip	1	
2	Pinion stopper	1	
3	Spring	1	
4	Pinion assembly	1	
5	Bolt	2	
6	Housing	1	
7	Washer set	1	
8	O-ring	1	Not reusable
9	Armature assembly	1	
10	Bracket	1	
11	Brush holder	1	
12	Brush	2	
13	Yoke assembly	1	

**Removing the starter motor pinion**

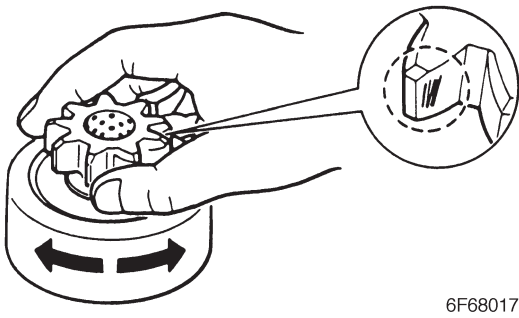
1. Slide the pinion stopper ① down as shown, and then remove the clip ②.



**NOTE:** \_\_\_\_\_  
 Remove the clip with a thin screwdriver.

**Checking the starter motor pinion**

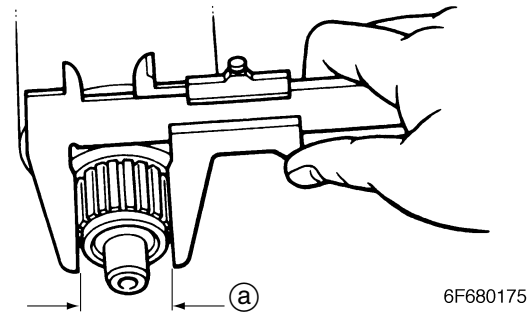
1. Check the teeth of the pinion for cracks or wear. Replace if necessary.
2. Check for smooth operation. Replace if necessary.




**NOTE:** \_\_\_\_\_  
 Turn the pinion counterclockwise to check that it operates smoothly and turn it clockwise to check that it locks in place.

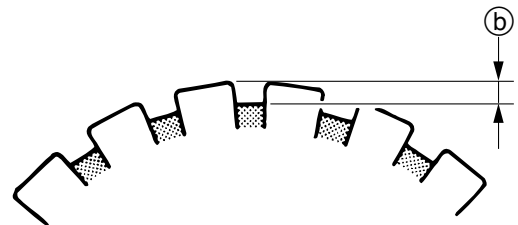
**Checking the armature**


1. Check the commutator for dirt. Clean with 600– grit sandpaper and compressed air if necessary.
2. Measure the commutator diameter ①. Replace the armature if below specification.



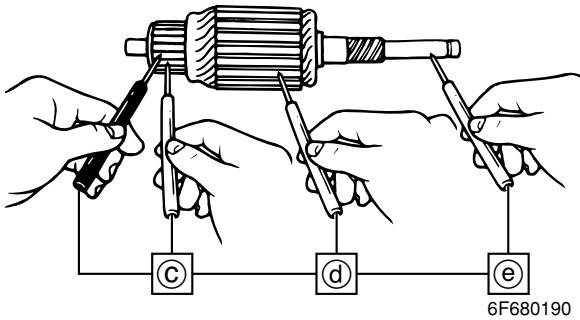
 Commutator diameter limit ①:  
 29.0 mm (1.14 in)


3. Measure the commutator undercut ②. Replace the armature if below specification.



 Commutator undercut limit ②:  
 0.2 mm (0.01 in)

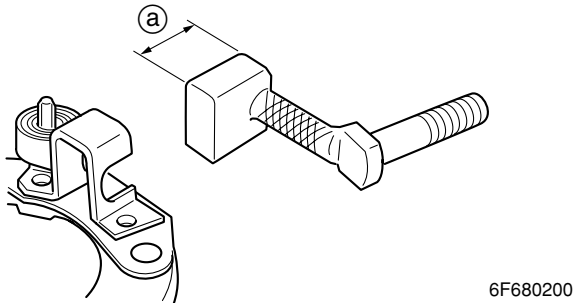
4. Check the armature for continuity. Replace if out of specifications.




