YAMAHA

E115A
115B
140B

SERVICE MANUAL

61U-28197-5H-11

NOTICE

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

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

Important information

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

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

⚠WARNING

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

CAUTION:

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

NOTE:

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

E115A, 115B, 140B
SERVICE MANUAL

Printed in Japan

Contents

General information	GEN INFO	1
Specification	SPEC	2
Periodic check and adjustment	CHK ADJ	3
Fuel system	FUEL	4
Power unit	POWR	5
Lower unit	LOWR	6
Bracket unit	BRKT	7
Electrical system	ELEC	8
Troubleshooting	TRBL SHTG	9
Index		

General information

How to use this manual 1-1
Manual format 1-1
Symbol 1-2

Safety while working 1-3
Fire prevention 1-3
Ventilation 1-3
Self-protection 1-3
Parts, lubricant, and sealant 1-3
Good working practice 1-4
Disassembly and assembly 1-4

Identification 1-5
Applicable model 1-5
Serial number 1-5

Special service tool 1-6

Propeller selection 1-11
Propeller size 1-11
Selection 1-11

Predelivery check 1-12
Checking the fuel system 1-12
Checking the gear oil 1-12
Checking the outboard motor mounting height 1-12
Checking the remote control cable (Remote control model) 1-13
Checking the steering system 1-14
Checking the gear shift and throttle operation.....1-14
Checking the PTT system (ET) 1-15
Checking the engine start switch and engine stop lanyard switch 1-15
Checking the cooling water pilot hole 1-16
Test run 1-16
Break-in 1-16
After test run 1-17

How to use this manual

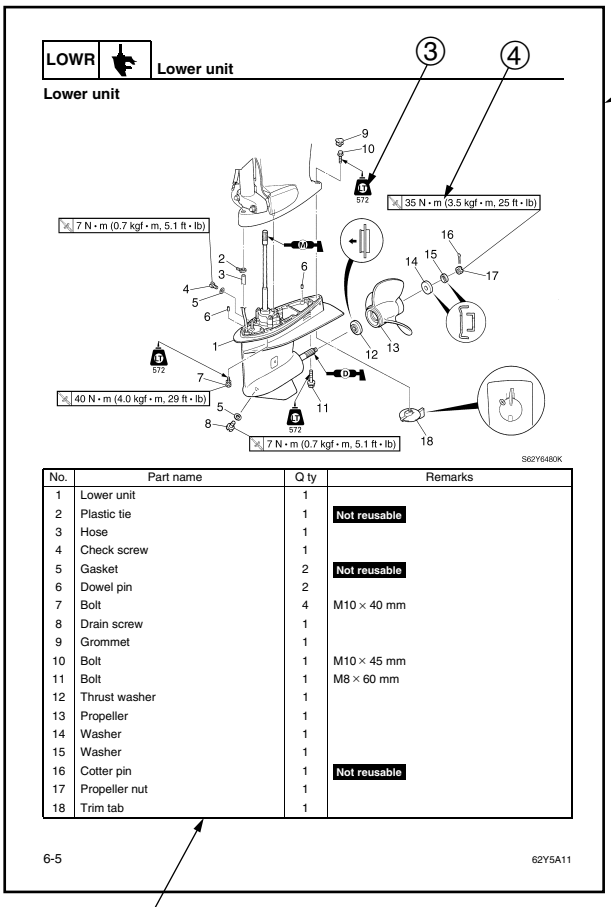
Manual format

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

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

NOTE:

For troubleshooting procedures, see Chapter 9, “Troubleshooting.”

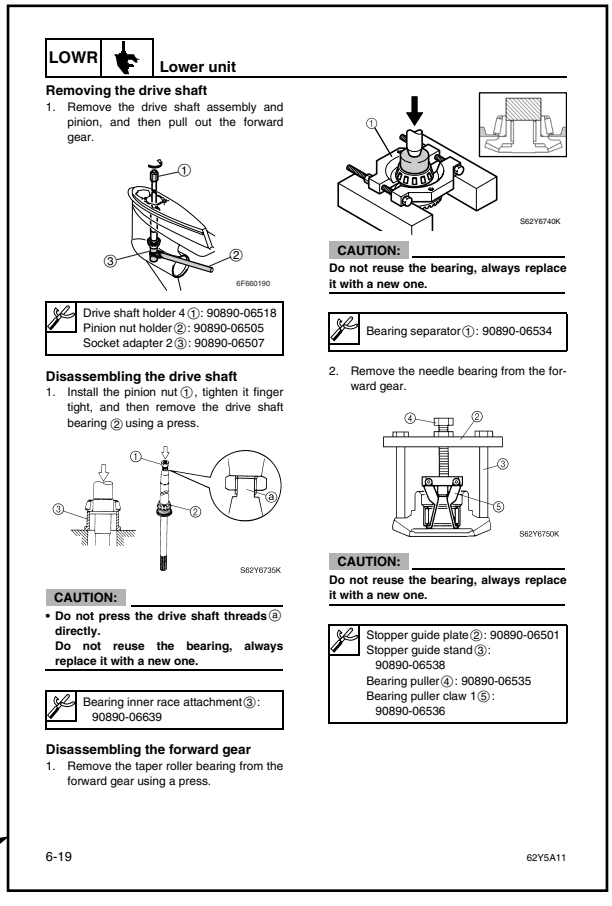


LOWR Lower unit

Lower unit

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

6-5 62Y5A11



LOWR Lower unit

Removing the drive shaft

1. 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

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

Bearing inner race attachment ③: 90890-06639

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

2. Remove the needle bearing from the forward gear.

CAUTION:

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

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

6-19 62Y5A11

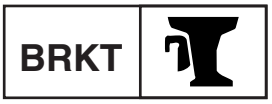
Symbol

The symbols below indicate the content of a chapter.

General information

Fuel system

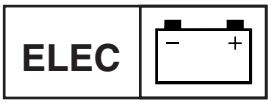
Bracket unit



Specification

Power unit

Electrical system

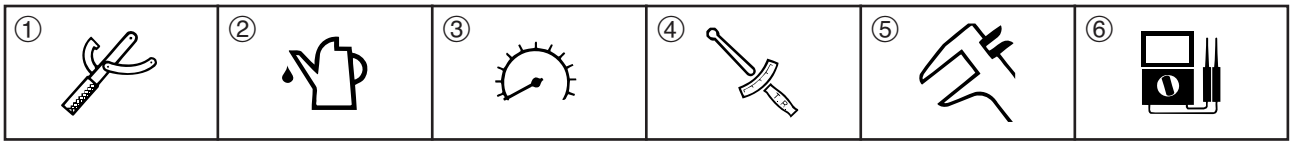


Periodic check and adjustment

Lower unit

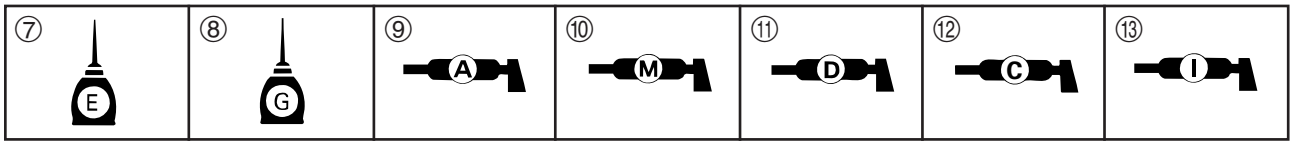
Troubleshooting

Symbols ① to ⑥ indicate specific data.



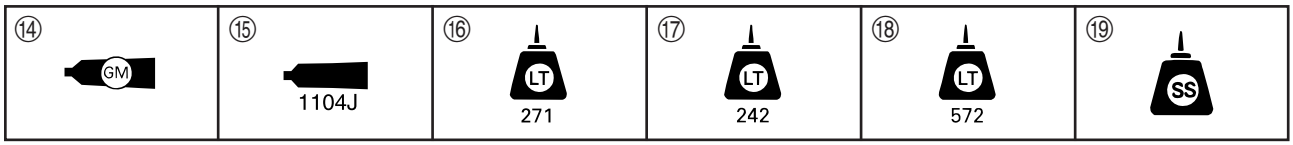
① Special tool
② Specified oil or fluid
③ Specified engine speed
④ Specified tightening torque
⑤ Specified measurement
⑥ Specified electrical value (resistance, voltage, electric current)

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



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

Symbols ⑭ to ⑲ in an exploded diagram or illustration indicate the type of sealant or locking agent and the application point.



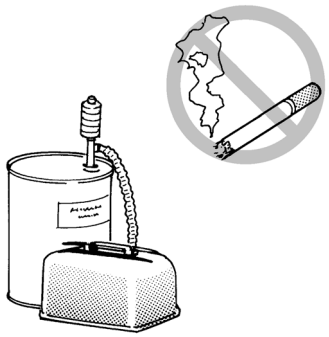
⑭ Apply Gasket Maker
⑮ Apply ThreeBond 1104J
⑯ Apply LOCTITE 271 (red)
⑰ Apply LOCTITE 242 (blue)
⑱ Apply LOCTITE 572
⑲ Apply silicon sealant

Safety while working

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

Fire prevention

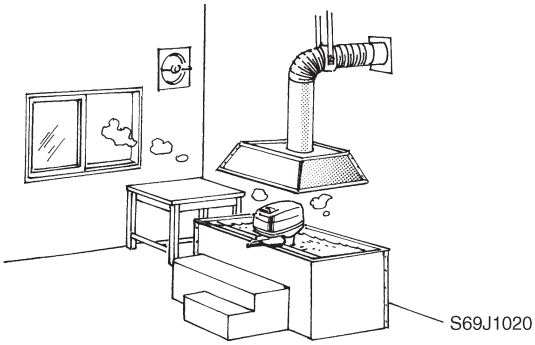
Gasoline is highly flammable.
Keep gasoline and all flammable products away from heat, sparks, and open flames.



S69J1010

Ventilation

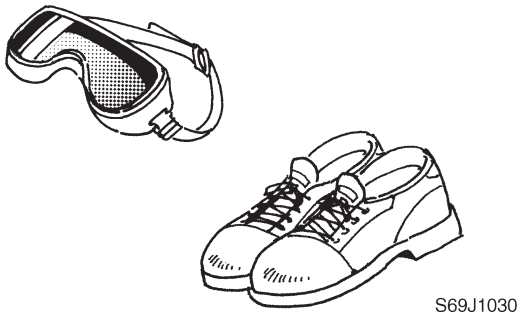
Gasoline vapor and exhaust gas are heavier than air and extremely poisonous. If inhaled in large quantities they may cause loss of consciousness and death within a short time. When test running an engine indoors (e.g., in a water tank) be sure to do so where adequate ventilation can be maintained.



S69J1020

Self-protection

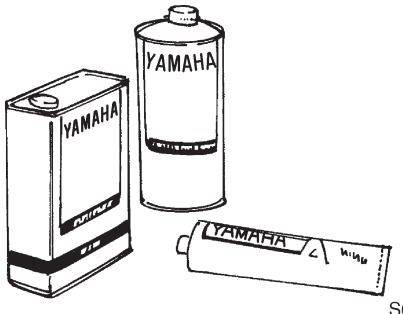
Protect your eyes by wearing safety glasses or safety goggles during all operations involving drilling and grinding, or when using an air compressor.
Protect your hands and feet by wearing protective gloves and safety shoes when necessary.



S69J1030

Parts, lubricant, and sealant

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



S69J1040

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

1. Maintain good standards of personal and industrial hygiene.

2. Change and wash clothing as soon as possible if soiled with lubricants.

3. Avoid contact with skin. Do not, for example, place a soiled rag in your pocket.

4. Wash hands and any other part of the body thoroughly with soap and hot water after contact with a lubricant or lubricant soiled clothing has been made.

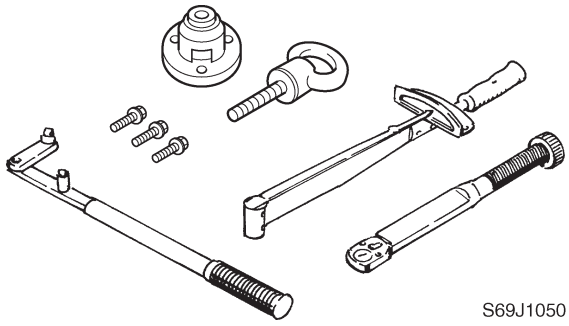
5. To protect your skin, apply a protective cream to your hands before working on the outboard motor.

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

Good working practice

Special service tool

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



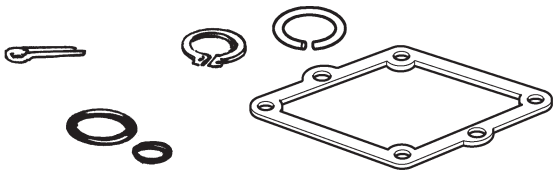
S69J1050

Tightening torque

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

Non-reusable parts

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



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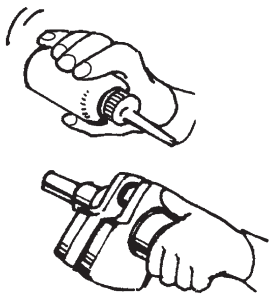
Disassembly and assembly

1. Use compressed air to remove dust and dirt during disassembly.

2. Apply engine oil to the contact surfaces of moving parts before assembly.



S69J1070

3. Install bearings with the manufacture identification mark in the direction indicated in the installation procedure. In addition, be sure to lubricate the bearings liberally.

4. Apply a thin coat of water-resistant grease to the lip and periphery of an oil seal before installation.

5. Check that moving parts operate normally after assembly.

Identification

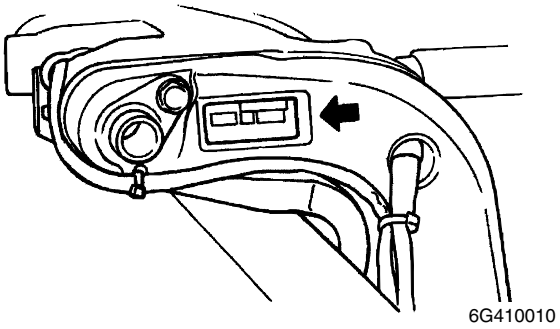
Applicable model

This manual covers the following model.

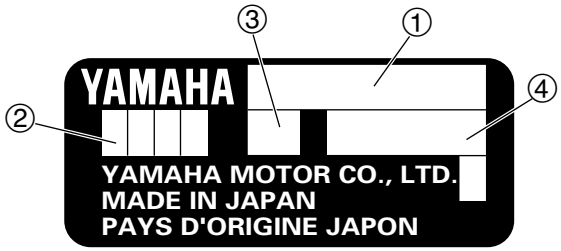
Applicable model
E115AMH, E115AWH, E115AE, E115AET 115BE, 115BET, 140BET

Serial number

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



6G410010

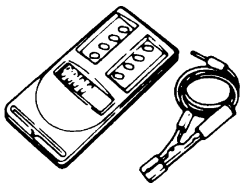


6B410020

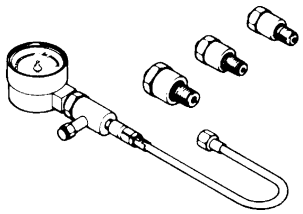
① Model name
② Approved model code
③ Transom height
④ Serial number

Model name	Approved model code	Starting serial No.
E115A	61U	1015056–
115B	6E5	1015056–
140B	6F3	1000671–

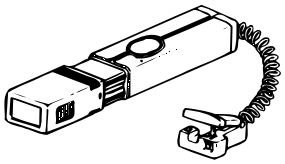
Special service tool



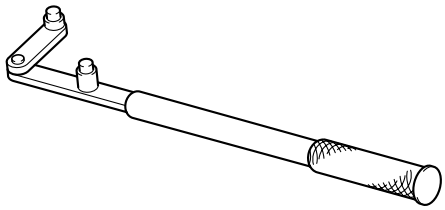
Digital tachometer
90890-06760



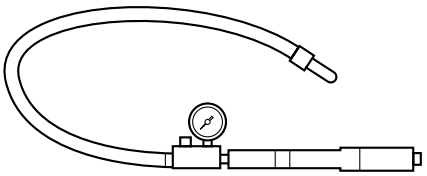
Compression gauge
90890-03160



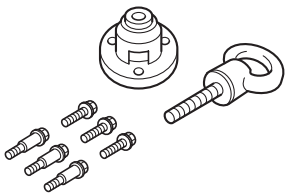
Timing light
90890-03141



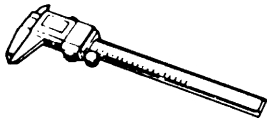
Flywheel holder
90890-06522



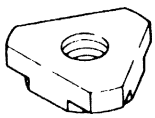
Leakage tester
90890-06840



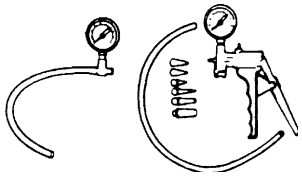
Flywheel puller
90890-06521



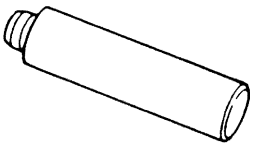
Digital caliper
90890-06704



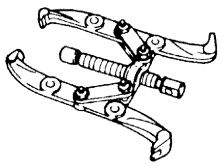
Ball bearing attachment
90890-06663



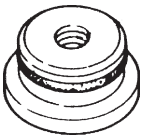
Vacuum/pressure pump gauge set
90890-06756



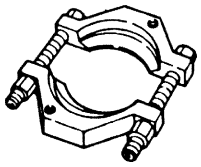
Driver rod LS
90890-06606



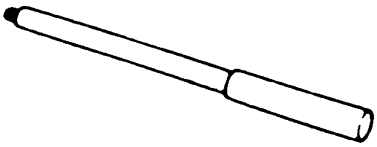
Gear puller
90890-06540



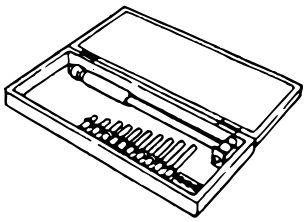
Needle bearing attachment
90890-06609, 90890-06610, 90890-06611,
90890-06612, 90890-06653, 90890-06654



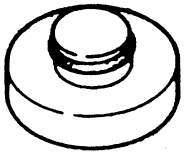
Bearing separator
90890-06534



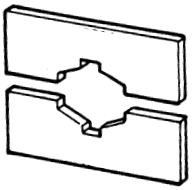
Driver rod L3
90890-06652



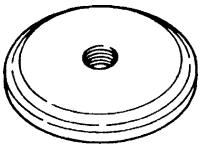
Cylinder gauge
90890-06759



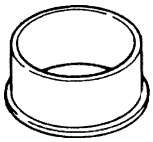
Ball bearing attachment
90890-06633, 90890-06636
90890-06637, 90890-06656



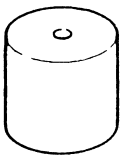
Support
90890-02394



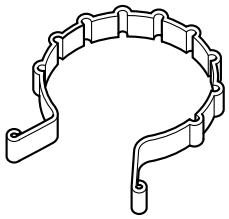
Bearing outer race attachment
90890-06620, 90890-06624



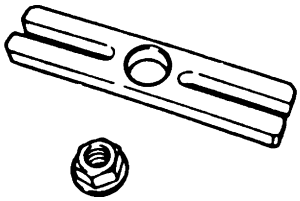
Bearing inner race attachment
90890-06640, 90890-06662



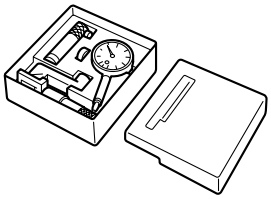
Small end bearing installer
90890-06528



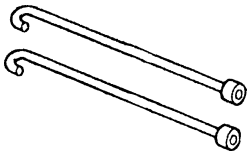
Piston slider
90890-06530



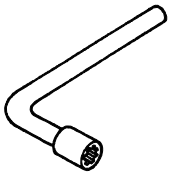
Stopper guide plate
90890-06501



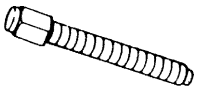
Dial gauge set
90890-01252



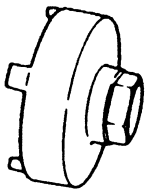
Bearing housing puller claw L
90890-06502