 Armature continuity	
Commutator segments (c)	Continuity
Segment – Armature core (d)	No continuity
Segment – Armature shaft (e)	No continuity

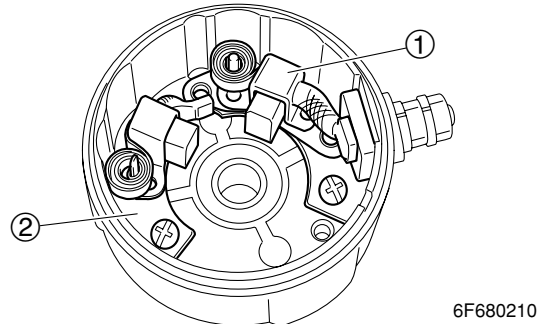
### Checking the brushes


1. Measure the brush length (a). Replace the brush assembly if below specification.



 Brush length limit (a): 9.0 mm (0.35 in)
---

2. Check the brush holder assembly for continuity. Replace if out of specifications.



 Brush continuity:	
Brush holder (1) — Brush base (2)	No continuity

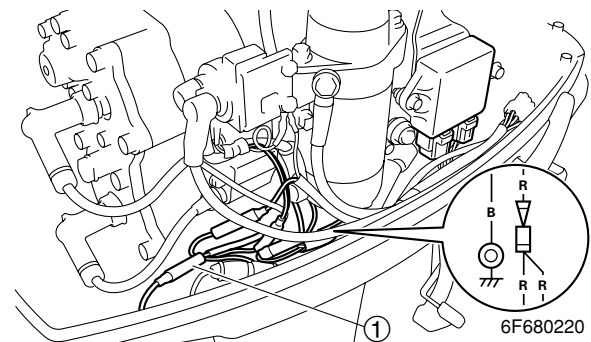
### Checking the starter motor operation

1. Check the operation of the starter motor after installing it onto the power unit.


### Charging system


#### Checking the rectifier (W)

1. Measure the rectifier output peak voltage. If below specification, measure the lighting coil output peak voltage. Replace the rectifier if the output peak voltage of the lighting coil is above specification.



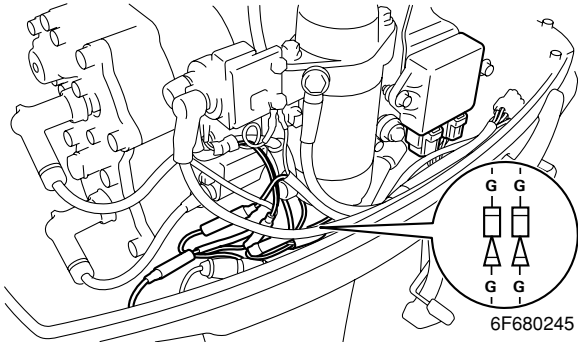
**NOTE:** \_\_\_\_\_  
After starting the engine, disconnect the output lead (red lead) (1) of the rectifier when measuring the output peak voltage.


	Digital circuit tester: 90890-3174 Peak voltage adaptor B: 90890-03172
---	--


	Rectifier output peak voltage: Red (R) — Black (B)	
r/min	Unloaded	
	1,500	3,500
DC V	13	13


**Checking the lighting coil**

1. Measure the lighting coil output peak voltage. Replace the lighting coil if below specification.



	Digital circuit tester: 90890-3174 Peak voltage adaptor B: 90890-03172
---	--

	Lighting coil output peak voltage: Green (G) – Green (G)		
r/min	Unloaded		
	Cranking	1,500	3,500
DC V	6.0	17.0	38.0

	Lighting coil resistance (reference data): Green (G) – Green (G) 0.32 – 0.39 Ω at 20°C (68°F)
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## Troubleshooting

<b>Power unit</b> .....	<b>9-1</b>
Ignition system .....	9-1
Fuel system .....	9-3
Compression pressure .....	9-4
<b>Lower unit</b> .....	<b>9-6</b>
<b>Electrical system</b> .....	<b>9-7</b>
Starting system .....	9-7
Charging system .....	9-8

**NOTE:**

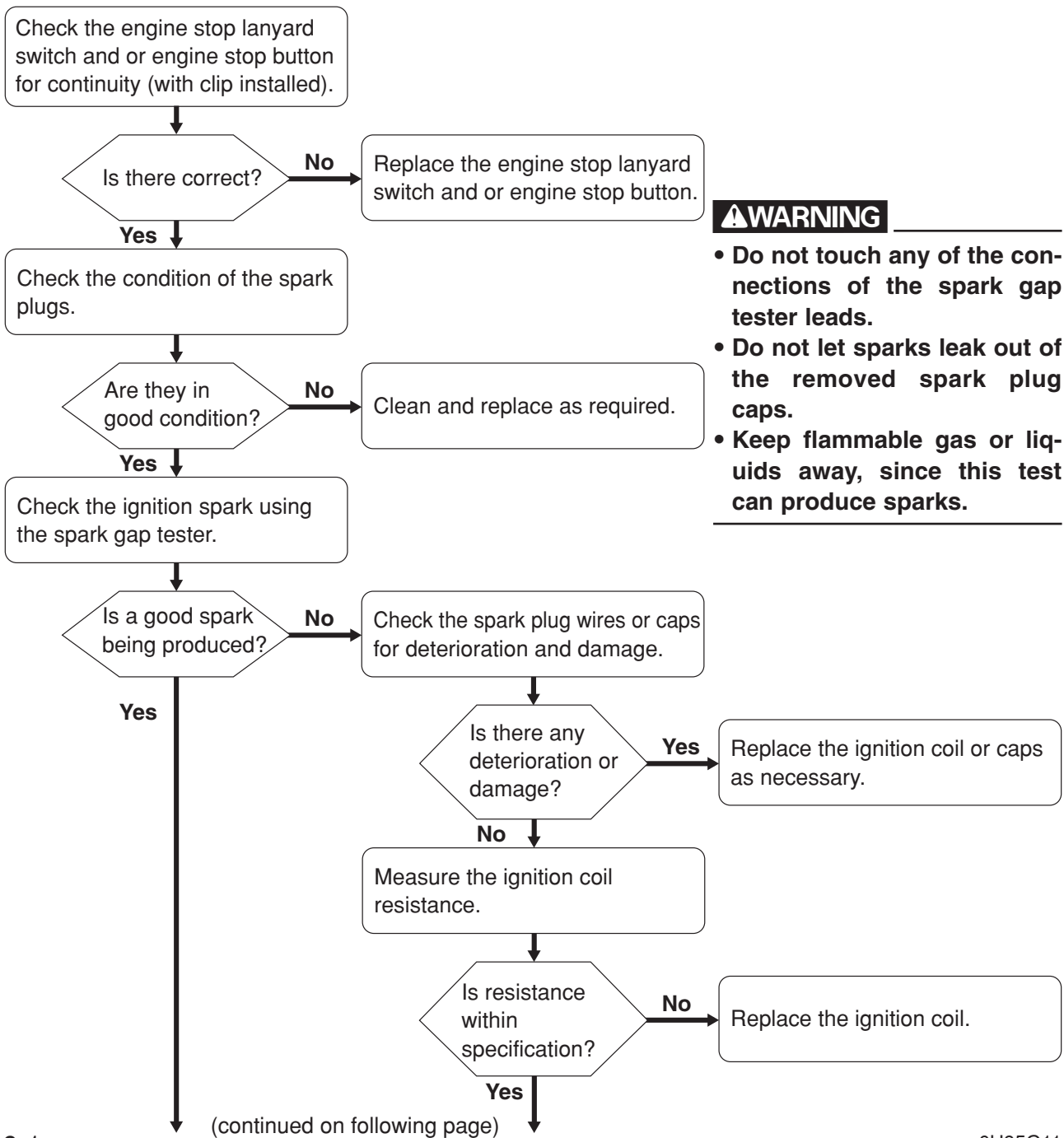
- To diagnose a mechanical malfunction, use the troubleshooting charts pertaining to the trouble located in this chapter. Also, when checking and maintaining the outboard motor, see Chapters 4–8 for safe maintenance procedures.
- Check that all electrical connections are tight and free from corrosion.

**Power unit**

**Symptom: Manual starter turns and or starter motor operate but engine will not start.**

- Check the ignition system, fuel system, and the compression pressure as listed below.
- Be sure the air vent screw on the fuel tank is open.