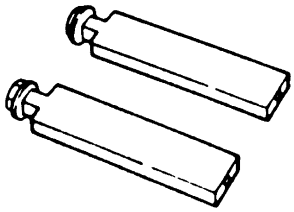
Shift rod push arm
90890-06052



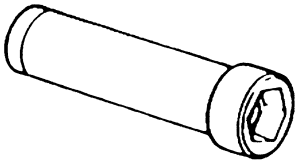
Center bolt
90890-06504



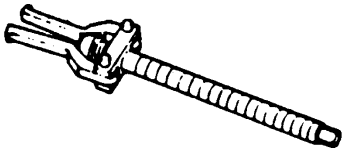
Ring nut wrench 3
90890-06511



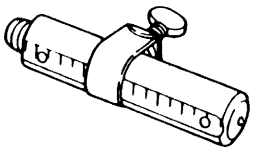
Stopper guide stand
90890-06538



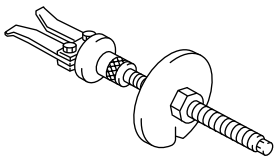
Ring nut wrench extension
90890-06513



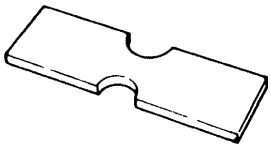
Bearing puller assembly
90890-06535



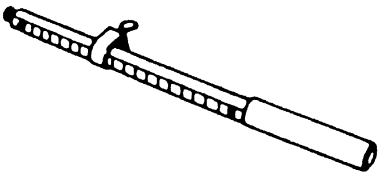
Driver rod SS
90890-06604



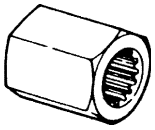
Bearing outer race puller assembly
90890-06523



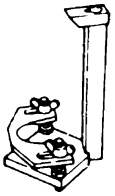
Bearing depth plate
90890-06603



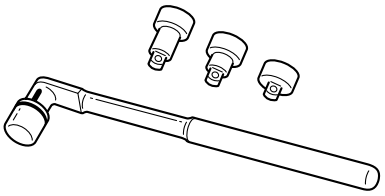
Driver rod SL
90890-06602



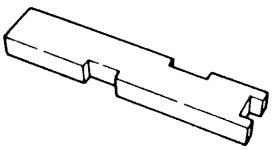
Drive shaft holder 6
90890-06520



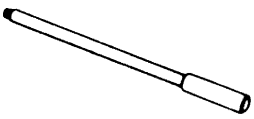
Pinion height gauge
90890-06710



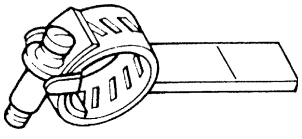
Pinion nut holder
90890-06715



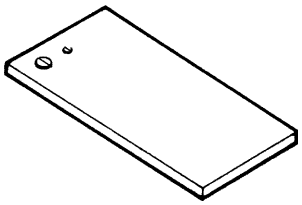
Shimming plate
90890-06701



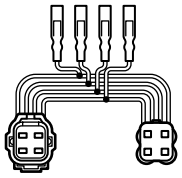
Driver rod LL
90890-06605



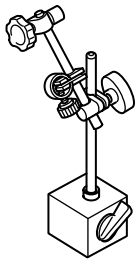
Backlash indicator
90890-06706



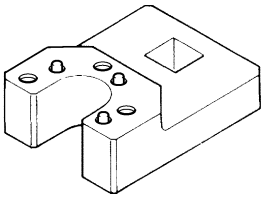
Magnet base plate
90890-07003



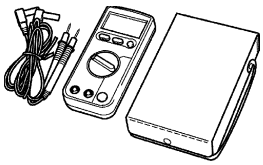
Test harness (4 pins)
90890-06878



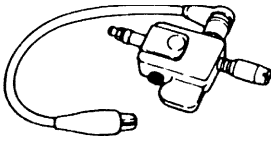
Magnet base B
90890-06844



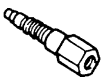
Trim and tilt wrench
90890-06587



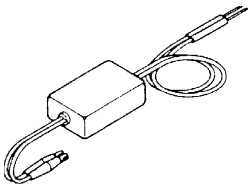
Digital circuit tester
90890-03174



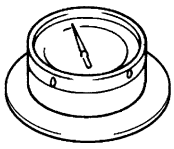
Ignition tester
90890-06754



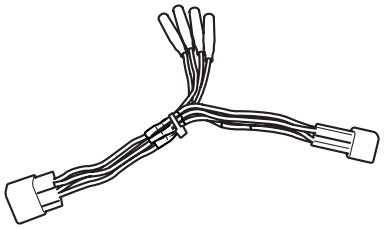
Up relief fitting
90890-06773
Down relief fitting
90890-06774



Peak voltage adaptor B
90890-03172



Hydraulic pressure gauge
90890-06776



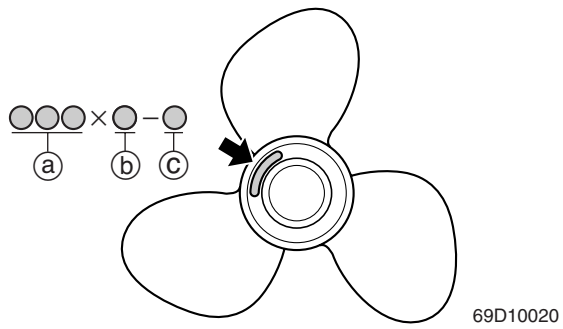
Test harness (4 pins)
90890-06871

Propeller selection

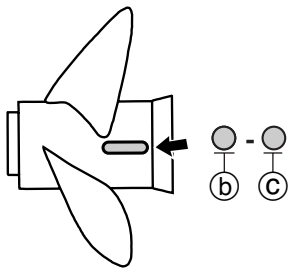
The performance of a boat and outboard motor will be critically affected by the size and type of propeller you choose. Propellers greatly affect boat speed, acceleration, engine life, fuel economy, and even boating and steering capabilities. An incorrect choice could adversely affect performance and could also seriously damage the engine.
Use the following information as a guide for selecting a propeller that meets the operating conditions of the boat and the outboard motor.

Propeller size

The size of the propeller is indicated as shown.



69D10020



6B410035

ⓐ 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.

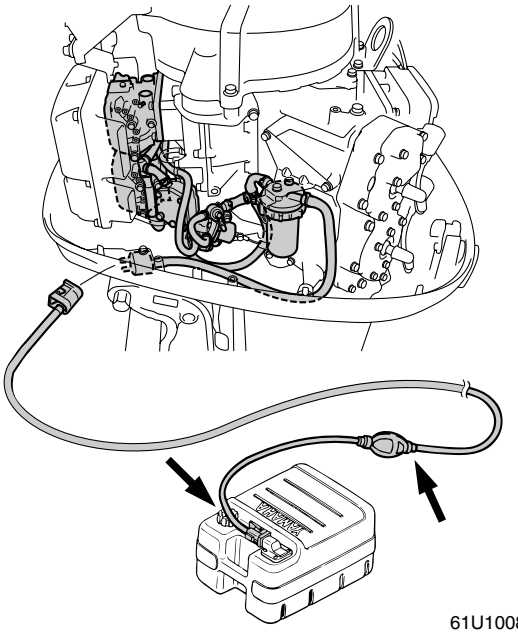
Propeller size (in)	Material
14 × 11 - K	Aluminum
13 5/8 × 13 - K	
13 1/2 × 14 - K	
12 1/2 × 15 - K	
13 1/2 × 16 - K	
13 × 17 - K	
13 1/4 × 17 - K	
13 × 19 - K	
12 5/8 × 21 - K	
13 × 21 - K	
13 × 23 - K	
13 × 25 - K	
14 × 20 - P	Stainless steel
14 × 22 - P	
14 × 24 - P	
14 × 26 - P	
14 × 28 - P	

Predelivery check

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

Checking the fuel system

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



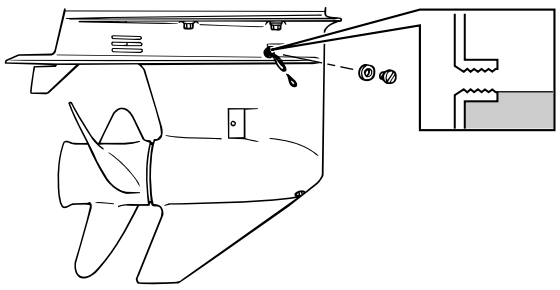
61U10080

CAUTION:

Use pre-mixed fuel only.
Fuel and oil mixing ratio is 50:1. For break-in period, 25:1 mixture shall be used.

Checking the gear oil

1. Check the gear oil level.



69D10055

Checking the battery (E, ET, WH)

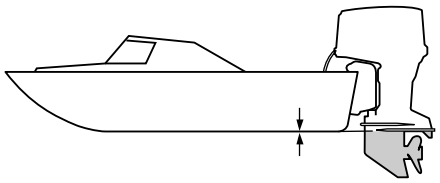
1. Check the capacity, electrolyte level, and specified gravity of the battery.

Recommended battery capacity:
CCA/EN: 430 A
20HR/IEC: 70 Ah
Electrolyte specified gravity:
1.280 at 20°C (68°F)

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

Checking the outboard motor mounting height

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



69D10080

NOTE:

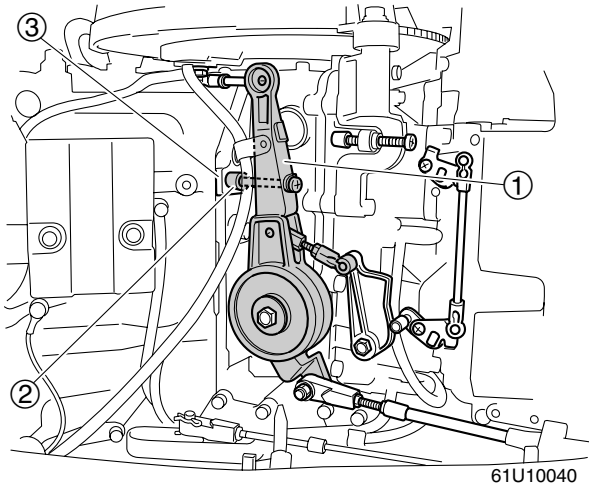
The optimum mounting height is affected by the combination of the boat and the outboard motor. To determine the optimum mounting height, test run the outboard motor at different heights.

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

Checking the remote control cable (Remote control model)

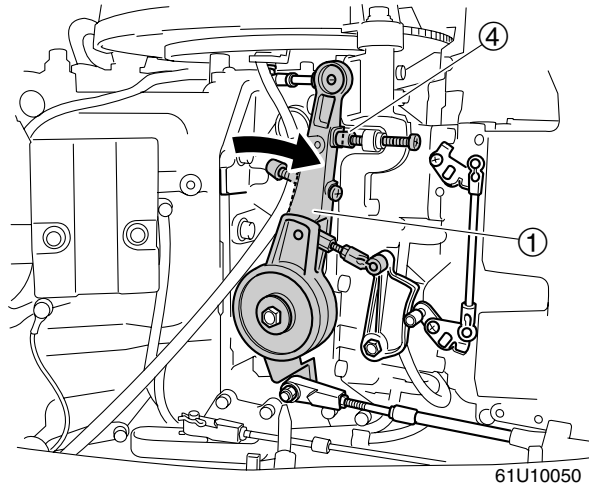
1. Set the remote control lever to the neutral position and fully close the throttle lever.

2. Check that the control lever ① is in its fully closed position, and check the adjusting screw ② is contact the stopper ③.



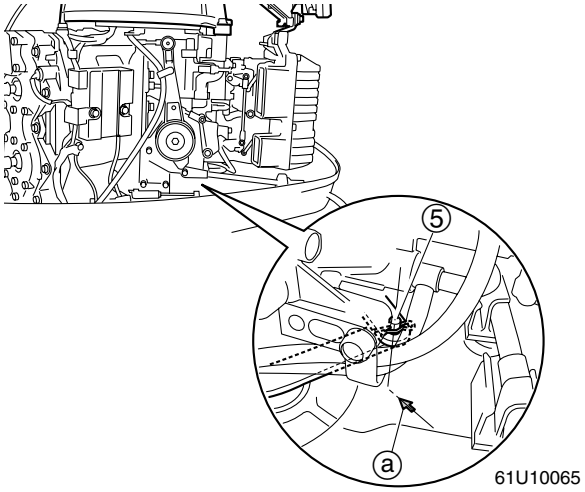
61U10040

3. Fully open the throttle lever, and then check that the control lever ① is in its fully opened position, and check the control lever contact the adjusting screw ④.

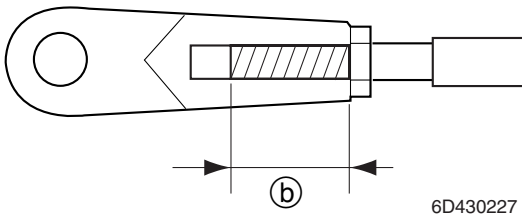


61U10050

4. Check that the remote control lever is in the neutral position, and check that the center of the set pin ⑤ is aligned with the alignment mark ⓐ on the bottom cowling.



61U10065



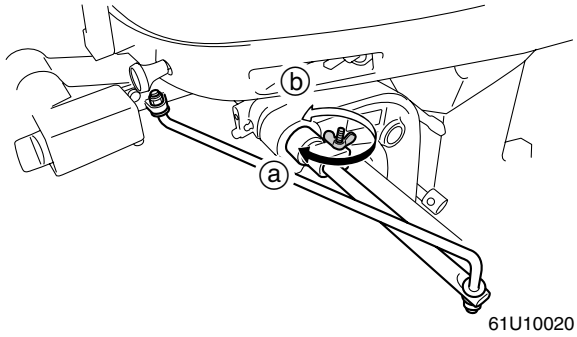
6D430227

CAUTION:

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

Checking the steering system

1. Check the steering friction for proper adjustment.

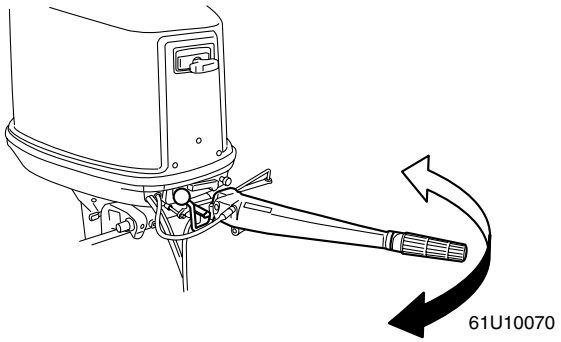


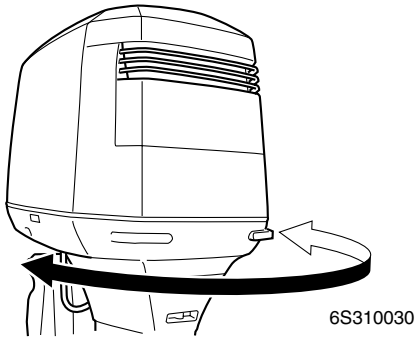
61U10020

NOTE:

- To increase the friction, turn the friction adjusting nut in direction ⓐ.
- To decrease the friction, turn the friction adjusting nut in direction ⓑ.

2. Check that the steering operates smoothly.


61U10070

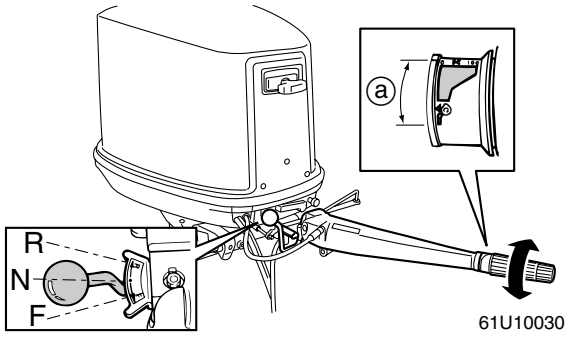

6S310030

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

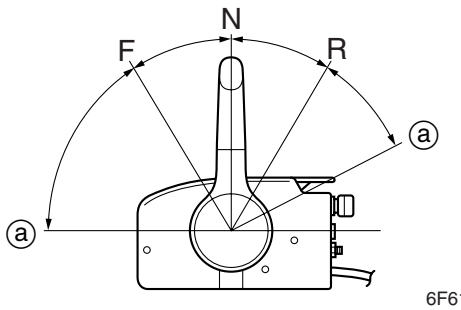
Checking the gear shift and throttle operation

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 ⓐ.
   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 ⓐ.



61U10030



6F610120

Checking the PTT system (ET)

1. Check that the outboard motor tilts up and down smoothly when operating the PTT unit.

2. Check that there is no abnormal noise produced when the outboard motor is tilted up or down.

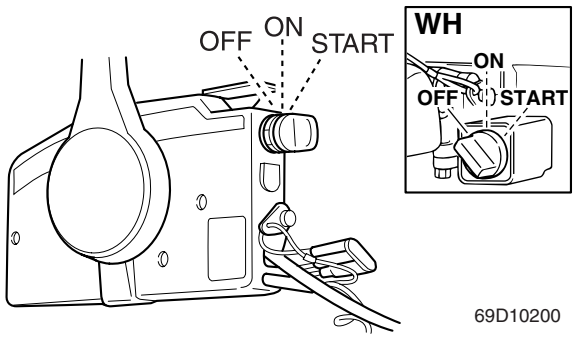
3. Check that there is no interference with wires or hoses when the tilted up outboard motor is steered.

4. Check that the trim meter points down when the outboard motor is tilted all the way down.

Checking the engine start switch, engine stop lanyard switch

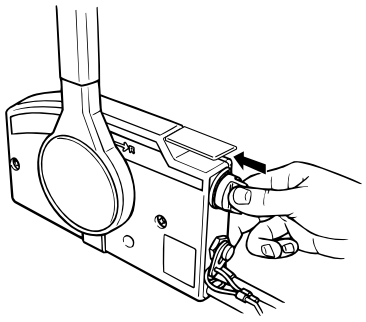
1. Check that the engine starts when the engine start switch is turned to START. (E, ET, WH)

2. Check that the engine turns off when the engine start switch is turned to OFF. (E, ET, WH)

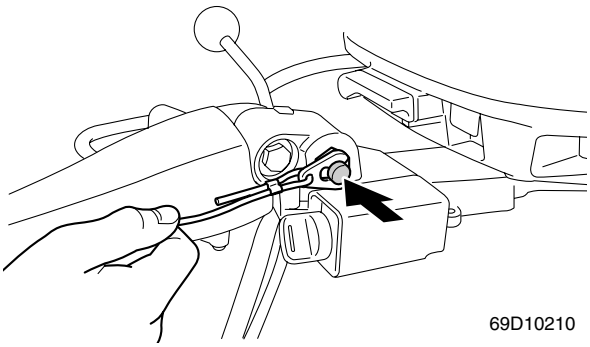


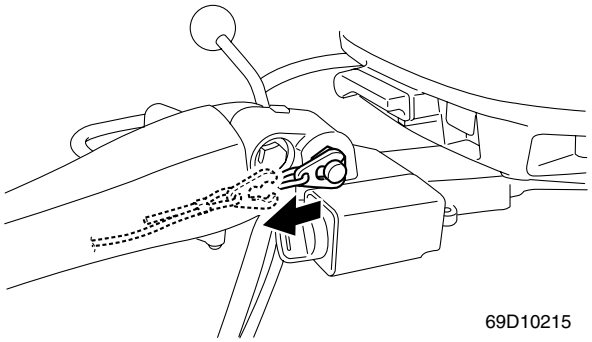
69D10200

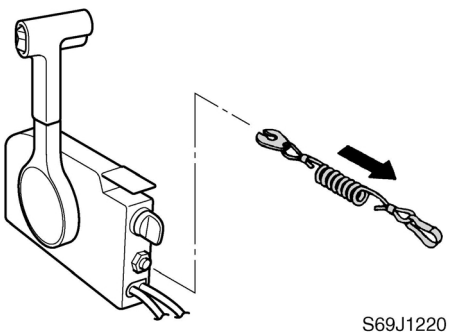
3. Check that the choke solenoid operates when the engine start switch is pushed in. (E, ET)


6S310110

4. Check that the engine turns off when the engine stop lanyard switch is pushed or the engine stop lanyard is pulled from the engine stop lanyard switch.

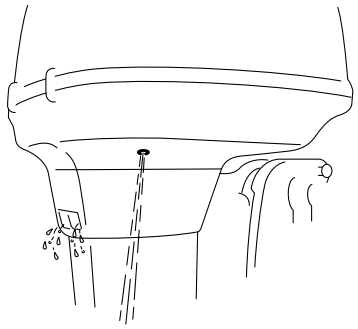

69D10210


69D10215


S69J1220

Checking the cooling water pilot hole

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



6G410070

Test run

1. Start the engine, and then check that the gear shift operates smoothly.

2. Check the engine idle speed after the engine has been warmed up.

3. Operate at trolling speed.

4. Run the outboard motor for 1 hour at 3,000 r/min or at half throttle, then for another hour at 4,000 r/min or at 3/4 throttle.

5. Check that the outboard motor does not tilt up when shifting into reverse and that water does not flow in over the transom.

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

Break-in

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

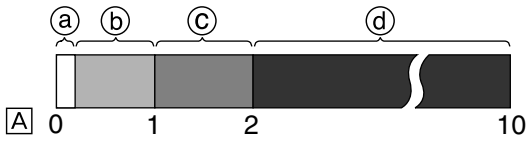
1. 10 minutes ⓐ at the lowest possible speed. A fast idle in neutral is best.

2. 50 minutes ⓑ 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 ⓒ 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 ⓓ 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 premix ratio of fuel and oil. Refer to page 1-12.



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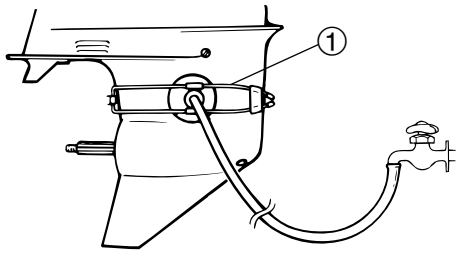
A Hours

After test run

1. Check for water in the gear oil.

2. Check for fuel leakage in the cowling.

3. Flush the cooling water passage with fresh water using the flushing kit ① and with the engine running at idle.



CAUTION:

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

Specification

General specification 2-1

Maintenance specification 2-5
Power unit (E115A models) 2-5
Lower unit (E115A models) 2-7
Electrical (E115A models) 2-7
Power unit (115B, 140B models) 2-10
Lower unit (115B, 140B models) 2-12
Electrical (115B, 140B models) 2-12
Dimension 2-15

Tightening torque 2-19
Specified torque 2-19
General torque 2-21

General specification

Item	Unit	Model			
		E115AMH	E115AWH	E115AE	E115AET
Dimension					
Overall length	mm (in)	1,458 (57.4)		828 (32.6)	
Overall width	mm (in)	600 (23.6)			
Overall height					
(L)	mm (in)	1,558 (61.3)		1,435 (56.5)	
(Y)	mm (in)	1,611 (63.4)		—	
(X)	mm (in)	1,684 (66.3)		1,561 (61.5)	
Boat transom height					
(L)	mm (in)	508 (20.0)			
(Y)	mm (in)	572 (22.5)		—	
(X)	mm (in)	635 (25.0)			
Weight					
(with aluminum propeller)					
(L)	kg (lb)	151 (333)	154 (340)	147 (324)	154 (340)
(Y)	kg (lb)	153 (337)	156 (344)	—	—
(X)	kg (lb)	155 (342)	158 (348)	151 (333)	158 (348)
(with stainless propeller)					
(L)	kg (lb)	153 (337)	156 (344)	149 (328)	156 (344)
(Y)	kg (lb)	153 (337)	156 (344)	—	—
(X)	kg (lb)	157 (346)	160 (353)	153 (337)	160 (353)
Performance					
Maximum output	kW (hp)	84.6 (115) at 5,000 r/min			
Full throttle operating range	r/min	4,500–5,500			
Maximum fuel consumption	L (US gal, lmp gal)/hr	47 (12.4, 10.3) 5,500 r/min			
Engine idle speed	r/min	700–800			
Power unit					
Engine type		2-stroke, V			
Cylinder quantity		4			
Total displacement	cm^3 (cu. in)	1,730 (105.56)			
Bore x stroke	mm (in)	90.0 × 68.0 (3.54 × 2.68)			
Compression ratio		5.70 :1			
Intake system		Reed valve			
Scavenging system		Loop charge			
Control system		Tiller handle		Remote control	
Starting system		Manual	Manual and electric	Electric	
Fuel system		Carburetor			
Ignition control system		CDI			
Maximum generator output	V, A	12, 10			
Starting enrichment		Manual injection		Choke valve	
Spark plug	(NGK)	B8HS-10			
		—		BR8HS-10	

Item	Unit	Model			
		E115AMH	E115AWH	E115AE	E115AET
Cooling system		Water			
Exhaust system		Propeller boss			
Lubrication system		Pre-mixed fuel and oil			
Fuel and oil					
Fuel type		Regular unleaded gasoline			
Engine oil		2-stroke outboard motor oil			
Engine oil grade		NMMA-certified TC-W3			
Gear oil type		Hypoid gear oil			
Gear oil grade (*1)	API	GL-4			
	SAE	90			
Gear oil quantity	cm^3 (US oz, Imp oz)	760 (25.70, 26.81)			
Bracket unit					
Trim angle (at 12° boat transom)	Degree	-4.0 to 16.0			
Tilt-up angle	Degree	66.0			70.0
Steering angle	Degree	35 + 35			
Drive unit					
Gear shift positions		F-N-R			
Gear ratio		2.00 (26/13)			
Reduction gear type		Spiral bevel gear			
Clutch type		Dog clutch			
Propeller shaft type		Spline			
Propeller direction (rear view)		Clockwise			
Propeller ID mark		K			
Electrical					
Battery minimum capacity (*2)					
CCA/EN	A	—	430		
20HR/IEC	Ah	—	70		

(*1) Meeting both API and SAE requirements

(*2) CCA: Cold Cranking Ampere
EN: European Norm (European standard)
IEC: International Electrotechnical Commission

Item	Unit	Model		
		115BE	115BET	140BET
Dimension				
Overall length	mm (in)	828 (32.6)		
Overall width	mm (in)	600 (23.6)		
Overall height				
(L)	mm (in)	1,435 (56.5)		
(X)	mm (in)	1,561 (61.5)		
Boat transom height				
(L)	mm (in)	508 (20.0)		
(X)	mm (in)	635 (25.0)		
Weight				
(with aluminum propeller)				
(L)	kg (lb)	146 (322)	154 (340)	
(X)	kg (lb)	158 (348)		
(with stainless propeller)				
(L)	kg (lb)	148 (326)	156 (344)	
(X)	kg (lb)	160 (353)		
Performance				
Maximum output	kW (hp)	84.6 (115) at 5,000 r/min		103 (140) at 5,000 r/min
Full throttle operating range	r/min	4,500–5,500		
Maximum fuel consumption	L (US gal, lmp gal)/hr	49 (12.9, 10.8) 5,500 r/min		56 (14.8, 12.3) 5,500 r/min
Engine idle speed	r/min	700–800		
Power unit				
Engine type		2-stroke, V		
Cylinder quantity		4		
Total displacement	cm^3 (cu. in)	1,730 (105.56)		
Bore x stroke	mm (in)	90.0 × 68.0 (3.54 × 2.68)		
Compression ratio		6.50 :1		6.80 :1
Intake system		Reed valve		
Scavenging system		Loop charge		
Control system		Remote control		
Starting system		Electric		
Fuel system		Carburetor		
Ignition control system		CDI		
Maximum generator output	V, A	12, 10		
Starting enrichment		Choke valve		
Spark plug	(NGK)	B8HS-10 BR8HS-10		B9HS-10 BR9HS-10

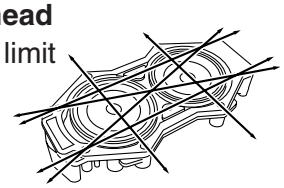
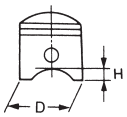
Item	Unit	Model		
		115BE	115BET	140BET
Cooling system		Water		
Exhaust system		Propeller boss		
Lubrication system		Pre-mixed fuel and oil		
Fuel and oil				
Fuel type		Regular unleaded gasoline		
Engine oil		2-stroke outboard motor oil		
Engine oil grade		NMMA-certified TC-W3		
Gear oil type		Hypoid gear oil		
Gear oil grade (*1)	API	GL-4		
	SAE	90		
Gear oil quantity	cm^3 (US oz, Imp oz)	760 (25.70, 26.81)		
Bracket unit				
Trim angle (at 12° boat transom)	Degree	-4.0 to 16.0		
Tilt-up angle	Degree	66.0	70.0	
Steering angle	Degree	35 + 35		
Drive unit				
Gear shift positions		F-N-R		
Gear ratio		2.00 (26/13)		
Reduction gear type		Spiral bevel gear		
Clutch type		Dog clutch		
Propeller shaft type		Spline		
Propeller direction (rear view)		Clockwise		
Propeller ID mark		K		
Electrical				
Battery minimum capacity (*2)				
CCA/EN	A	430		
20HR/IEC	Ah	70		

(*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 (E115A models)

Item	Unit	Model			
		E115AMH	E115AWH	E115AE	E115AET
Power unit					
Minimum compression pressure (*1) at electric starter	kPa (kgf/cm², psi)	—	450 (4.5, 64)		
at manual starter		400 (4.0, 57)		—	
Cylinder head					
Warpage limit  (lines indicate straightedge position)	mm (in)	0.10 (0.0039)			
Cylinder					
Bore size 	mm (in)	90.000–90.020 (3.5433–3.5441)			
Piston					
Piston diameter (D) 	mm (in)	89.920–89.935 (3.5402–3.5407)			
Measuring point (H)	mm (in)	10.0 (0.39)			
Piston clearance	mm (in)	0.080–0.085 (0.0032–0.0033)			
Piston pin boss bore	mm (in)	21.504–21.515 (0.8466–0.8470)			
Oversize piston					
1st	mm (in)	0.25 (0.010)			
2nd	mm (in)	0.50 (0.020)			
Oversize piston diameter					
1st	mm (in)	90.170–90.185 (3.5500–3.5506)			
2nd	mm (in)	90.420–90.435 (3.5598–3.5604)			
Piston pin					
Piston pin diameter	mm (in)	21.495–21.500 (0.8463–0.8465)			

(*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			
		E115AMH	E115AWH	E115AE	E115AET
Piston ring					
Top ring					
Dimension B	mm (in)	1.970–1.990 (0.0776–0.0783)			
Dimension T	mm (in)	2.700–2.900 (0.1063–0.1142)			
End gap	mm (in)	0.30–0.40 (0.0118–0.0157)			
Side clearance	mm (in)	0.02–0.06 (0.0008–0.0024)			
Oversize outside diameter					
1st	mm (in)	90.25 (3.5531)			
2nd	mm (in)	90.50 (3.5630)			
2nd piston ring					
Dimension B	mm (in)	1.970–1.990 (0.0776–0.0783)			
Dimension T	mm (in)	2.700–2.900 (0.1063–0.1142)			
End gap	mm (in)	0.30–0.40 (0.0118–0.0157)			
Side clearance	mm (in)	0.02–0.06 (0.0008–0.0024)			
Oversize outside diameter					
1st	mm (in)	90.25 (3.5531)			
2nd	mm (in)	90.50 (3.5630)			
Connecting rod					
Small-end inside diameter	mm (in)	26.500–26.512 (1.0433–1.0438)			
Connecting rod big-end side clearance	mm (in)	0.120–0.260 (0.0047–0.0102)			
Small-end axial play limit	mm (in)	2.0 (0.08)			
Crankshaft					
Crankshaft journal diameter	mm (in)	53.975–53.991 (2.1250–2.1256)			
Crankpin diameter	mm (in)	35.985–36.000 (1.4167–1.4173)			
Runout limit	mm (in)	0.02 (0.0008)			
Thermostat					
Opening temperature	°C (°F)	48–52 (118.40–125.60)			
Fully open temperature	°C (°F)	60 (140)			
Valve open lower limit	mm (in)	3.0 (0.12)			
Reed valve					
Valve stopper height	mm (in)	6.2–6.8 (0.24–0.26)			
Valve bending limit	mm (in)	0.2 (0.0079)			
Carburetor					
ID mark		61UM2		61U03	61U03/61U10
Main jet (M.J.)	#	174			
Main nozzle (M.N.)	mm (in)	3.6 (0.14)			
Main air jet	#	270			
Pilot jet (P.J.)	#	78			
Pilot air jet (P.A.J.)	#	60			
Pilot screw (P.S.)	turns out	1–1 1/2			
Valve seat size	mm (in)	1.2 (0.05)			
Float height	mm (in)	16 (0.63)			

Lower unit (E115A models)

Item	Unit	Model			
		E115AMH	E115AWH	E115AE	E115AET
Gear backlash					
Pinion-to-forward	mm (in)	0.32–0.50 (0.0126–0.0197)			
Pinion-to-reverse	mm (in)	0.80–1.17 (0.0315–0.0461)			
Pinion gear shims	mm	0.10, 0.12, 0.15, 0.18, 0.30, 0.40, 0.50			
Forward gear shims	mm	0.10, 0.12, 0.15, 0.18, 0.30, 0.40, 0.50			
Reverse gear shims	mm	0.10, 0.12, 0.15, 0.18, 0.30, 0.40, 0.50			

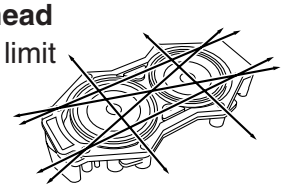
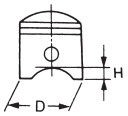
Electrical (E115A models)

Item	Unit	Model			
		E115AMH	E115AWH	E115AE	E115AET
Ignition and ignition control system					
Ignition timing (full retarded)	Degree	ATDC 4–6			
Ignition timing (full advanced)	Degree	BTDC 22–24			
Spark plug gap	mm (in)	0.9–1.0 (0.035–0.039)			
Ignition coil resistance					
Primary coil (B/W–B) at 20°C (68°F)	Ω	0.18–0.24			
Secondary coil (B/W–spark plug wire) at 20°C (68°F)	kΩ	3.26–4.88			
CDI unit output peak voltage (B/W–B)					
at Cranking (loaded)	V	120			
at 1,500 r/min (loaded)	V	150			
at 3,500 r/min (loaded)	V	150			
Pulser coil output peak voltage (W/R–W/Y, W/B–W/G)					
at Cranking (unloaded)	V	4.8			
at Cranking (loaded)	V	3.8			
at 1,500 r/min (loaded)	V	8.8			
at 3,500 r/min (loaded)	V	14.2			
Pulser coil resistance at 20°C (68°F) (W/R–W/Y, W/B–W/G)	Ω	256–384			
Thermoswitch					
ON temperature	°C (°F)	84.0–90.0 (183–194)			
OFF temperature	°C (°F)	60.0–74.0 (140–165)			

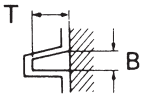
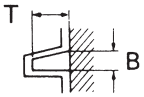
Item	Unit	Model			
		E115AMH	E115AWH	E115AE	E115AET
Charge coil output peak voltage (B/R–L: High-speed)					
at Cranking (unloaded)	V	45			
at Cranking (loaded)	V	45			
at 1,500 r/min (loaded)	V	160			
at 3,500 r/min (loaded)	V	160			
(R–Br: Low-speed)					
at Cranking (unloaded)	V	130			
at Cranking (loaded)	V	140			
at 1,500 r/min (loaded)	V	160			
at 3,500 r/min (loaded)	V	160			
Charge coil resistance at 20°C (68°F)					
(B/R–L)	Ω	48–72			
(R–Br)	Ω	428–642			
Starter motor					
Type		—	Bendix		
Output	kW	—	1.10		
Brushes					
Standard length	mm (in)	—	17.0 (0.67)		
Wear limit	mm (in)	—	10.0 (0.39)		
Commutator					
Standard diameter	mm (in)	—	33.0 (1.30)		
Wear limit	mm (in)	—	32.0 (1.26)		
Standard undercut	mm (in)	—	0.8 (0.03)		
Wear limit	mm (in)	—	0.2 (0.01)		
Choke solenoid resistance	Ω	—		3.4–4.0	
Charging system					
Fuse	A	—	20		
Lighting coil output peak voltage (G–G/W)					
at Cranking (unloaded)	V	8.0			
at 1,500 r/min (unloaded)	V	31.0			
at 3,500 r/min (unloaded)	V	72.0			
Lighting coil resistance at 20°C (68°F) (G–G/W)	Ω	0.36–0.54			
Rectifier Regulator output peak voltage (battery)					
at 1,500 r/min (loaded)	V	13			
at 3,500 r/min (loaded)	V	13			

Item	Unit	Model			
		E115AMH	E115AWH	E115AE	E115AET
PTT system					
Trim sensor resistance at 20°C (68°F) (P–B)	Ω		—		239–379
Fluid type			—		ATF Dexron Ⅱ
Motor type			—		64E00
Output	kW		—		0.40
Brushes					
Standard length	mm (in)		—		9.8 (0.39)
Wear limit	mm (in)		—		4.8 (0.19)
Commutator					
Standard diameter	mm (in)		—		22.0 (0.87)
Wear limit	mm (in)		—		21.0 (0.83)
Standard undercut	mm (in)		—		1.35 (0.053)
Wear limit	mm (in)		—		0.85 (0.033)
Hydraulic pressure (down)	MPa (kgf/cm²)		—		6–9 (60–90)
Hydraulic pressure (up)	MPa (kgf/cm²)		—		10–12 (100–120)

Power unit (115B, 140B models)

Item	Unit	Model		
		115BE	115BET	140BET
Power unit				
Minimum compression pressure (*1)	kPa (kgf/cm², psi)	450 (4.5, 64)		
Cylinder head				
Warpage limit  (lines indicate straightedge position)	mm (in)	0.10 (0.0039)		
Cylinder				
Bore size 	mm (in)	90.000–90.020 (3.5433–3.5441)		
Piston				
Piston diameter (D) 	mm (in)	89.920–89.935 (3.5402–3.5407)		
Measuring point (H)	mm (in)	10.0 (0.39)		
Piston clearance	mm (in)	0.080–0.085 (0.0032–0.0033)		
Piston pin boss bore	mm (in)	23.074–23.085 (0.9084–0.9089)		
Oversize piston				
1st	mm (in)	0.25 (0.010)		
2nd	mm (in)	0.50 (0.020)		
Oversize piston diameter				
1st	mm (in)	90.170–90.185 (3.5500–3.5506)		
2nd	mm (in)	90.420–90.435 (3.5598–3.5604)		
Piston pin				
Piston pin diameter	mm (in)	23.065–23.070 (0.9081–0.9083)		

(*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		
		115BE	115BET	140BET
Piston ring				
Top ring				
Dimension B 	mm (in)	1.970–1.990 (0.0776–0.0783)		
Dimension T	mm (in)	2.700–2.900 (0.1063–0.1142)		
End gap	mm (in)	0.30–0.50 (0.0118–0.0197)		
Side clearance	mm (in)	0.02–0.06 (0.0008–0.0024)		
Oversize outside diameter				
1st	mm (in)	90.25 (3.5531)		
2nd	mm (in)	90.50 (3.5630)		
2nd piston ring				
Dimension B 	mm (in)	1.970–1.990 (0.0776–0.0783)		
Dimension T	mm (in)	2.700–2.900 (0.1063–0.1142)		
End gap	mm (in)	0.30–0.40 (0.0118–0.0157)		
Side clearance	mm (in)	0.02–0.06 (0.0008–0.0024)		
Oversize outside diameter				
1st	mm (in)	90.25 (3.5531)		
2nd	mm (in)	90.50 (3.5630)		
Connecting rod				
Small-end inside diameter	mm (in)	28.070–28.082 (1.1051–1.1056)		
Connecting rod big-end side clearance	mm (in)	0.120–0.260 (0.0047–0.0102)		
Small-end axial play limit	mm (in)	2.0 (0.08)		
Crankshaft				
Crankshaft journal diameter	mm (in)	53.975–53.991 (2.1250–2.1256)		
Crankpin diameter	mm (in)	35.985–36.000 (1.4167–1.4173)		
Runout limit	mm (in)	0.02 (0.0008)		
Thermostat				
Opening temperature	°C (°F)	48–52 (118.40–125.60)		
Fully open temperature	°C (°F)	60 (140)		
Valve open lower limit	mm (in)	3.0 (0.12)		
Reed valve				
Valve stopper height	mm (in)	6.2–6.8 (0.24–0.26)		
Valve bending limit	mm (in)	0.2 (0.0079)		
Carburetor				
ID mark		6E517		6L105
Main jet (M.J.)	#	176		180
Main nozzle (M.N.)	mm (in)	3.6 (0.14)		
Main air jet	#	270		240
Pilot jet (P.J.)	#	78		82
Pilot air jet (P.A.J.)	#	60		
Pilot screw (P.S.)	turns out	3/8–7/8		5/8–1 1/8
Valve seat size	mm (in)	1.2 (0.05)		
Float height	mm (in)	16 (0.63)		

Lower unit (115B, 140B models)