**Ignition system**

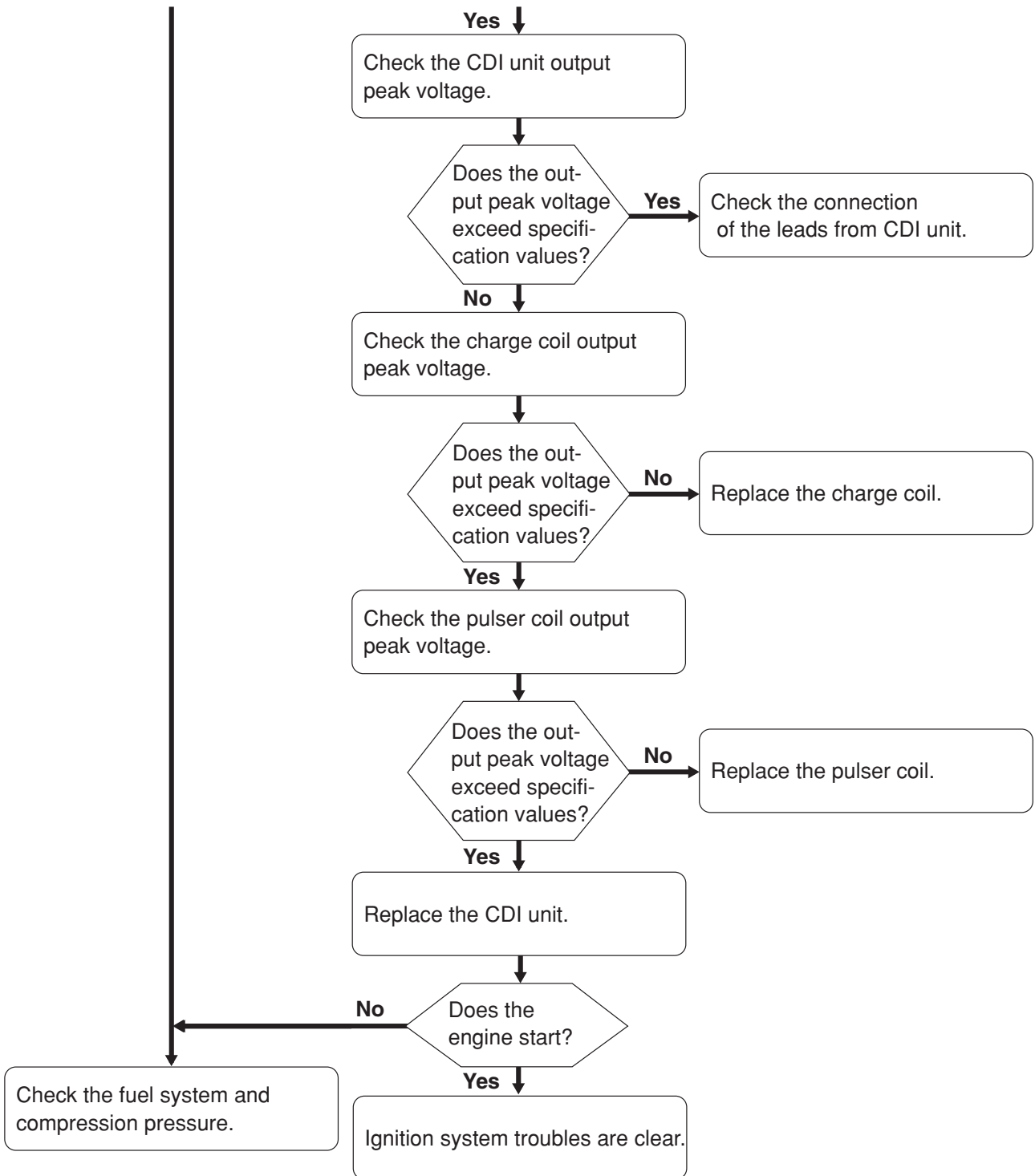


**⚠ WARNING**

- Do not touch any of the connections of the spark gap tester leads.
- Do not let sparks leak out of the removed spark plug caps.
- Keep flammable gas or liquids away, since this test can produce sparks.