Item	Unit	Model		
		115BE	115BET	140BET
Gear backlash				
Pinion-to-forward	mm (in)	0.32–0.50 (0.0126–0.0197)		
Pinion-to-reverse	mm (in)	0.80–1.17 (0.0315–0.0461)		
Pinion gear shims	mm	0.10, 0.12, 0.15, 0.18, 0.30, 0.40, 0.50		
Forward gear shims	mm	0.10, 0.12, 0.15, 0.18, 0.30, 0.40, 0.50		
Reverse gear shims	mm	0.10, 0.12, 0.15, 0.18, 0.30, 0.40, 0.50		

Electrical (115B, 140B models)

Item	Unit	Model		
		115BE	115BET	140BET
Ignition and ignition control system				
Ignition timing (full retarded)	Degree	ATDC 4–6		
Ignition timing (full advanced)	Degree	BTDC 24–26		BTDC 21–23
Spark plug gap	mm (in)	0.9–1.0 (0.035–0.039)		
Ignition coil resistance				
Primary coil (B/W–B) at 20°C (68°F)	Ω	0.18–0.24		
Secondary coil (B/W–spark plug wire) at 20°C (68°F)	kΩ	3.26–4.88		
CDI unit output peak voltage (B/W–B)				
at Cranking (loaded)	V	120		
at 1,500 r/min (loaded)	V	150		
at 3,500 r/min (loaded)	V	150		
Pulser coil output peak voltage (W/R–W/Y, W/B–W/G)				
at Cranking (unloaded)	V	4.8		
at Cranking (loaded)	V	3.8		
at 1,500 r/min (loaded)	V	8.8		
at 3,500 r/min (loaded)	V	14.2		
Pulser coil resistance at 20°C (68°F) (W/R–W/Y, W/B–W/G)	Ω	256–384		
Thermoswitch				
ON temperature	°C (°F)	84.0–90.0 (183–194)		
OFF temperature	°C (°F)	60.0–74.0 (140–165)		

Item	Unit	Model		
		115BE	115BET	140BET
Charge coil output peak voltage				
(B/R–L: High-speed)				
at Cranking (unloaded)	V	45		
at Cranking (loaded)	V	45		
at 1,500 r/min (loaded)	V	160		
at 3,500 r/min (loaded)	V	160		
(R–Br: Low-speed)				
at Cranking (unloaded)	V	130		
at Cranking (loaded)	V	140		
at 1,500 r/min (loaded)	V	160		
at 3,500 r/min (loaded)	V	160		
Charge coil resistance at 20°C (68°F)				
(B/R–L)	Ω	48–72		
(R–Br)	Ω	428–642		
Starter motor				
Type		Bendix		
Output	kW	1.10		
Brushes				
Standard length	mm (in)	17.0 (0.67)		
Wear limit	mm (in)	10.0 (0.39)		
Commutator				
Standard diameter	mm (in)	33.0 (1.30)		
Wear limit	mm (in)	32.0 (1.26)		
Standard undercut	mm (in)	0.8 (0.03)		
Wear limit	mm (in)	0.2 (0.01)		
Choke solenoid resistance	Ω	3.4–4.0		
Charging system				
Fuse	A	20		
Lighting coil output peak voltage (G–G/W)				
at Cranking (unloaded)	V	8.0		
at 1,500 r/min (unloaded)	V	31.0		
at 3,500 r/min (unloaded)	V	72.0		
Lighting coil resistance at 20°C (68°F) (G–G/W)	Ω	0.36–0.54		
Rectifier Regulator output peak voltage (battery)				
at 1,500 r/min (loaded)	V	13		
at 3,500 r/min (loaded)	V	13		

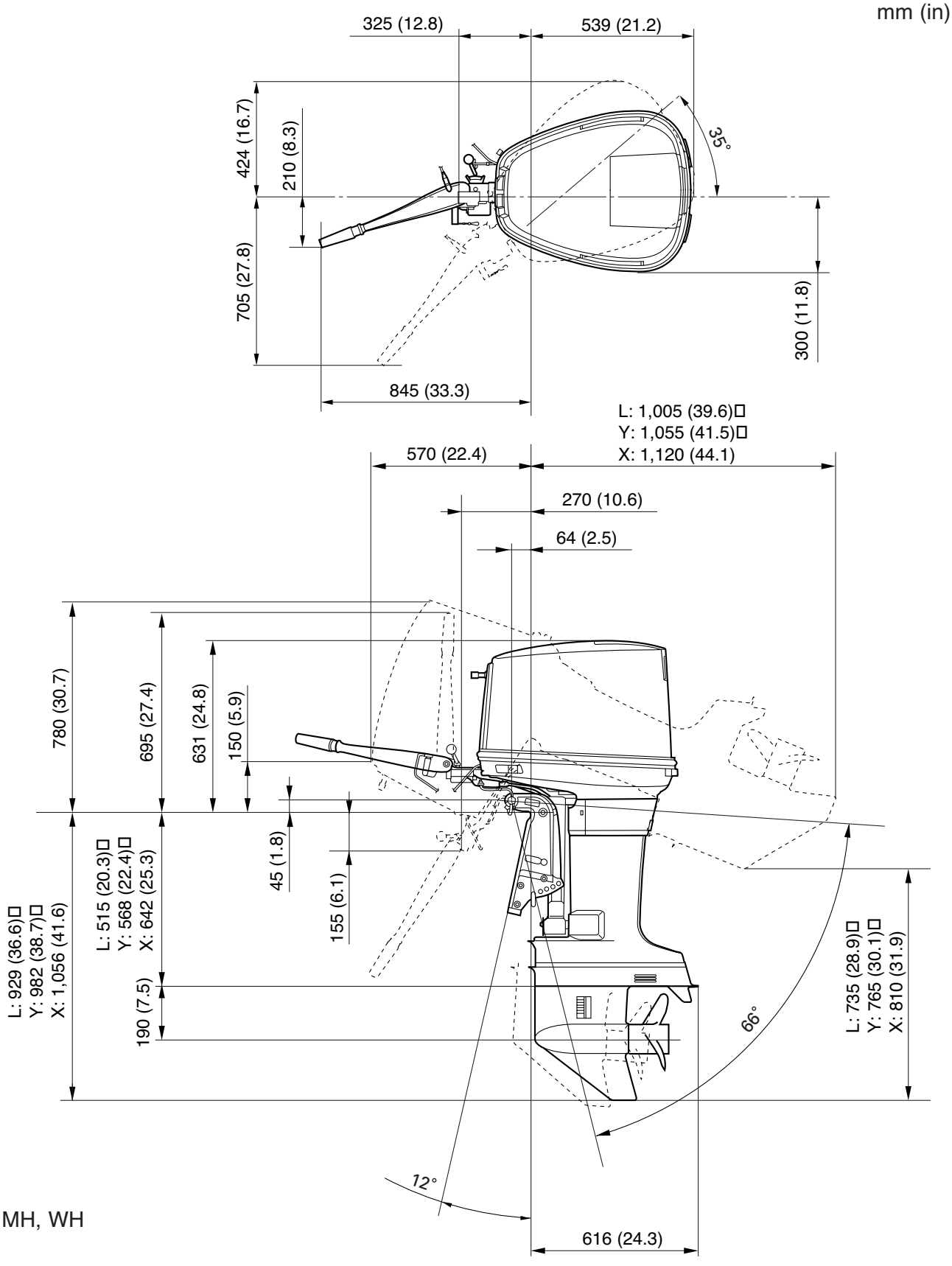
Item	Unit	Model		
		115BE	115BET	140BET
PTT system				
Trim sensor resistance at 20°C (68°F) (P–B)	Ω	—	239–379	
Fluid type		—	ATF Dexron Ⅱ	
Motor type		—	64E00	
Output	kW	—	0.40	
Brushes				
Standard length	mm (in)	—	9.8 (0.39)	
Wear limit	mm (in)	—	4.8 (0.19)	
Commutator				
Standard diameter	mm (in)	—	22.0 (0.87)	
Wear limit	mm (in)	—	21.0 (0.83)	
Standard undercut	mm (in)	—	1.35 (0.053)	
Wear limit	mm (in)	—	0.85 (0.033)	
Hydraulic pressure (down)	MPa (kgf/cm²)	—	6–9 (60–90)	
Hydraulic pressure (up)	MPa (kgf/cm²)	—	10–12 (100–120)	

Dimension

Exterior

E115A

mm (in)

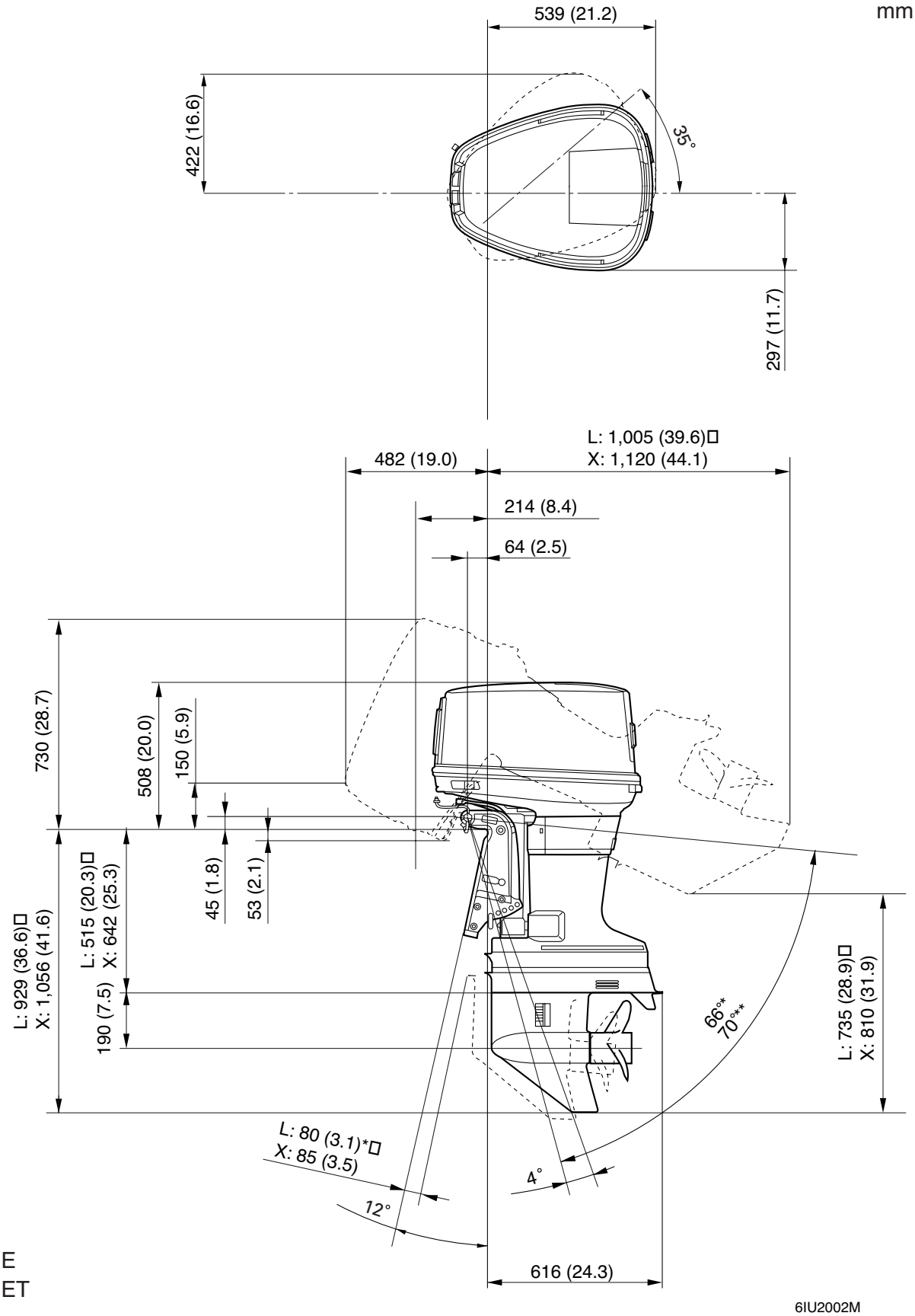


MH, WH

61U2001M

E115A, 115B, 140B

mm (in)

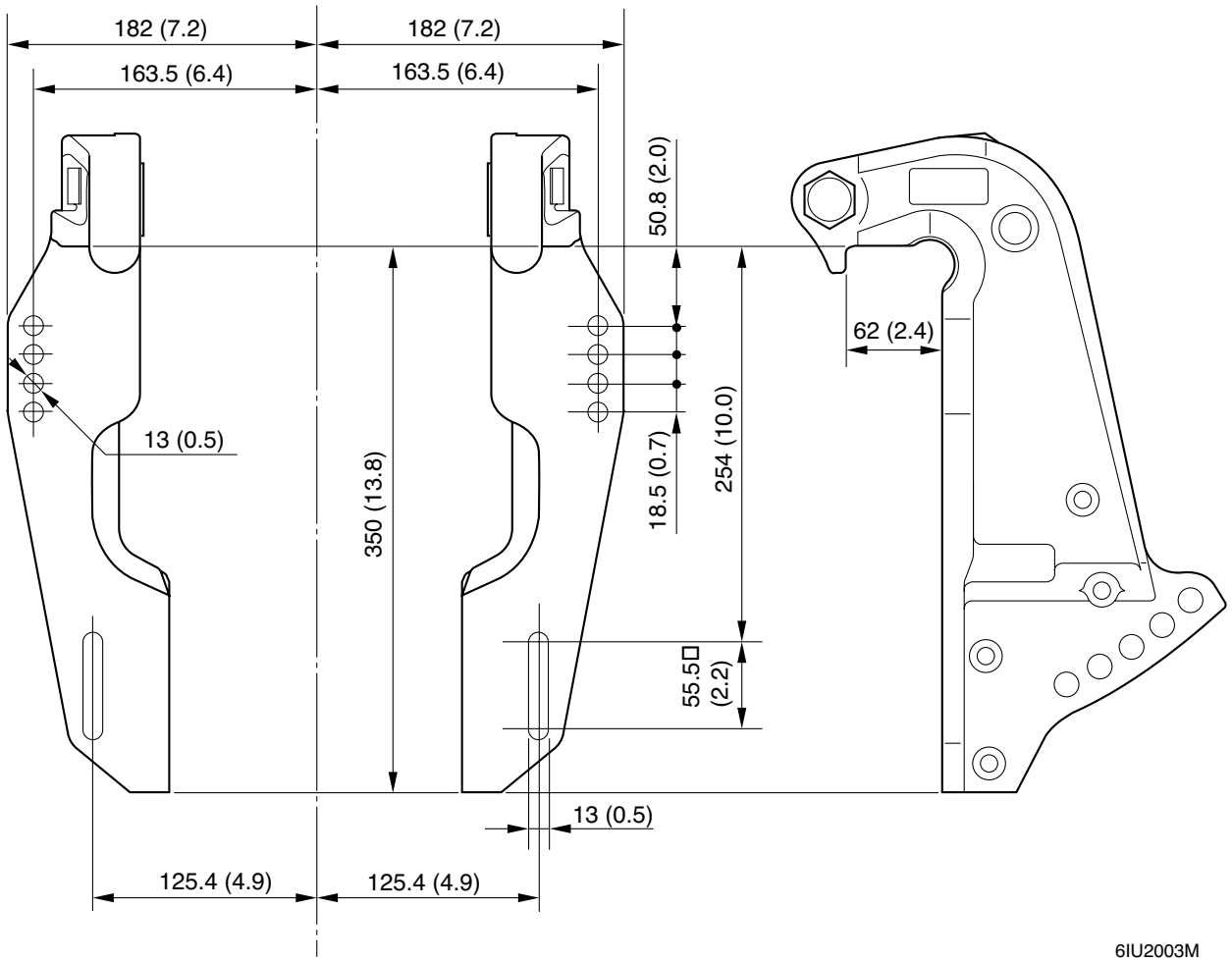


* E
** ET

6IU2002M

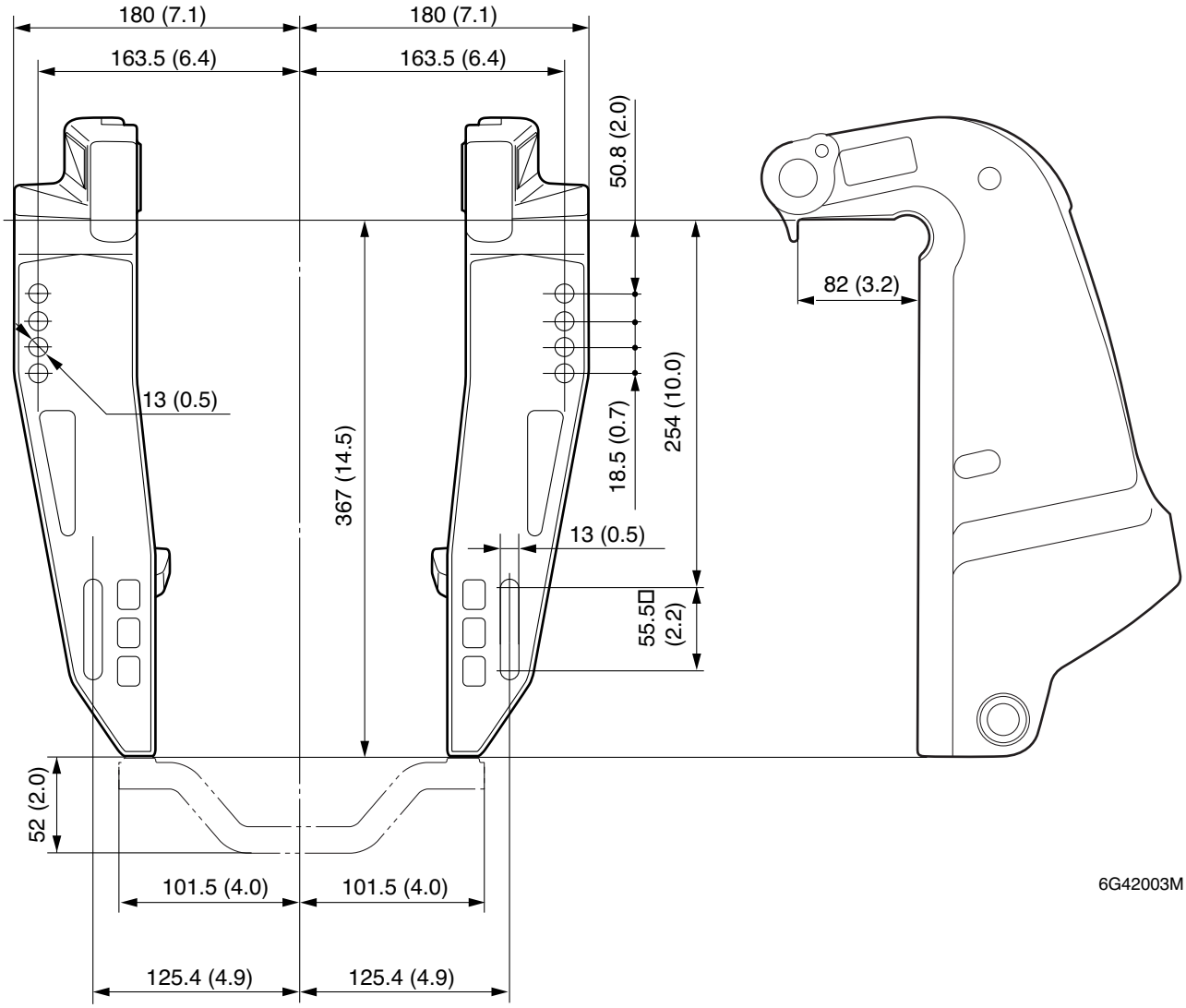
Clamp bracket

mm (in)



mm (in)

2


180 (7.1)
180 (7.1)
163.5 (6.4)
163.5 (6.4)
50.8 (2.0)
82 (3.2)
13 (0.5)
367 (14.5)
18.5 (0.7)
254 (10.0)
13 (0.5)
55.5□
(2.2)
52 (2.0)
101.5 (4.0)
101.5 (4.0)
125.4 (4.9)
125.4 (4.9)
6G42003M