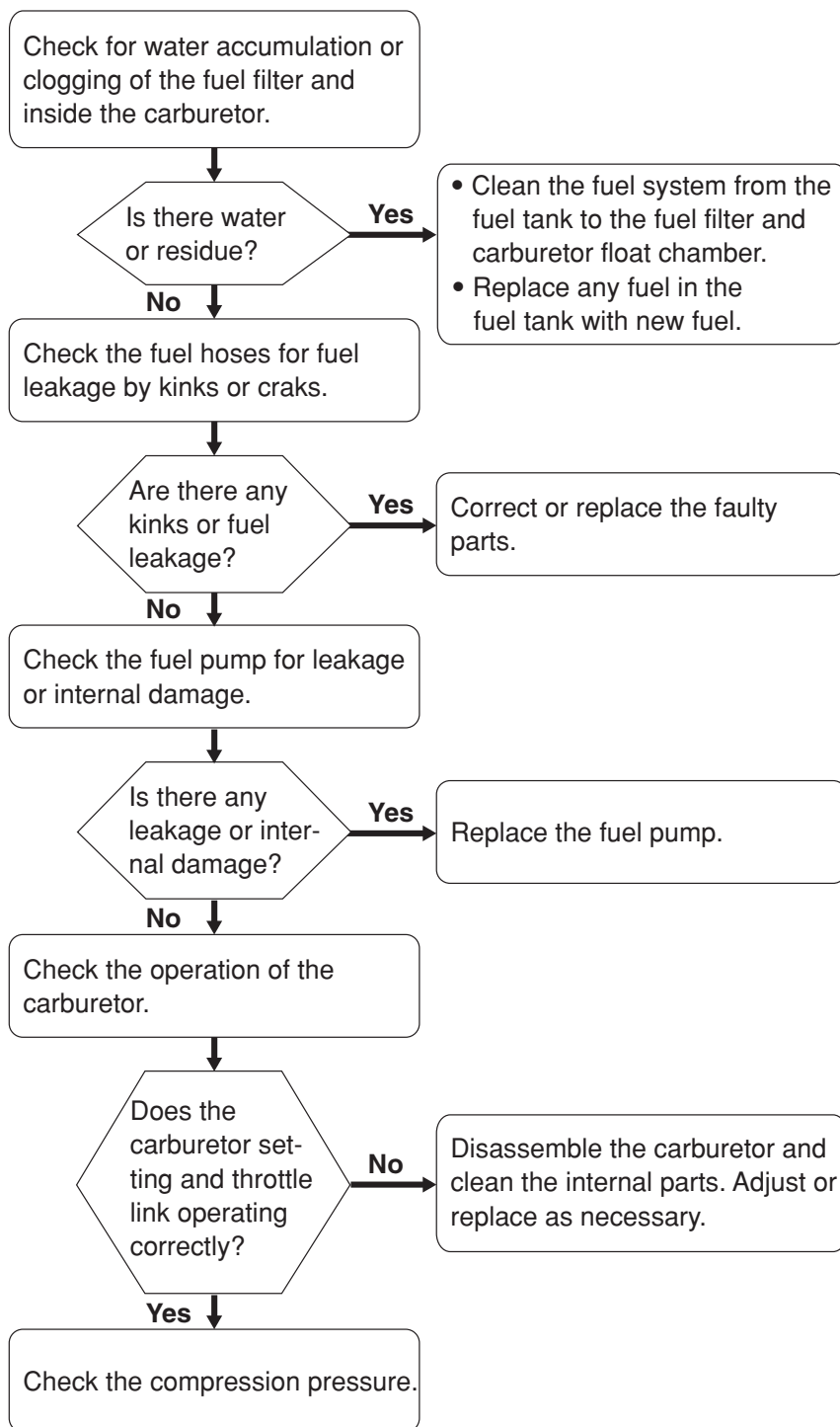


Ignition system (continued from previous page)



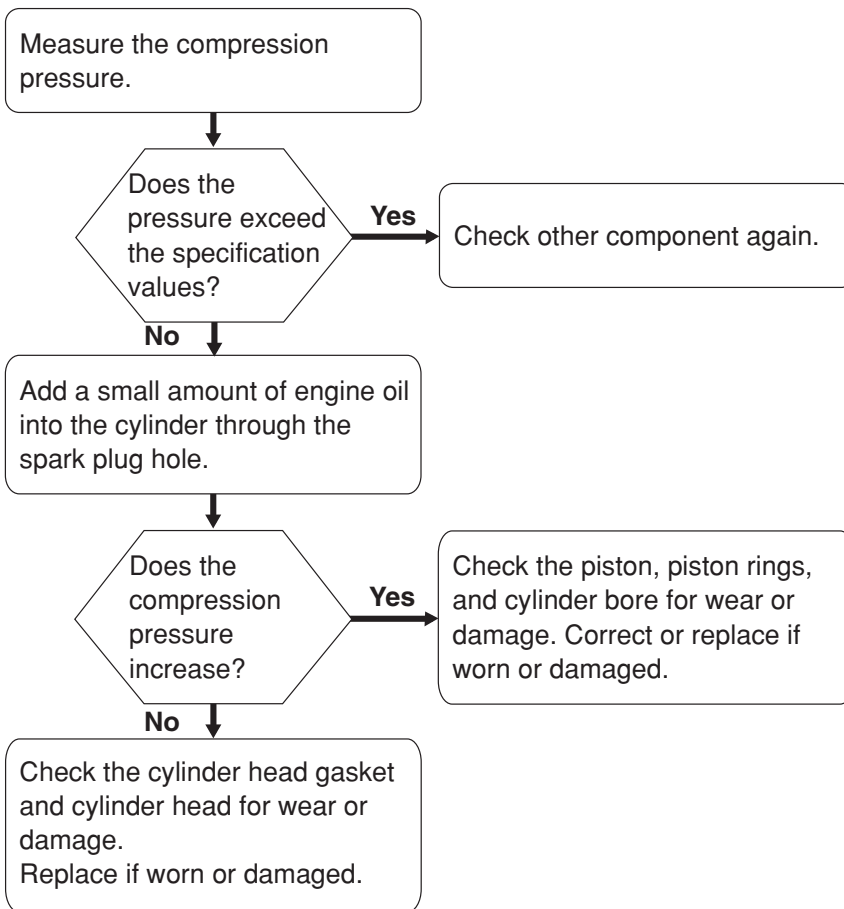
### Fuel system

• Consult this chart after the ignition system has been checked.