Tightening torque

Specified torque

Part to be tightened		Thread size	Tightening torques		
			N·m	kgf·m	ft·lb
Fuel system					
Intake silencer cover bolt		M6	6	0.6	4.4
Manual injection cable end bolt		M5	4	0.4	3.0
Screw (carburetor)		—	2	0.2	1.5
Plug (carburetor)		—	6	0.6	4.4
Plug (float chamber)		—	10	1.0	7.4
Fuel pump screw		—	3.5	0.35	2.6
Power unit					
Power unit bolt		M8	25	2.5	18.4
Apron bolt		M6	8	0.8	5.9
Flywheel magnet nut		—	186	18.6	137
Hour meter screw		—	3	0.3	2.2
Relay terminal nut		—	4	0.4	3.0
Starter motor mount bolt		M8	29	2.9	21.4
Starter motor positive terminal nut		—	9	0.9	6.6
Intake manifold bolt	1st	M6	4	0.4	3.0
	2nd		8	0.8	5.9
Thermostat cover bolt	1st	M6	4	0.4	3.0
	2nd		8	0.8	5.9
Cover bolt	1st	M6	4	0.4	3.0
	2nd		8	0.8	5.9
PCV cover bolt	1st	M6	4	0.4	3.0
	2nd		8	0.8	5.9
Exhaust cover bolt	1st	M6	4	0.4	3.0
	2nd		8	0.8	5.9
Cylinder head cover bolt	1st	M6	4	0.4	3.0
	2nd		8	0.8	5.9
Cylinder head bolt	1st	M8	15	1.5	11.1
	2nd		30	3.0	22.1
Spark plug		M14	25	2.5	18.4
Crankcase bolt	1st	M10	20	2.0	14.8
	2nd		37	3.7	27.3
	1st	M8	10	1.0	7.4
	2nd		18	1.8	13.3
Connecting rod bolt	1st	M8	19	1.9	14.0
	2nd		36	3.6	26.6
	3rd		Loosen completely		
	4th		19	1.9	14.0
	5th		36	3.6	26.6
Sensor plug		—	23	2.3	17.0
Bearing housing bolt		M6	12	1.2	8.9

Part to be tightened	Thread size	Tightening torques		
		N·m	kgf·m	ft·lb
Lower unit				
Check screw	—	9	0.9	6.6
Drain screw	—	9	0.9	6.6
Lower case mount bolt	M10	39	3.9	28.8
Lower case mount nut (E115A: Y-transom)	—	39	3.9	28.8
Trim tab bolt	M10	39	3.9	28.8
Water pump housing bolt	M8	18	1.8	13.3
Ring nut	—	103	10.3	76.0
Pinion nut	—	93	9.3	68.6
Propeller nut	—	54	5.4	39.8
Cooling water inlet cover screw	—	4	0.4	3.0
Bracket unit				
Lock nut	—	11	1.1	8.1
Tiller handle mount nut (MH, WH)	—	37	3.7	27.3
Tiller handle bracket nut (MH, WH)	—	37	3.7	27.3
Engine stop lanyard switch nut	—	3	0.3	2.2
Engine start switch nut (WH)	—	4	0.4	3.0
Shift position bolt	—	24	2.4	17.7
Upper mount nut	—	51	5.1	37.6
Lower mount nut	—	71	7.1	52.4
Exhaust guide bolt	M8	18	1.8	13.3
Exhaust manifold bolt	M8	18	1.8	13.3
Muffler bolt	M8	18	1.8	13.3
Upper case mount bolt	M8	21	2.1	15.5
Self-locking nut	—	15	1.5	11.1
Trim stopper nut	—	36	3.6	26.6
Trim sensor cam screw		—	2	0.2
1.5				
PTT unit				
PTT motor mount bolt	M6	5	0.5	3.7
Reservoir tank mount bolt	M6	5	0.5	3.7
Reservoir cap	—	7	0.7	5.2
Manual valve	—	3	0.3	2.2
Gear pump cover bolt	M5	6	0.6	4.4
Gear pump housing bolt	M6	8	0.8	5.9
Tilt cylinder end screw	—	127	12.7	93.7
Tilt piston nut	—	96	9.6	70.8
Trim cylinder end screw	—	132	13.2	97.4
Erectrical				
Starter motor bracket bolt	M8	30	3.0	21.1

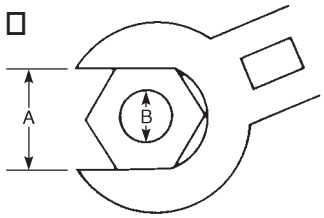
General torque

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

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

Components should be at room temperature.

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



CHK
ADJ

Periodic check and adjustment

Maintenance interval chart 3-1

Top cowling 3-2
Checking the top cowling 3-2

Fuel system 3-2
Checking the fuel joint and fuel hose (fuel joint-to-carburetor) 3-2
Checking the fuel filter 3-2

Power unit 3-3
Checking the spark plug 3-3
Checking the thermostat 3-3
Checking the cooling water passage 3-4

Control system 3-4
Adjusting the start-in-gear protection (MH, WH) 3-4
Checking the control link and throttle link position 3-5
Synchronizing the carburetor 3-5
Checking the engine idle speed 3-6
Adjusting the throttle cable 3-6
Checking the gear shift operation 3-7
Checking the ignition timing 3-8
Checking the choke solenoid (E, ET) 3-9

Bracket 3-10
Checking the PTT operation (ET) 3-10
Checking the PTT fluid level (ET) 3-10
Checking the tilt operation (MH, WH, E) 3-11

Lower unit 3-11
Checking the gear oil level 3-11
Changing the gear oil 3-12
Checking the lower unit for air leakage 3-13
Checking the propeller 3-13

General 3-13
Checking the anode 3-13
Checking the battery (WH, E, ET) 3-14
Lubricating the outboard motor 3-14

3

Maintenance interval chart

Use the following chart as a guideline for general maintenance.
Adjust the maintenance intervals according to the operating conditions of the outboard motor.

Item	Actions	Initial		Every		Refer to page
		10 hours (Break-in)	50 hours (3 months)	100 hours (6 months)	200 hours (1 year)	
Anode (s) (external)	Check / replace		○	○		3-13
Anode (s) (internal)	Check / replace				○	3-13
Battery	Check / charge	○				3-14
Cooling water passages	Clean		○	○		3-4
Cowling clamp	Check				○	3-2
Fuel filter (can be disassembled)	Check / clean	○	○	○		3-2
Fuel system	Check	○	○	○		3-2
Fuel tank (Yamaha portable tank)	Check / clean				○	—
Gear oil	Change	○		○		3-12
Lubrication points	Lubricate			○		3-14
Idle speed (carburetor model)	Check / adjust	○		○		3-6
PCV	Check				○	5-26
PTT unit	Check / replace		○	○		3-10
Propeller and cotter pin	Check / replace		○	○		3-13
Shift link / shift cable	Check / adjust				○	3-7
Thermostat	Check				○	3-3
Throttle link / throttle cable / throttle pick-up timing	Check / adjust				○	3-5 3-6
Water pump	Check				○	6-5
Spark plugs	Clean / adjust / replace	○	○	○		3-3

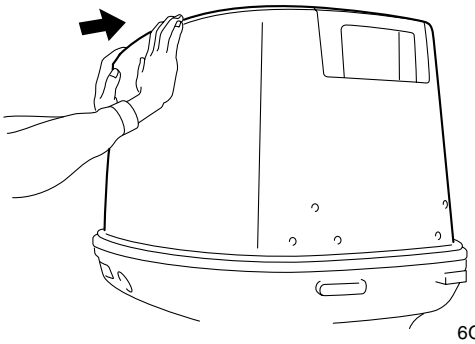
NOTE:

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

Top cowling

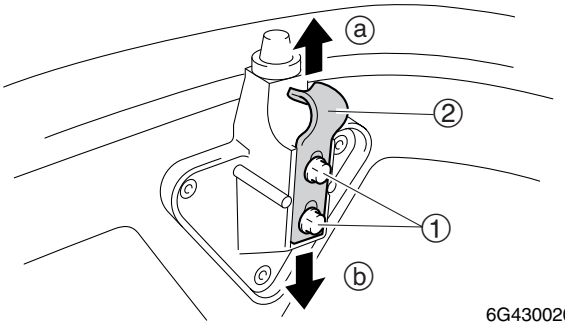
Checking the top cowling

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


6G430010

2. Loosen the bolts ①.

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



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NOTE:
- To loosen the fitting, move the hook ② in direction ⓐ.
- To tighten the fitting, move the hook ② in direction ⓑ.

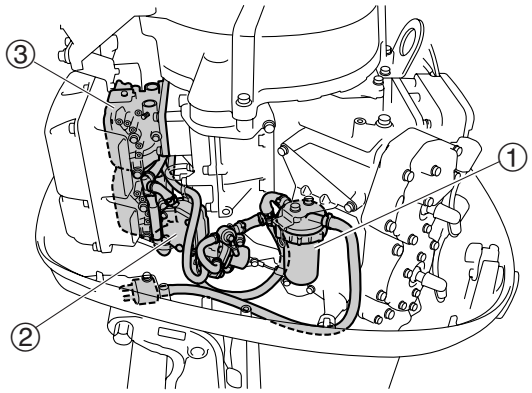
4. Tighten the bolts ①.

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

Fuel system

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

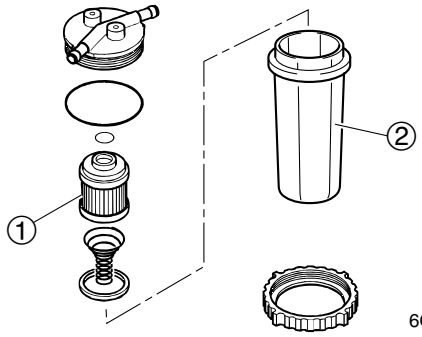
1. Check the fuel hose connections and fuel joint for leaks. Replace them if necessary. Also, check the fuel filter ①, fuel pump ②, and carburetors ③ for leaks or deterioration. Replace if necessary.



61U30200

Checking the fuel filter

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



6G430045

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

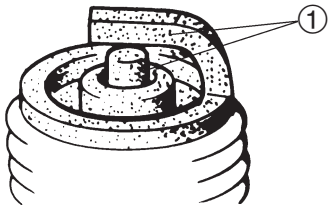
3

Power unit

Checking the spark plug

1. Disconnect the spark plug caps, and then remove the spark plugs.

2. Clean the electrodes ① with a spark plug cleaner or wire brush. Replace the spark plug if necessary.



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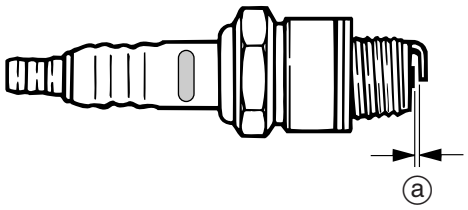
3. Check the electrodes for erosion and excessive carbon or other deposits, and the gasket for damage. Replace the spark plug if necessary.

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



6B430030

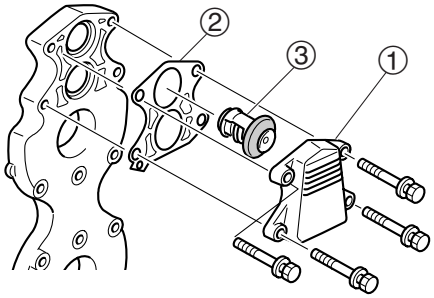
Specified spark plug:
E115AMH, E115AWH
B8HS-10 (NGK)
E115AE, E115AET
B8HS-10, BR8HS-10 (NGK)
115B
B8HS-10, BR8HS-10 (NGK)
140B
B9HS-10, BR9HS-10 (NGK)
Spark plug gap ⓐ:
0.9–1.0 mm (0.035–0.039 in)

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

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

Checking the thermostat

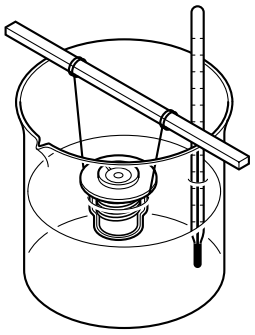
1. Remove the thermostat covers ①, gaskets ②, and thermostats ③.



61U30210

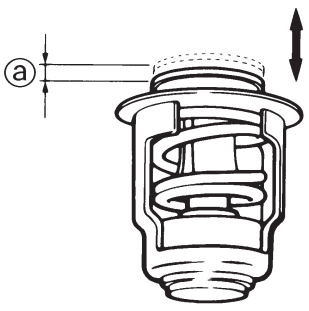
2. Suspend the thermostats ③ in a container with water.

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



6B430060

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



6B430070

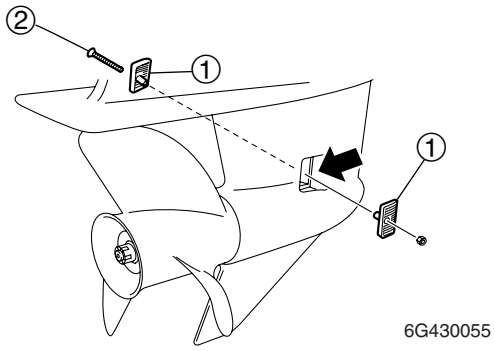
Water temperature	Valve lift ⓐ
48–52°C (118.4–125.6°F)	0.05 mm (0.002 in) (valve begins to tilt)
above 60°C (140°F)	more than 3.0 mm (0.12 in)

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

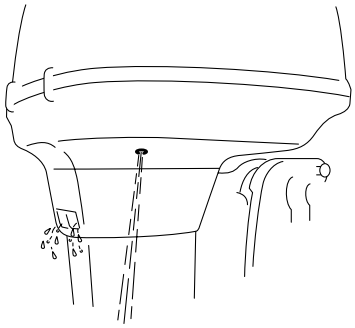
Thermostat cover bolt:
1st : 4 N·m (0.4 kgf·m, 3.0 ft·lb)
2nd : 8 N·m (0.8 kgf·m, 5.9 ft·lb)

Checking the cooling water passage

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



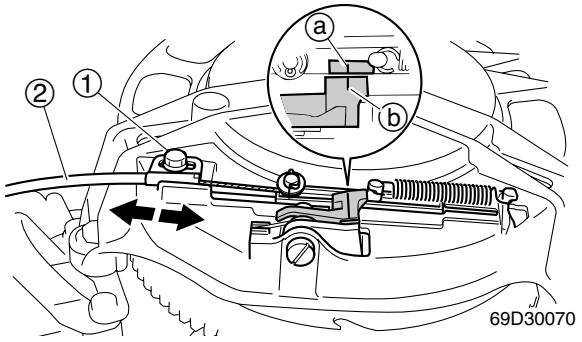
2. Place the lower unit in water, and then start the engine.
3. Check for water flow at the cooling water pilot hole. If there is no water flow, check the cooling water passage inside of the outboard motor.



Control system

Adjusting the start-in-gear protection (MH, WH)

1. Set the gear shift to the neutral position.
2. Loosen the bolt ①, and then adjust the start-in-gear protection cable ② until the mark ⓐ, aligns with the mark ⓑ as shown.

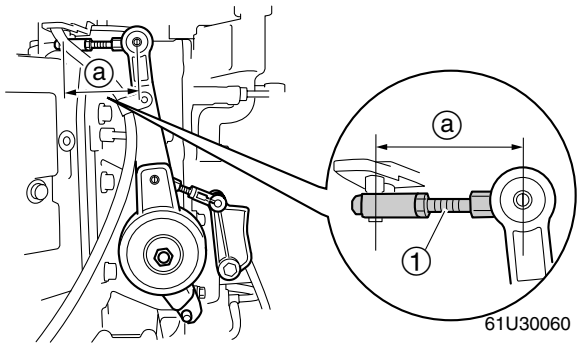


3. Tighten the bolt ①.

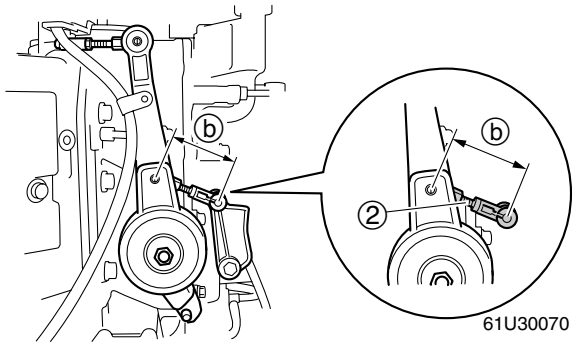
Checking the control link and throttle link position

1. Remove the throttle cable.

2. Measure the length of control link rod ①.



3. Measure the length of throttle link rod ②.



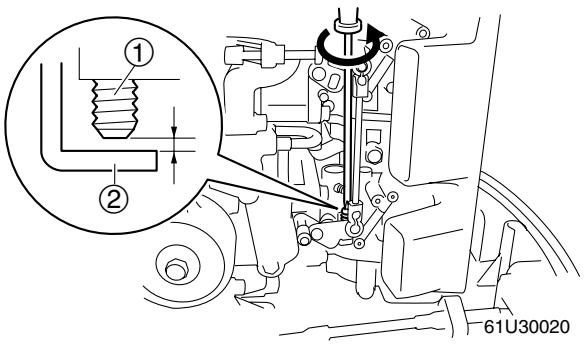
4. Adjust the length of the link rod if out of specification.

Length (reference):
ⓐ : 60 mm (2.36 in)
ⓑ : 53 mm (2.09 in)

Synchronizing the carburetor

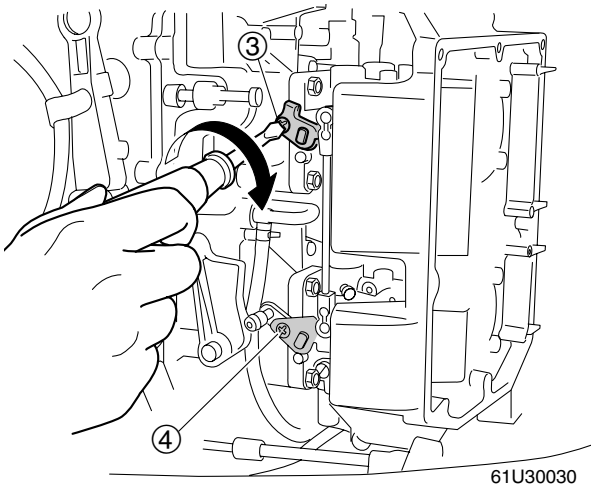
1. Remove the throttle cable and intake silencer cover.

2. Loosen the throttle stop screw ① on the lower carburetor to make a clearance until the screw tip does not touch the stopper ②.



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

3. Loosen the throttle lever tightening screws ③ and ④ clockwise.



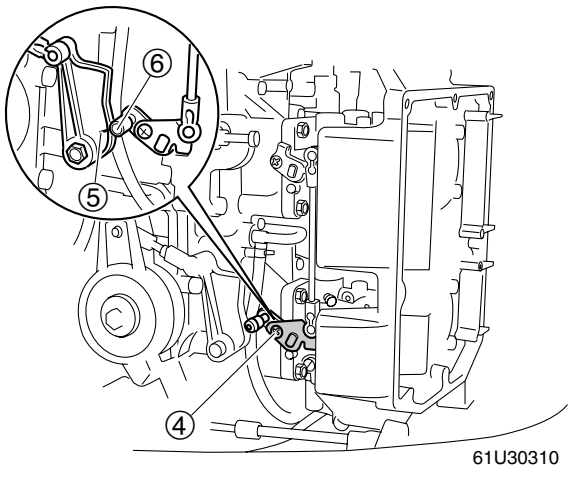
NOTE:
The screws ③ and ④ are left hand thread.

4. Make sure that the throttle valves are fully closed position.

5. Tighten the throttle lever tightening screw ③ counterclockwise on the upper carburetor.

6. Turn the throttle stop screw ① until it contacts the stopper. From this position, tighten it another 1 1/8 turns further.

7. Make sure that the mark ⑤ on the accelerator cam align with the center of the roller ⑥ on the lower carburetor.



8. Tighten the throttle lever tightening screw ④ counterclockwise on the lower carburetor.

NOTE:
The screw ④ is left hand thread.

9. Make sure the throttle valves are open and close simultaneously.

10. Install the throttle cable and intake silencer.

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

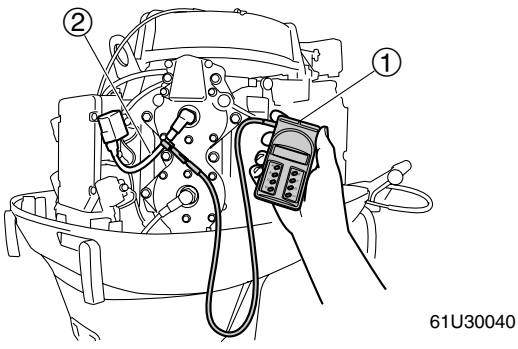
Checking the engine idle speed

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

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

Digital tachometer ①: 90890-06760

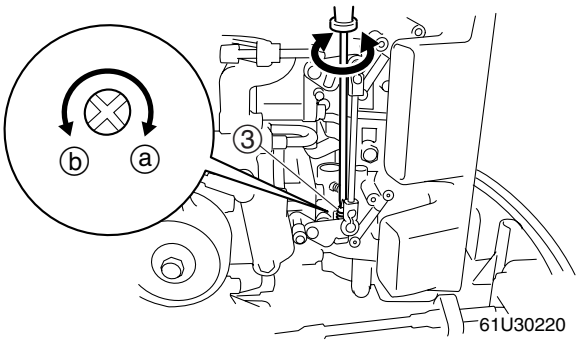
2. Start the engine and warm it up for 5 minutes, and then check the engine idle speed. Adjust if out of specification.