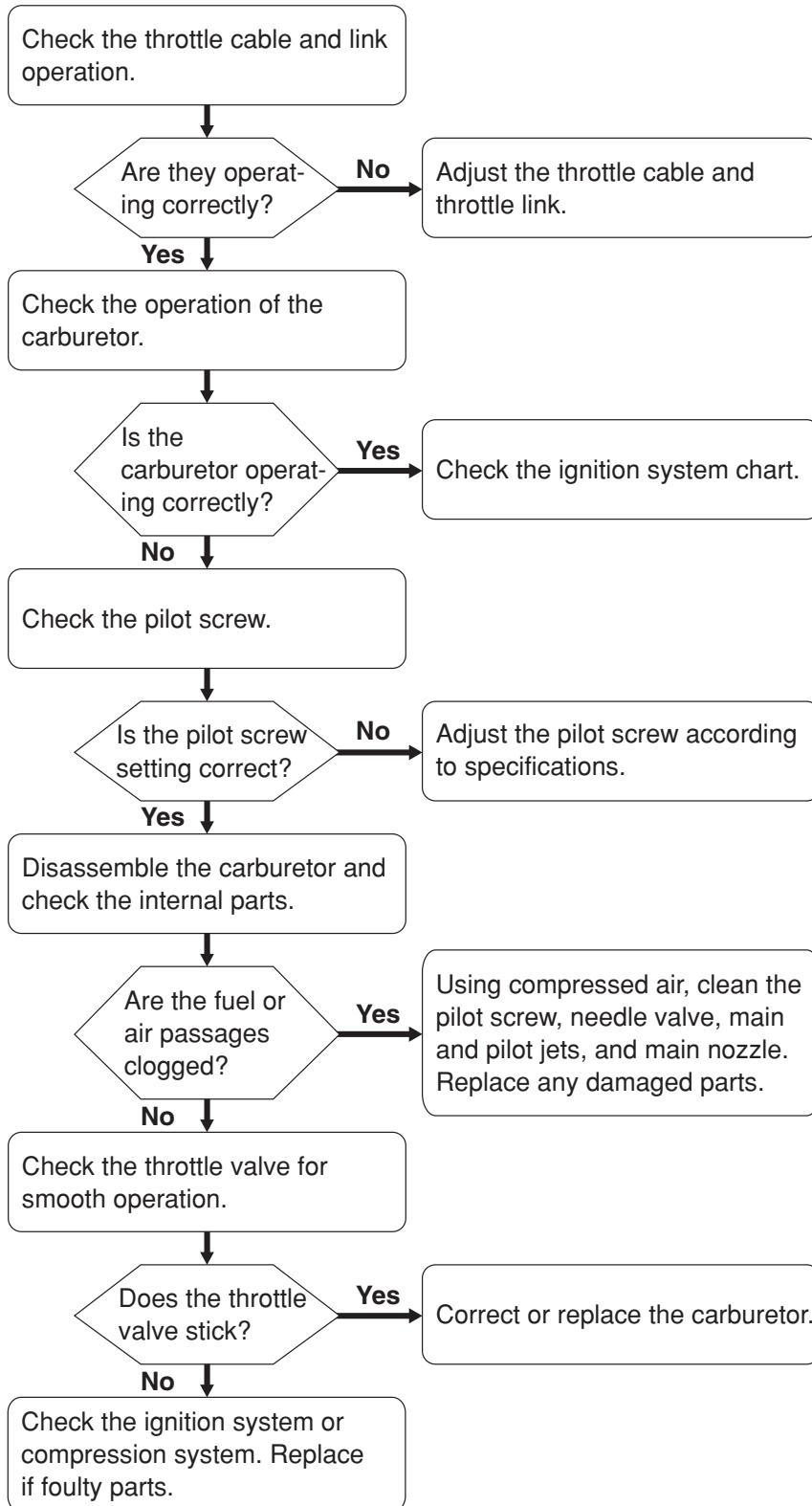
## Compression pressure

- Consult this chart after the ignition and fuel systems have been checked.

**NOTE:**

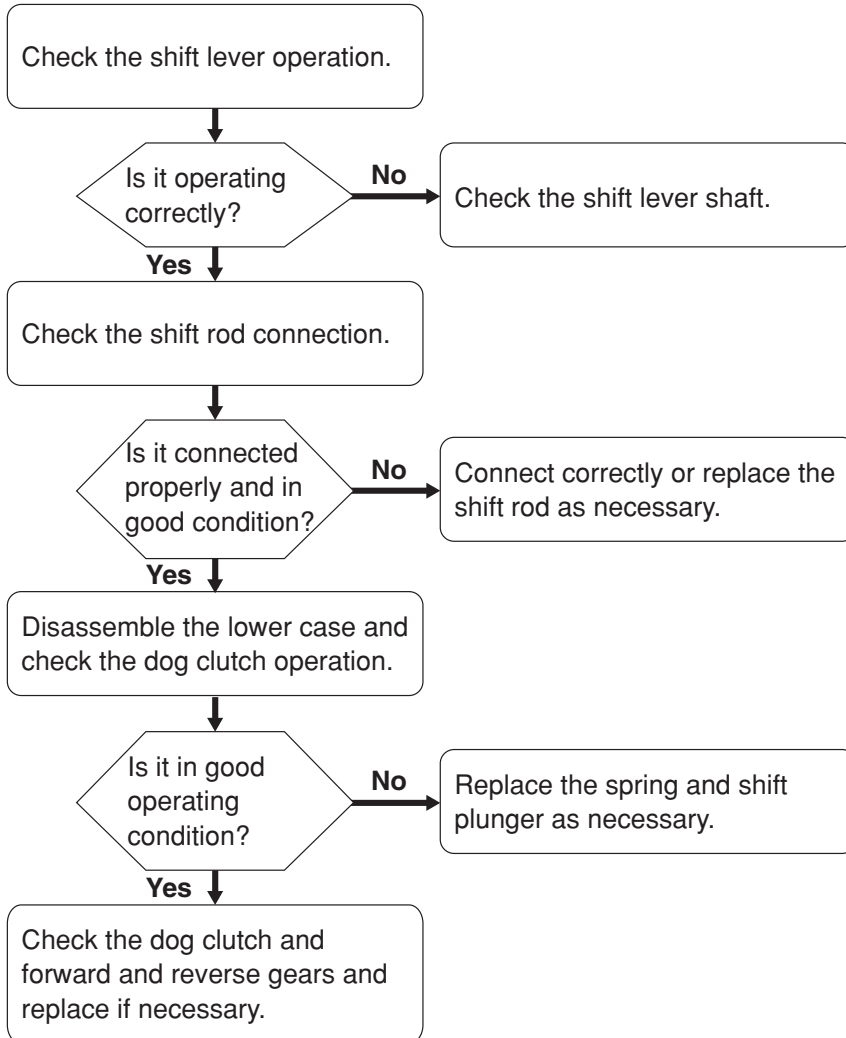
While restoring a damaged part, it is also necessary to trace and solve the cause of the damage.