Engine idle speed:
700–800 r/min

NOTE:
Verify the stability of the engine idle speed.

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



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

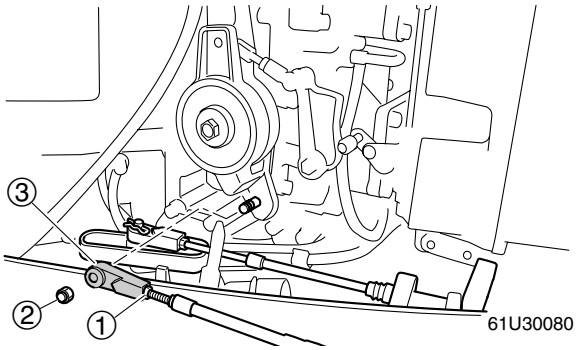
4. If the specified engine idle speed cannot be obtained, adjust the pilot screws.

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

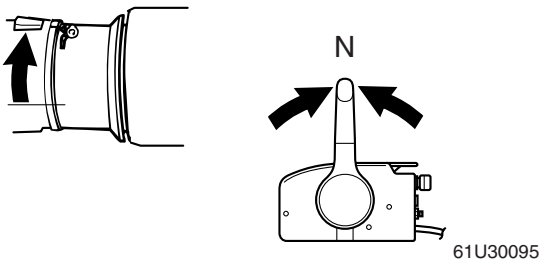
Adjusting the throttle cable

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

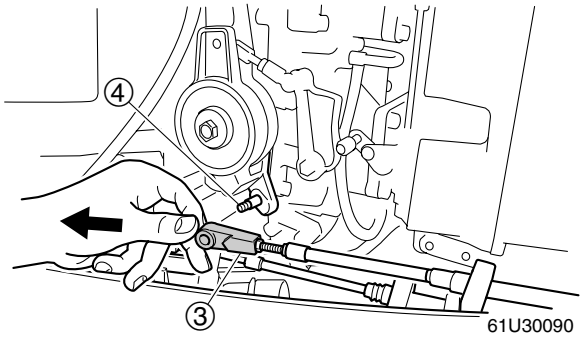
1. Loosen the locknut ①, remove the nut ② and then remove the throttle cable joint ③.

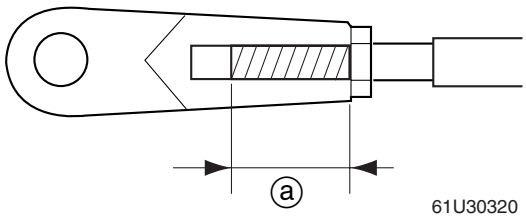


2. Set the throttle grip or remote control lever to the fully closed position.



3. Adjust the position of the throttle cable joint ③ until its hole aligned with the set pin ④ on control lever.





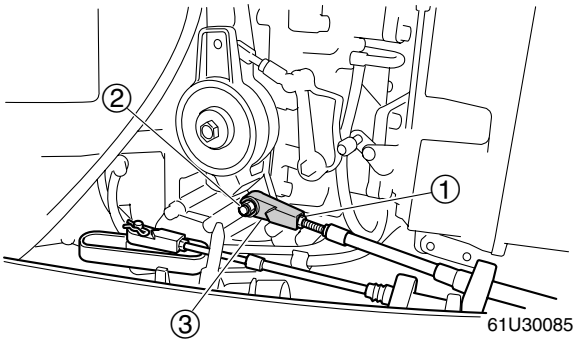
⚠WARNING

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

NOTE:

Pull the throttle cable arrow direction shown to remove any free play in the cable before adjusting the position of the throttle cable joint.

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



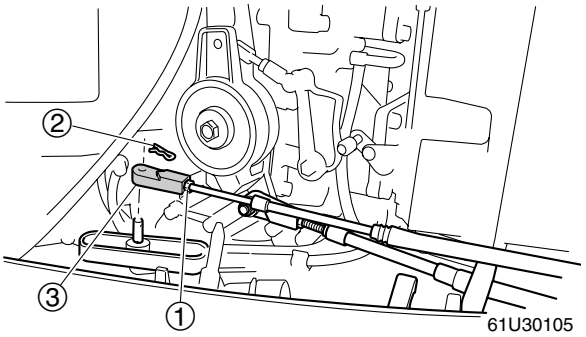
5. Check the throttle grip or remote control lever fully closed position and adjust the throttle cable length, if necessary, repeat the steps 1–4.

Checking the gear shift operation

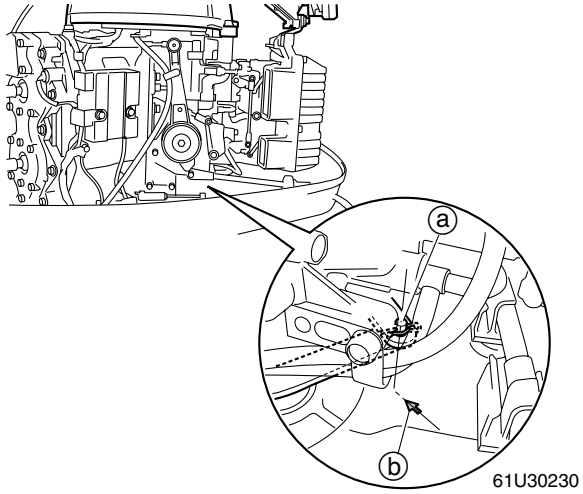
1. Check that the gear shift operates smoothly when shifting it from neutral to forward or reverse. Adjust the shift cable if necessary.

2. Set the gear shift to the neutral position.

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

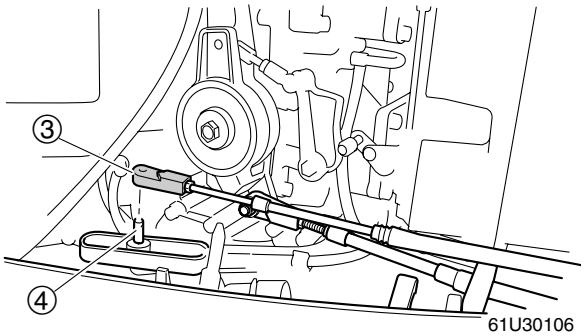


4. Make sure to align the center of the set pin ⓐ on the shift lever with the alignment mark ⓑ on the bottom cowling.

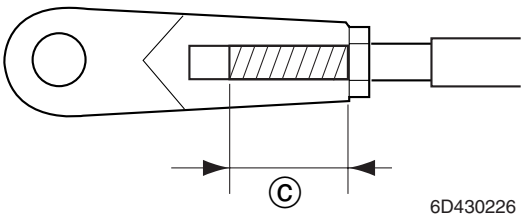


61U30230

5. Adjust the position of the shift cable joint ③ until its hole is aligned with the set pin ④.



61U30106

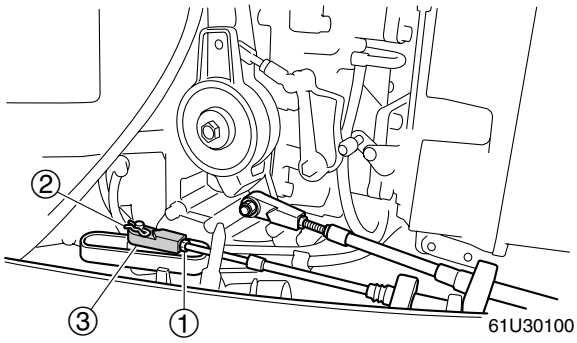


6D430226

⚠WARNING

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

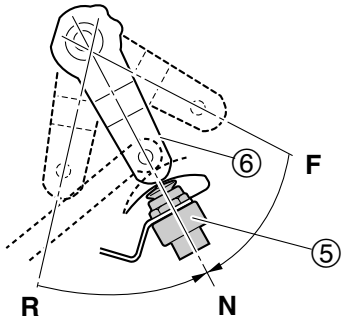
6. Install the shift cable joint ③, install the clip ②, and then tighten the locknut ①.



61U30100

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

8. Check that the neutral switch ⑤ is pushing by the shift lever ⑥. (WH)



61U30240

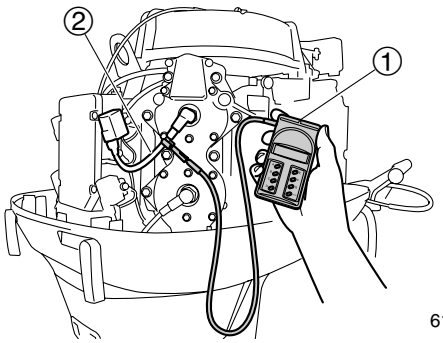
Checking the ignition timing

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

NOTE:

Turn off the engine when warmed it up completely.

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

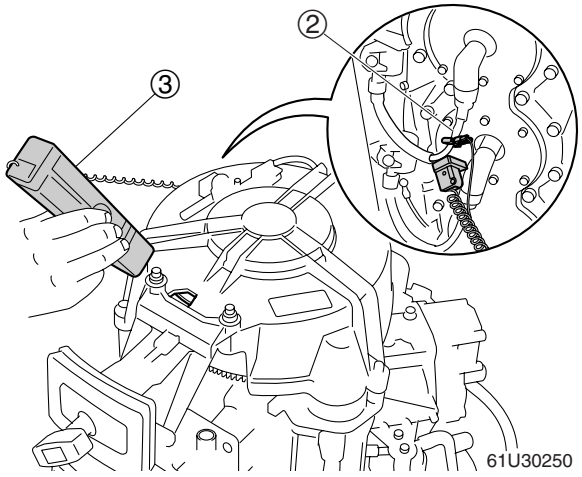


61U30040

Digital tachometer ①: 90890-06760

3

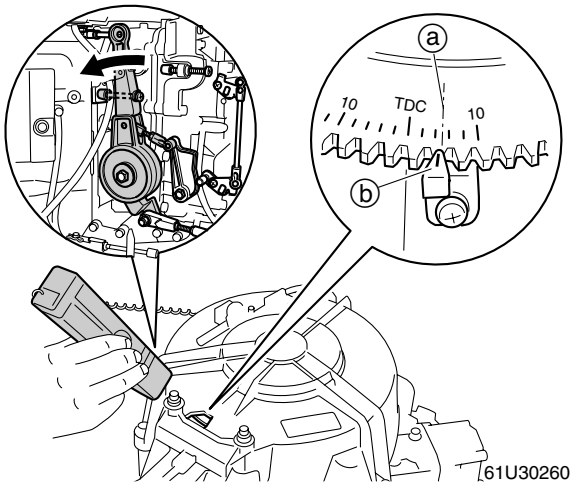
3. Attach the special service tool ③ to spark plug wire #1 ②, and then start the engine. Cheek the engine idle speed and ignition timing.



Engine idle speed:
700–800 r/min

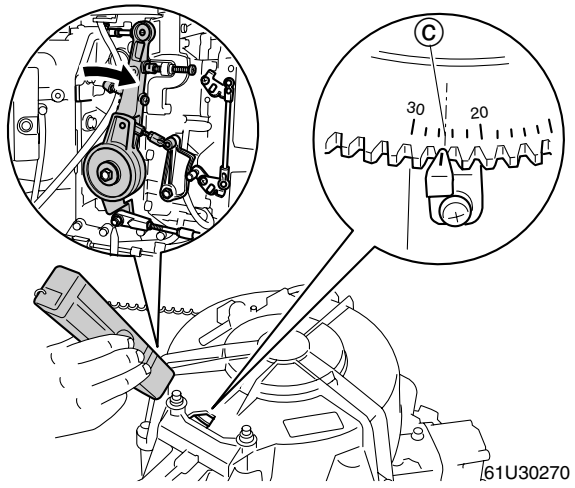
Timing light ③: 90890-03141

4. Check that the ATDC 5° scale ⓐ on the flywheel magnet is aligned with the pointer ⓑ on the timing plate, when the throttle is fully closed.



Timing plate position:
ATDC 4–6°

5. Check that the scale ⓒ on the flywheel magnet is advances to specified position, when the throttle is fully opened.



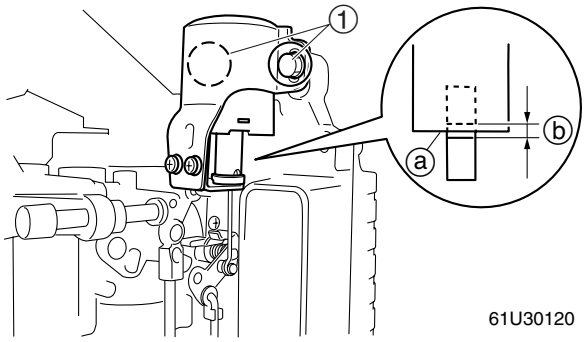
Engine speed (throttle fully opened):
5,500 r/min

Timing plate position:
E115A:
BTDC 22–24°
115B:
BTDC 24–26°
140B:
BTDC 21–23°

6. If the ignition timing is out of specification, refer to “Adjusting the timing plate” P5-52 and “Adjusting the ignition timing stopper” P5-53.

Checking the choke solenoid (E, ET)

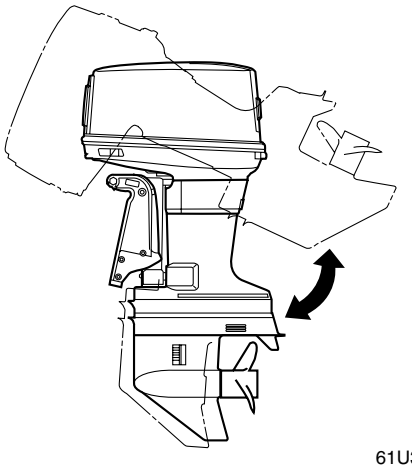
1. Check that the choke solenoid face ⓐ is between the line ⓑ on the plunger. Adjust the position of the choke solenoid to loosen the bolt ① if necessary.



Bracket

Checking the PTT operation (ET)

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

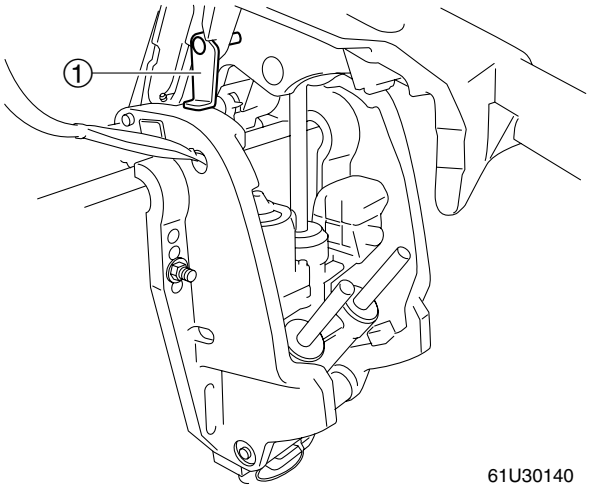


61U30280

NOTE:

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

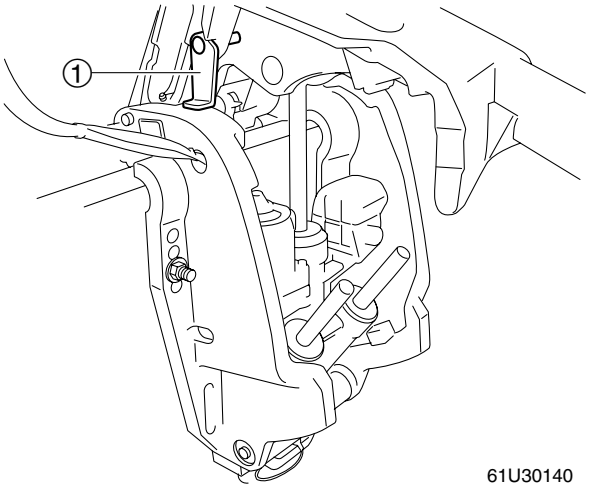
2. Fully tilt the outboard motor up, and then support it with the tilt stop lever ① to check the lock mechanism of the lever.



61U30140

Checking the PTT fluid level (ET)

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

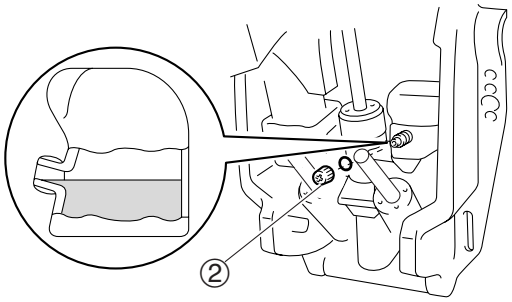


61U30140

⚠WARNING

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

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



6G430380

⚠WARNING

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

NOTE:

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

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

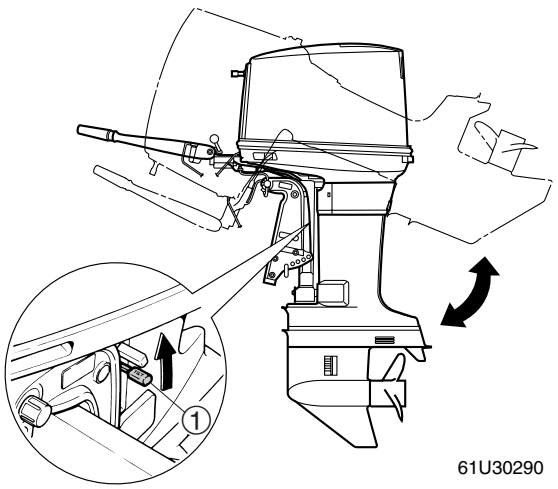
Recommended PTT fluid:
ATF Dexron Ⅱ

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

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

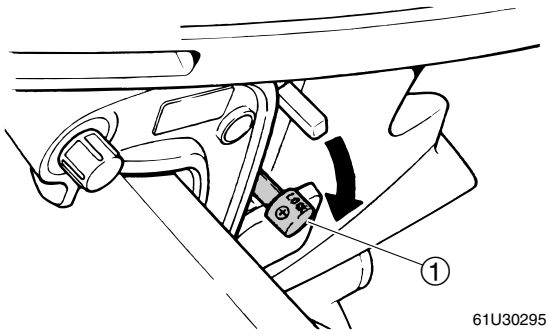
Checking the tilt operation (MH, WH, E)

1. Set the tilt lock lever ① to tilt position. Check the outboard motor could tilting up. Fully tilt the outboard motor up and down a few times and check the entire tilt range for smooth operation.



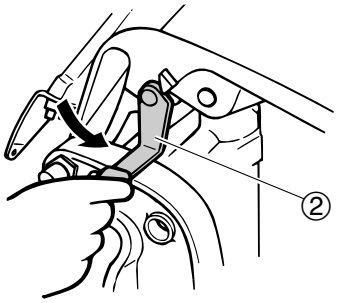
61U30290

2. Fully tilt the outboard motor down and set the tilt lock lever ① to lock position. Check the outboard motor could not tilting up.



61U30295

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



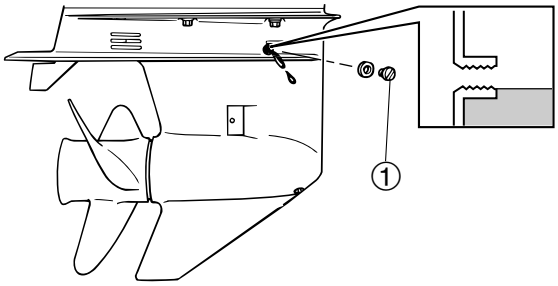
69D30135

Lower unit

Checking the gear oil level

1. Fully tilt the outboard motor down.

2. Remove the check screw ①, and then check the gear oil level in the lower case.



69D10055

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

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

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

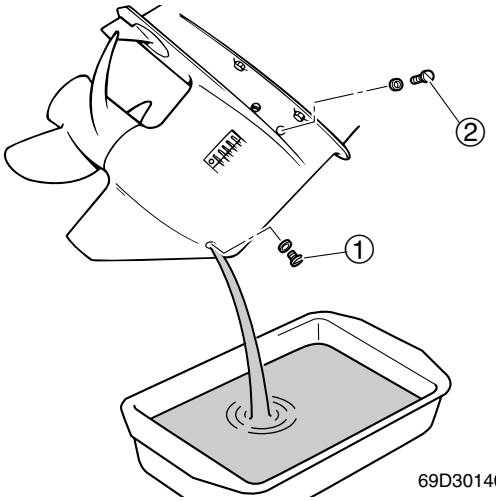
4. Install the new gasket, check screw ①, and then tighten it to the specified torque.

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

Changing the gear oil

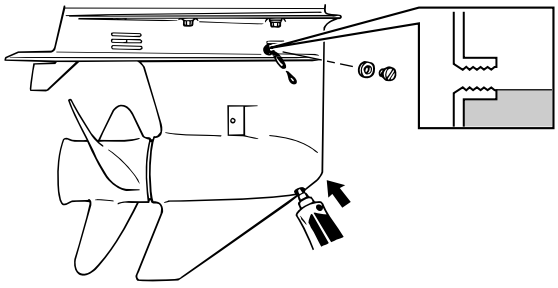
1. Tilt the outboard motor so that the gear oil drain screw at the lowest point possible.

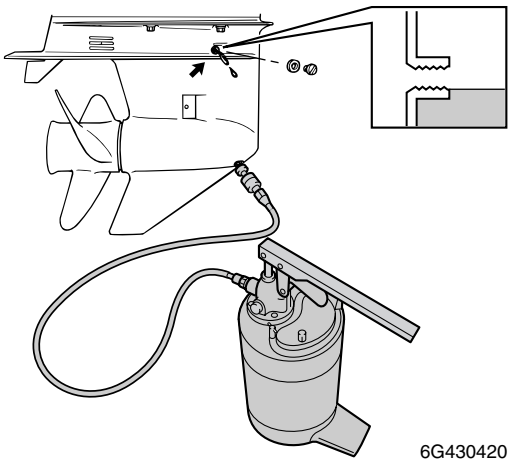
2. Place a drain pan under the drain screw ①, remove the drain screw, then the check screw ② and let the oil drain completely.



3. Check the oil for metal and discoloration, and its viscosity. Check the internal parts of the lower case if necessary.

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





Recommended gear oil:
Hypoid gear oil
API: GL-4
SAE: 90
Gear oil quantity
760 cm^3
(25.70 US oz, 26.81 Imp oz)

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

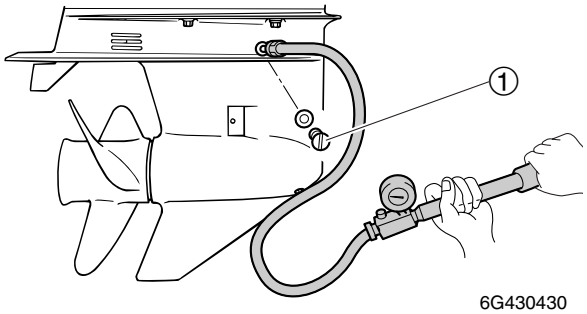
Check and drain screw:
9 N·m (0.9 kgf·m, 6.6 ft·lb)

Checking the lower unit for air leakage

CAUTION:

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

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



Leakage tester: 90890-06840

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

NOTE:

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

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

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

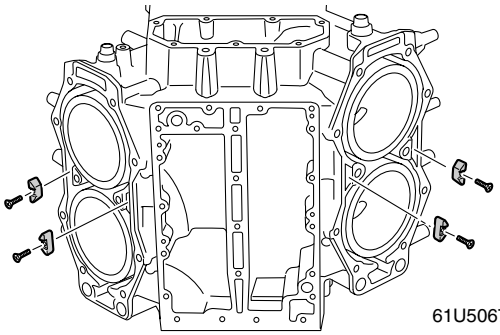
Checking the propeller

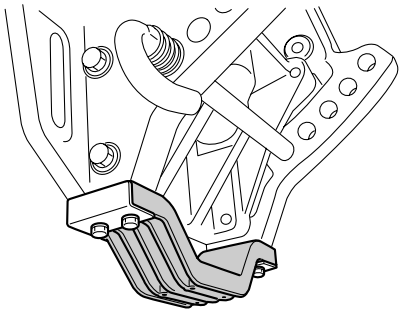
1. Check the propeller blades for cracks and splines for damage or wear. Replace if necessary.

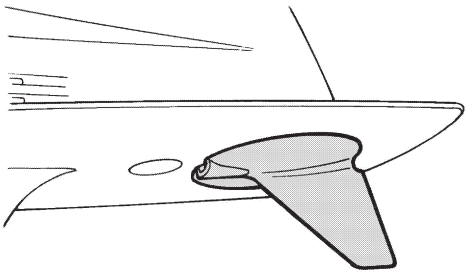
General

Checking the anode

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







CAUTION:

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

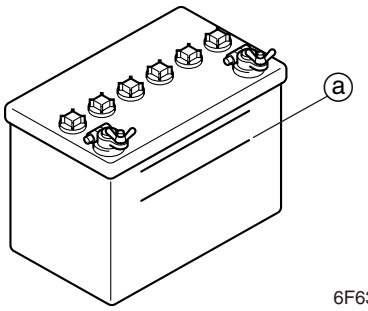
NOTE:

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

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

Checking the battery (WH, E, ET)

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



6F630240

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

⚠WARNING

Battery electrolyte is dangerous; it contains sulfuric acid which is poisonous and highly caustic.
- **Avoid bodily contact with electrolyte as it can cause severe burns or permanent eye injury.**
- **Wear protective eye gear when handling or working near batteries.**

Antidote (EXTERNAL):
- **SKIN – Wash with water.**
- **EYES – Flush with water for 15 minutes and get immediate medical attention.**

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

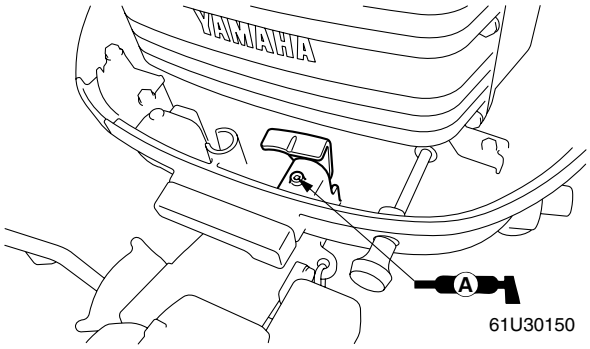
KEEP BATTERIES AND ELECTROLYTE OUT OF REACH OF CHILDREN.

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

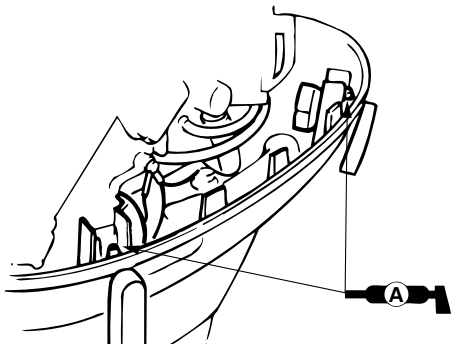
Electrolyte specific gravity:
1.280 at 20° C (68° F)

Lubricating the outboard motor

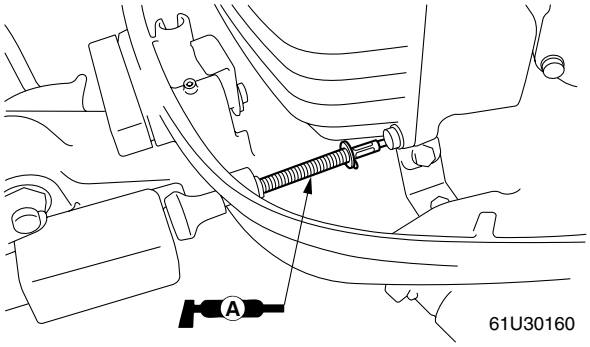
1. Apply water resistant grease to the areas shown.



61U30150

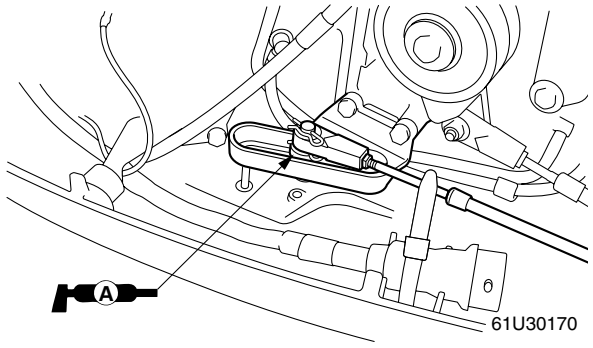


61U30300

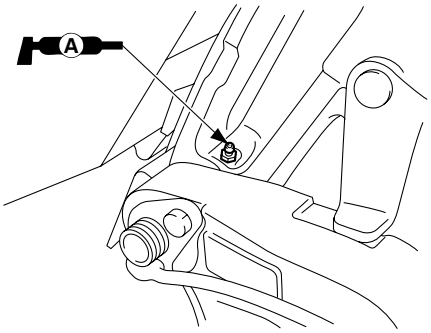


61U30160

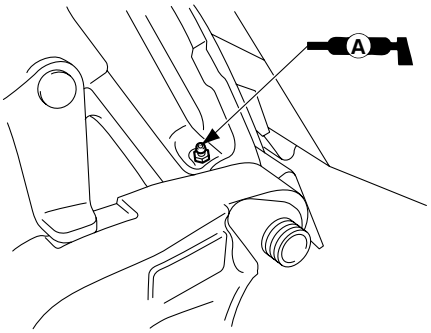
3



61U30170



6G430500



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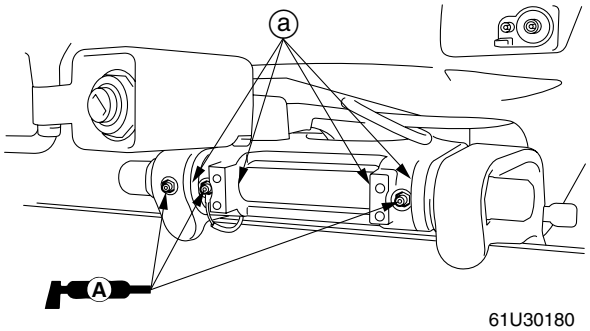
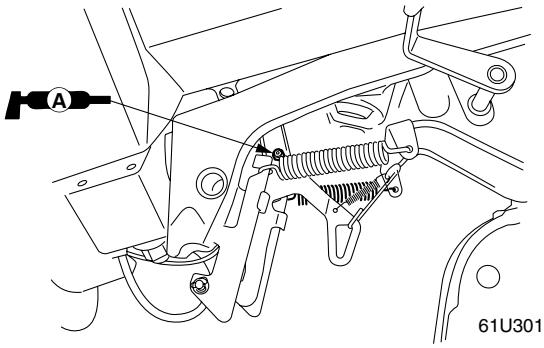
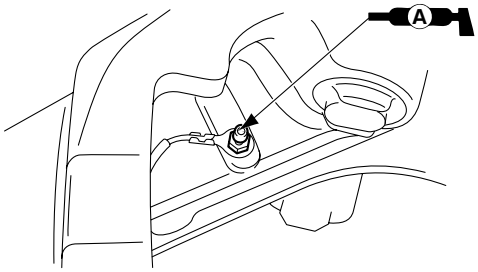
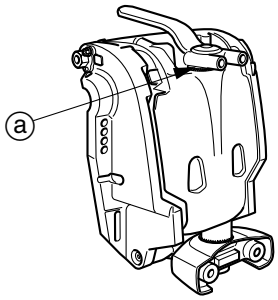


61U30180



61U30190

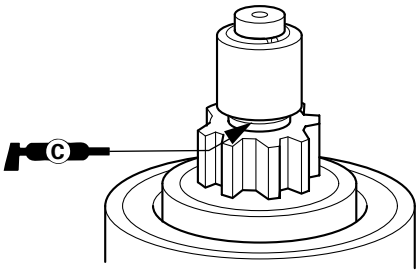




6G430530

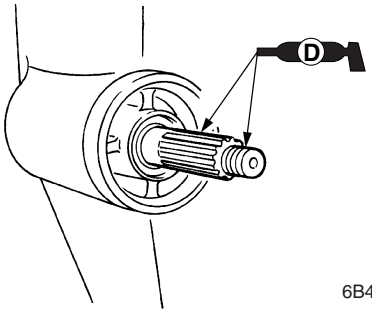
NOTE:
Apply grease to the grease nipple until it flows from the bushings ⓐ.

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



6G430540

3. Apply corrosion resistant grease to the area shown.



6B430300

Fuel system

Hose routing 4-1
Fuel hose and breather hose 4-1

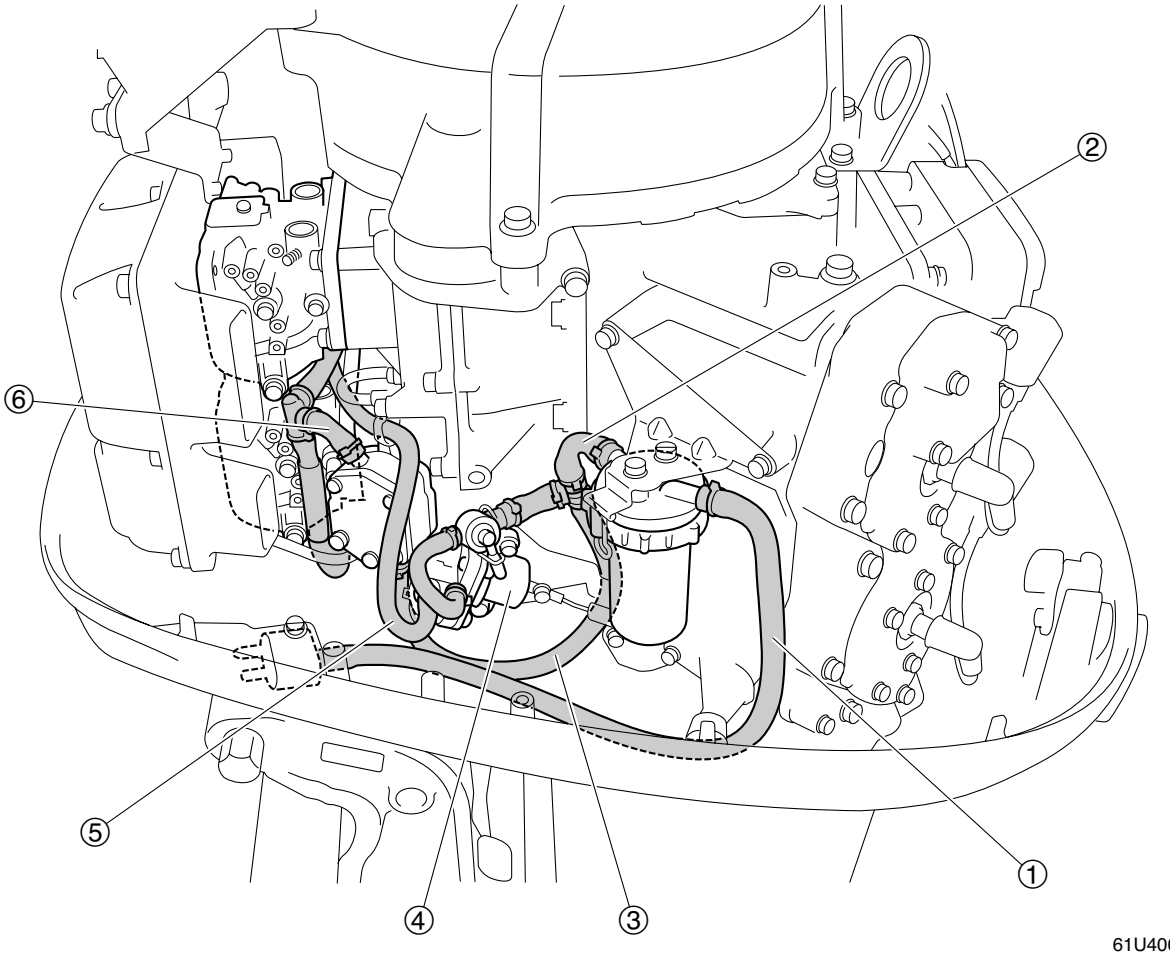
Fuel line 4-3

Carburetor 4-6
Disassembling the carburetor 4-12
Checking the carburetor 4-12
Assembling the carburetor 4-13

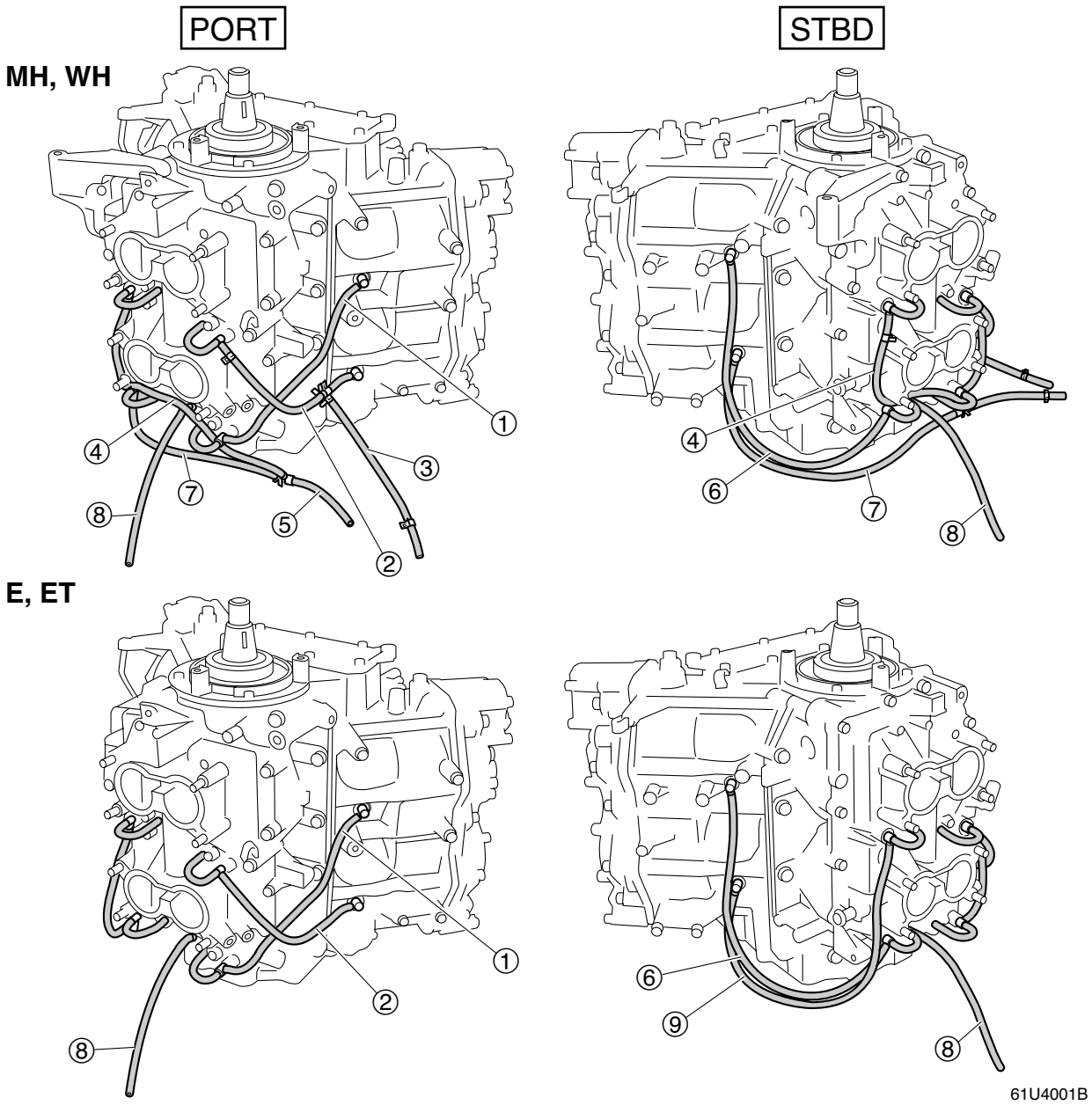
Fuel pump 4-15
Checking the fuel pump 4-16
Disassembling the fuel pump 4-16
Assembling the fuel pump 4-17
Checking the fuel joint 4-17