**Symptom: The engine idle speed does not remain steady.**



**Lower unit**

**Symptom: The forward and reverse gear shift mechanism does not operate properly.**

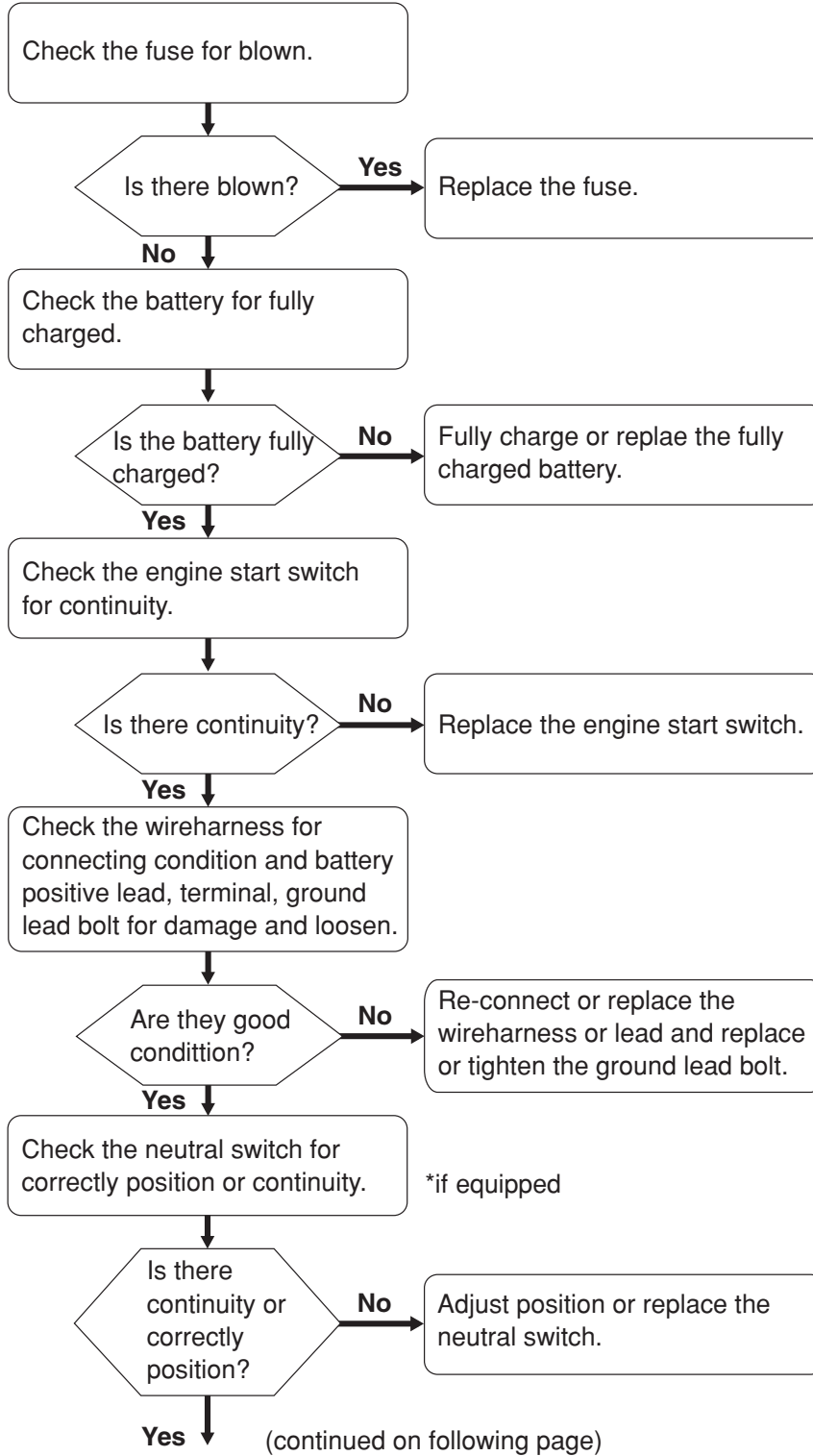


## Electrical system

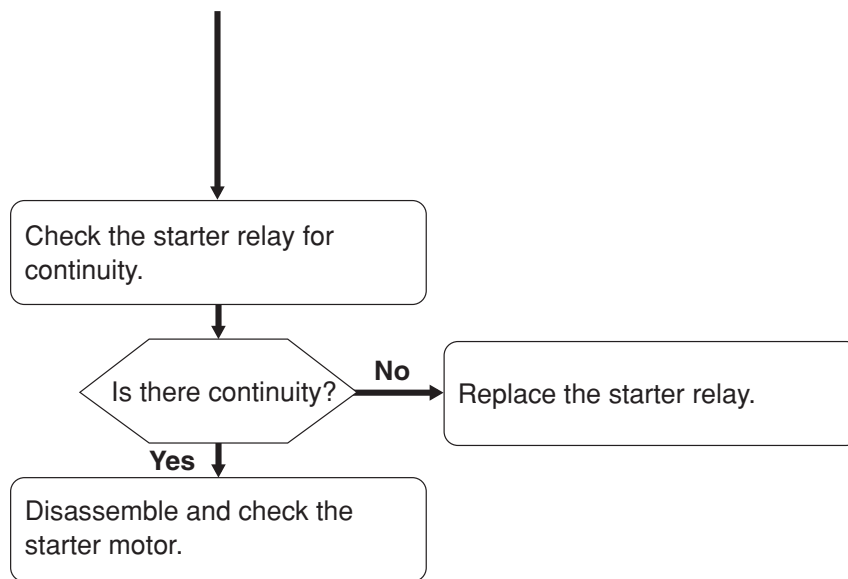
**Symptom: The starter motor does not operate. (W)**

- Engine stop lanyard switch is operating normally.

### Starting system



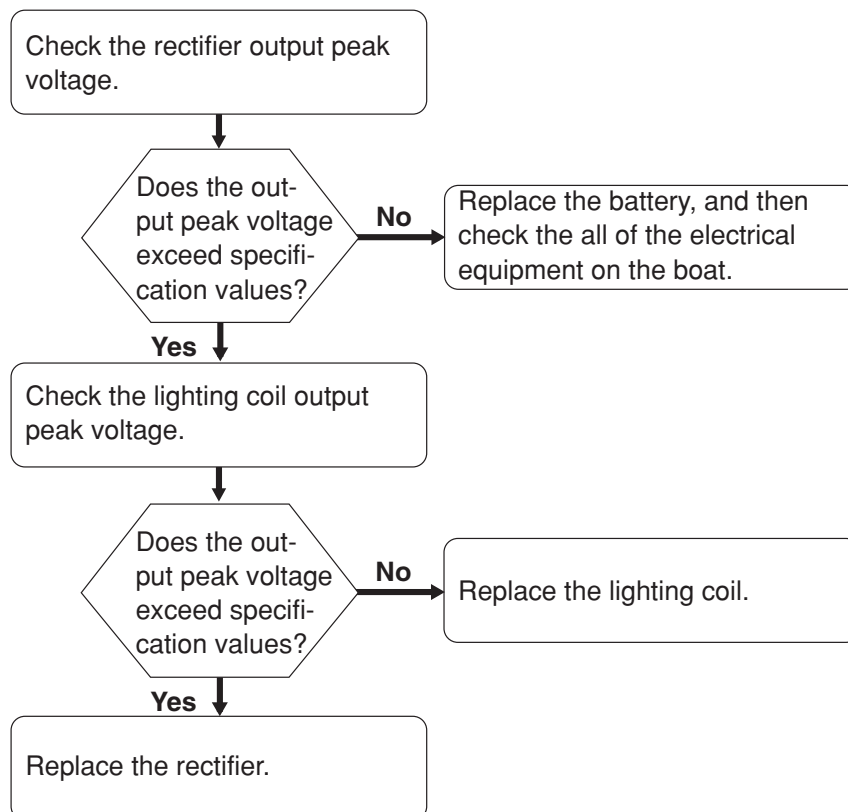
Starting system (continued from previous page)



**Symptom: The battery loses power quickly. (W)**

- Be sure the electrolyte level and gravity are specific condition.
- Be sure the wireharness, couplers and connectores are good connection.

**Charging system**



**A.**

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