Hose routing

Fuel hose and breather hose

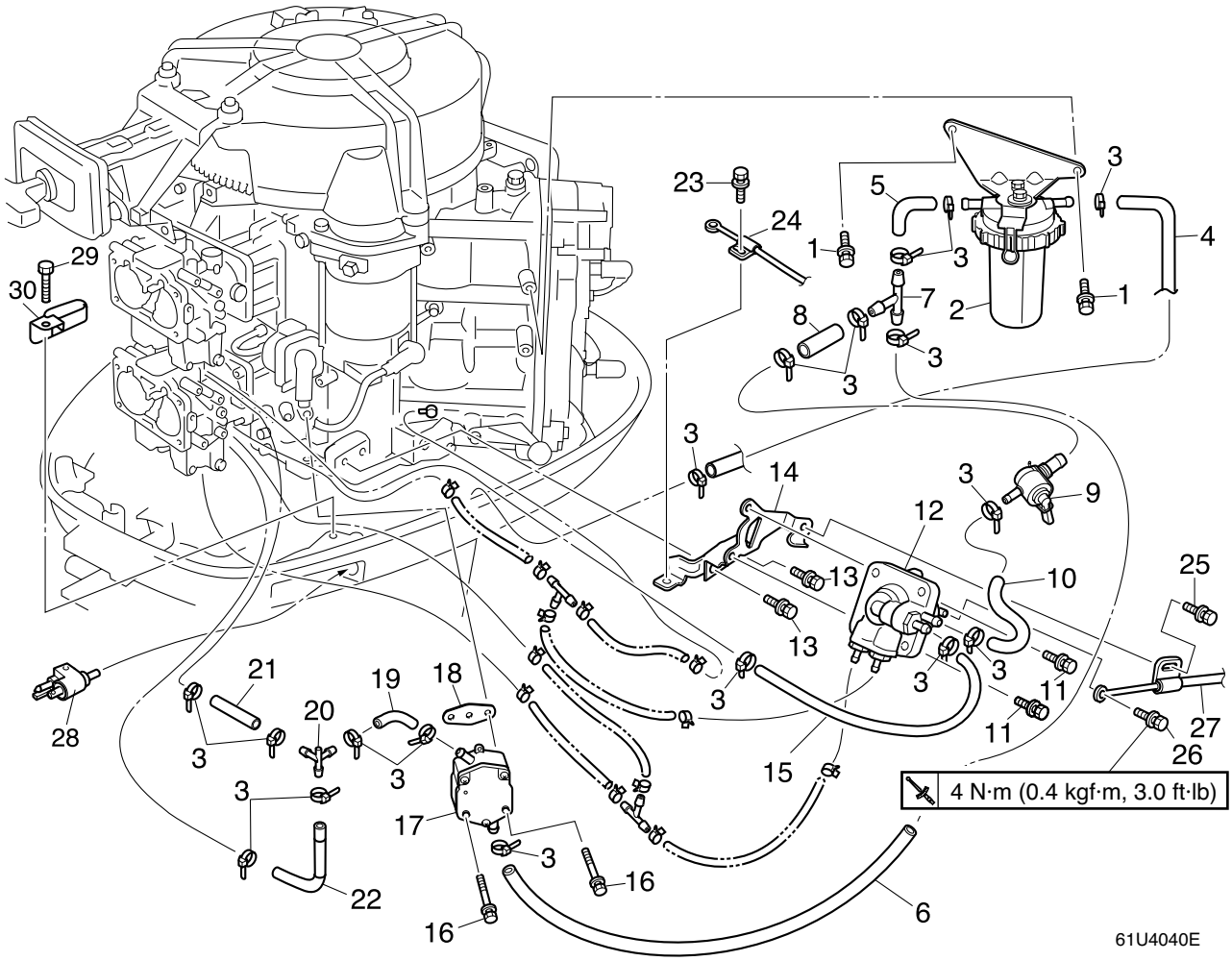


① Fuel hose (fuel joint-to-fuel filter)
② Fuel hose (fuel filter-to-manual injection : MH, WH)
③ Fuel hose (fuel filter-to-fuel pump)
④ Manual injection pump : MH, WH
⑤ Fuel hose (manual injection-to-upper carburetor : MH, WH)
⑥ Fuel hose (fuel pump-to-carburetor)

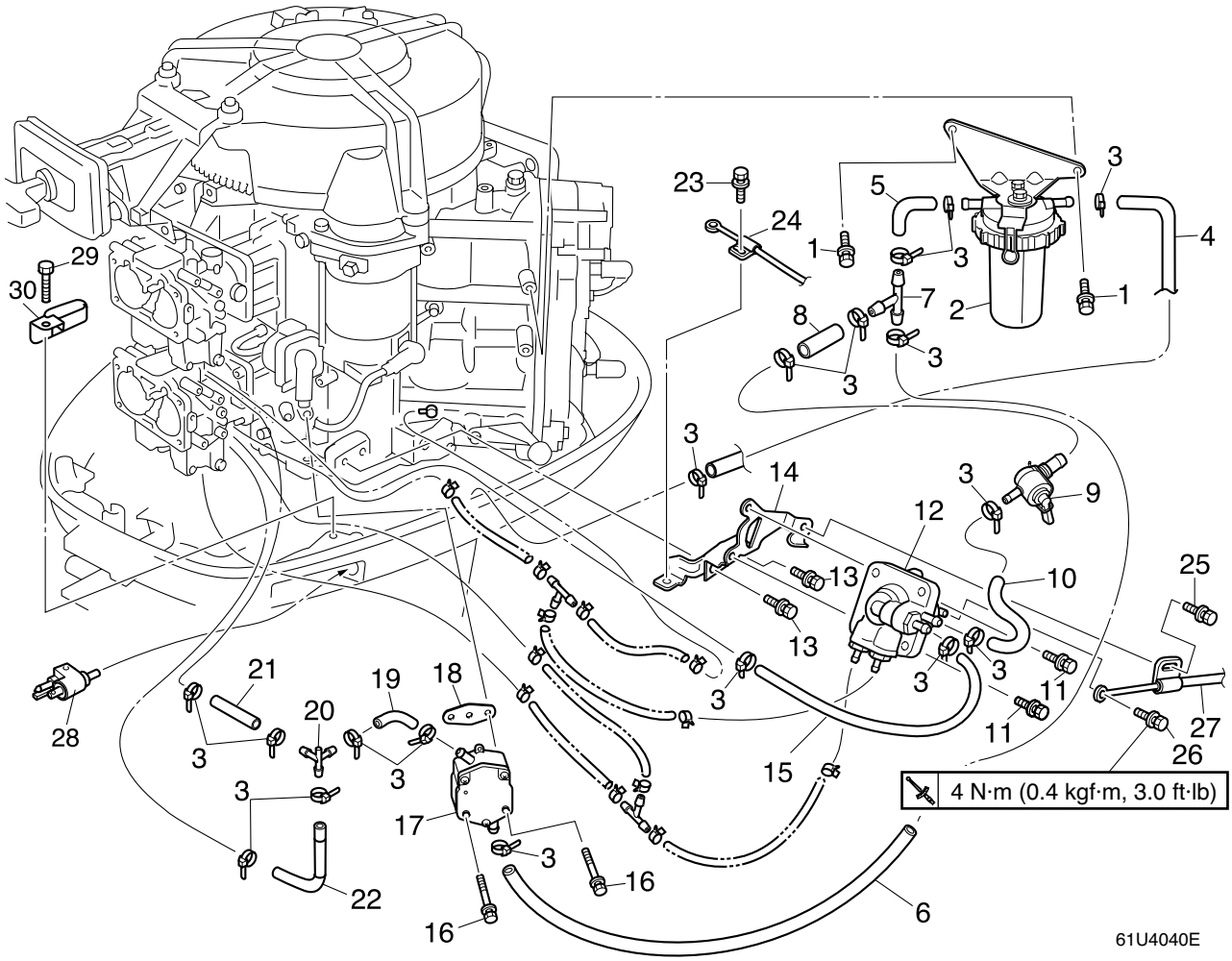


① Breather hose (manifold-to-cylinder body #2)
② Breather hose (manifold-to-cylinder body #4)
③ Breather hose (breather hose-to-manual injection)
④ Breather hose (manifold-to-manual injection)
⑤ Breather hose (breather hose-to-manual injection hose)
⑥ Breather hose (manifold-to-cylinder body #1)
⑦ Breather hose (cylinder body #3-to-manual injection hose)
⑧ Breather hose (manifold-to-intake silencer)
⑨ Breather hose (manifold-to-cylinder body #3)

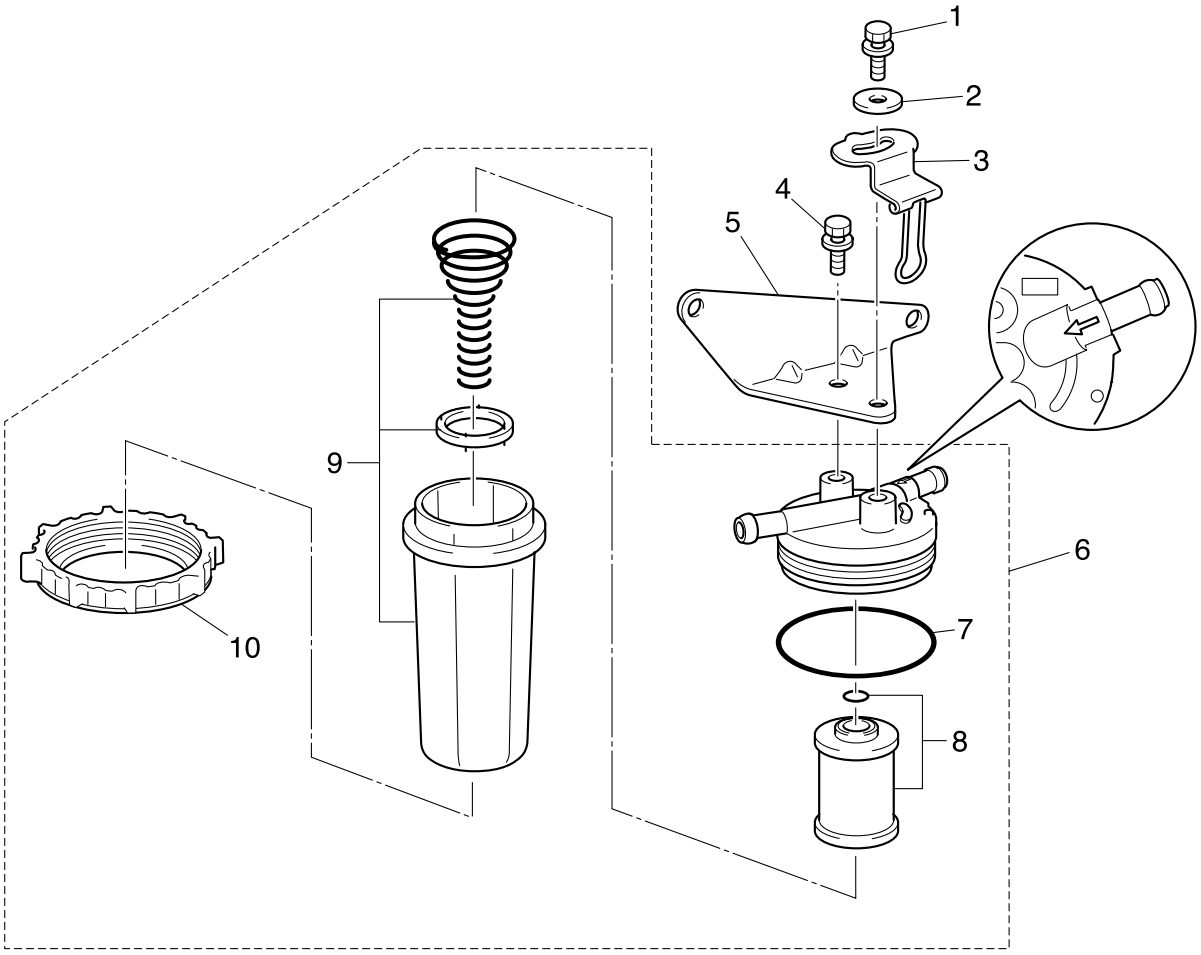
Fuel line



No.	Part name	Q'ty	Remarks
1	Bolt	2	M6 × 16 mm
2	Fuel filter assembly	1	
3	Lock tie	18	Not reusable MH, WH
	Lock tie	10	Not reusable E, ET
4	Fuel hose	1	
5	Fuel hose	1	MH, WH
6	Fuel hose	1	
7	Joint	1	MH, WH
8	Hose	1	MH, WH
9	Bypass valve	1	MH, WH
10	Hose	1	MH, WH
11	Bolt	2	M6 × 20 mm MH, WH
12	Manual injection pump	1	MH, WH
13	Bolt	2	M8 × 30 mm
14	Bracket	1	MH, WH
15	Hose	1	MH, WH
16	Bolt	2	M6 × 50 mm



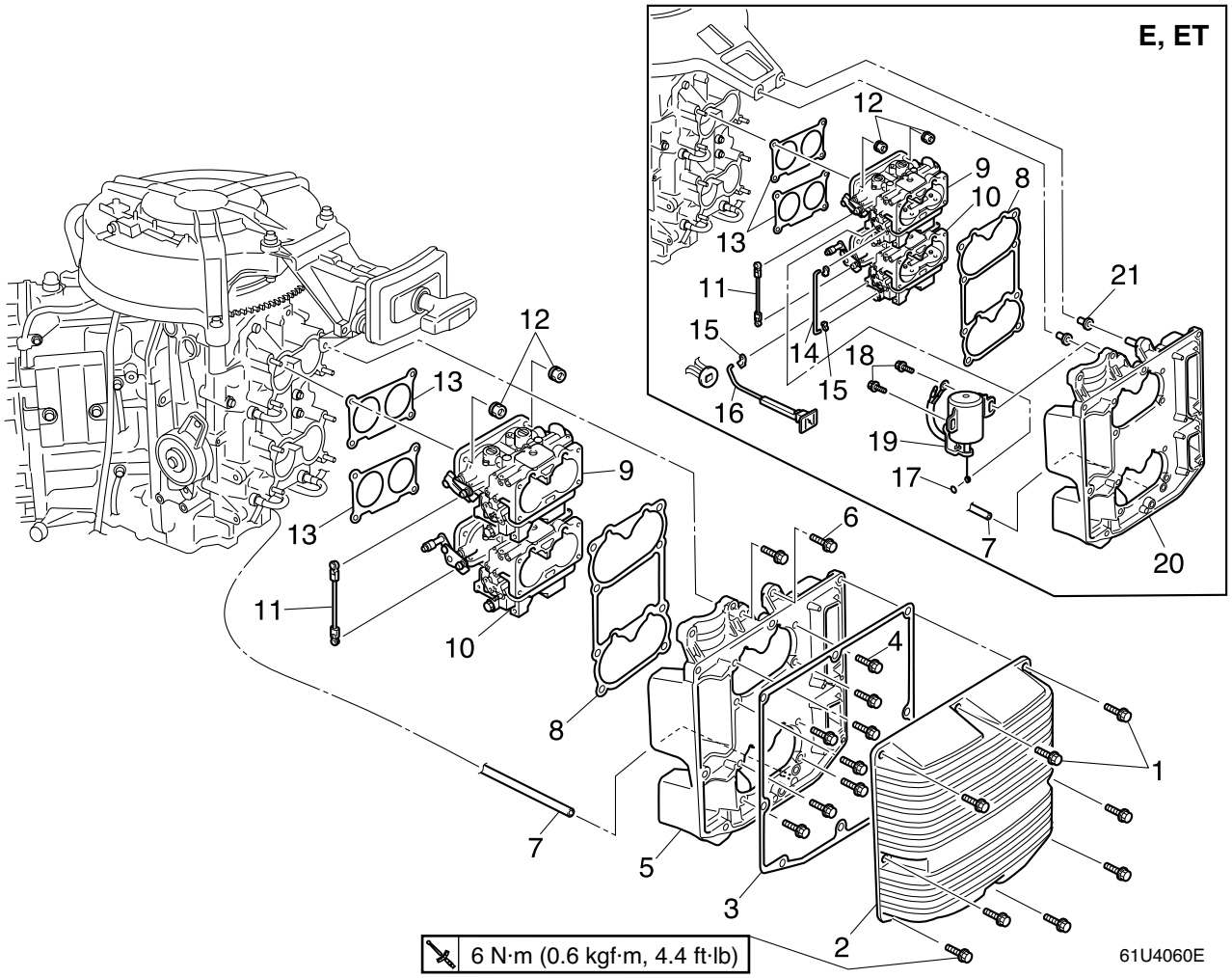
No.	Part name	Q'ty	Remarks
17	Fuel pump assembly	1	
18	Gasket	1	Not reusable
19	Fuel hose	1	
20	Joint	1	
21	Fuel hose	1	
22	Fuel hose	1	
23	Bolt	1	M6 × 10 mm MH, WH
24	Start-in-gear protection cable	1	MH, WH
25	Bolt	1	M6 × 12 mm MH, WH
26	Bolt	1	M5 × 10 mm MH, WH
27	Cable	1	MH, WH
28	Fuel joint	1	
29	Bolt	1	M8 × 28 mm
30	Clamp	1	



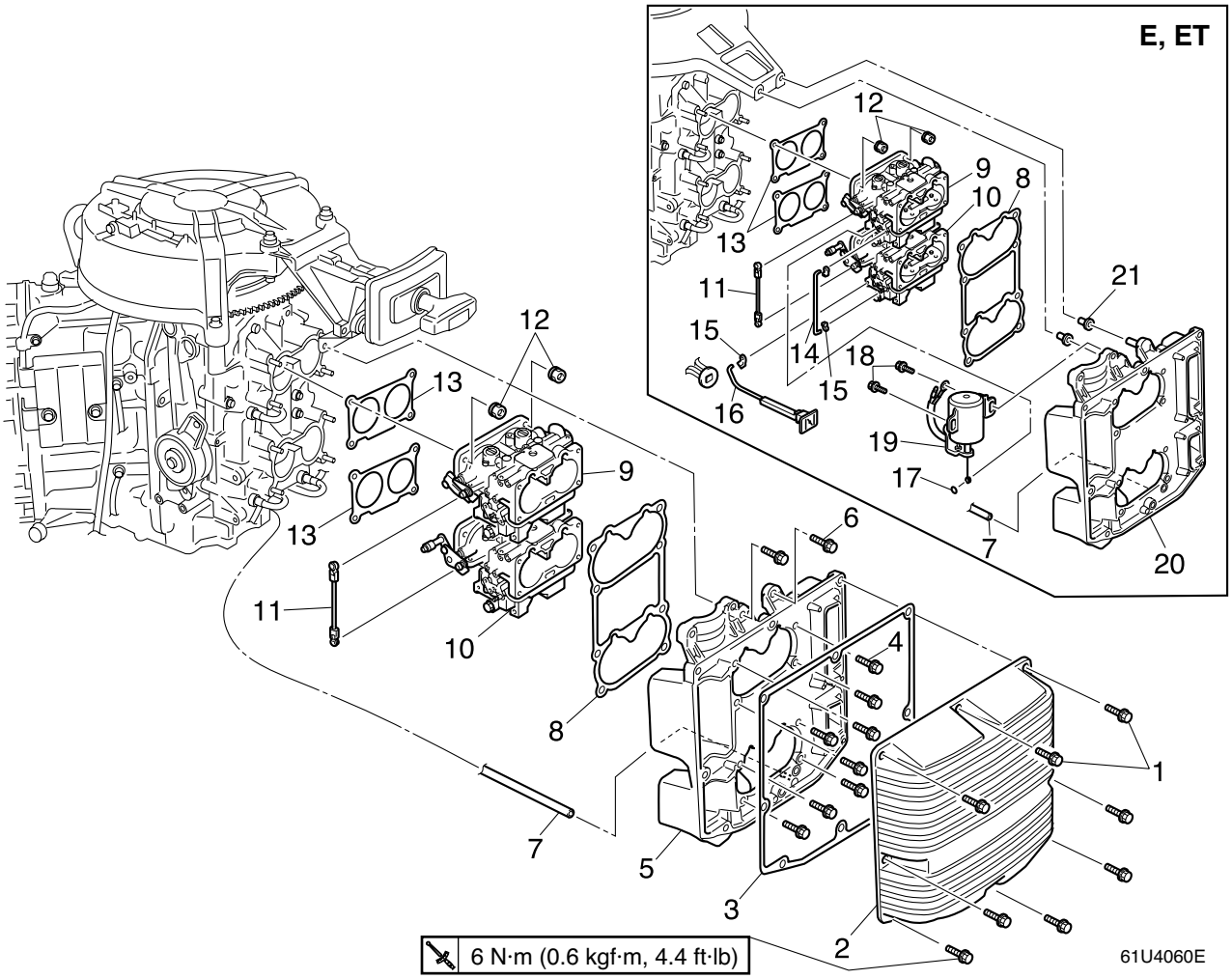
6G44040E

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

Carburetor

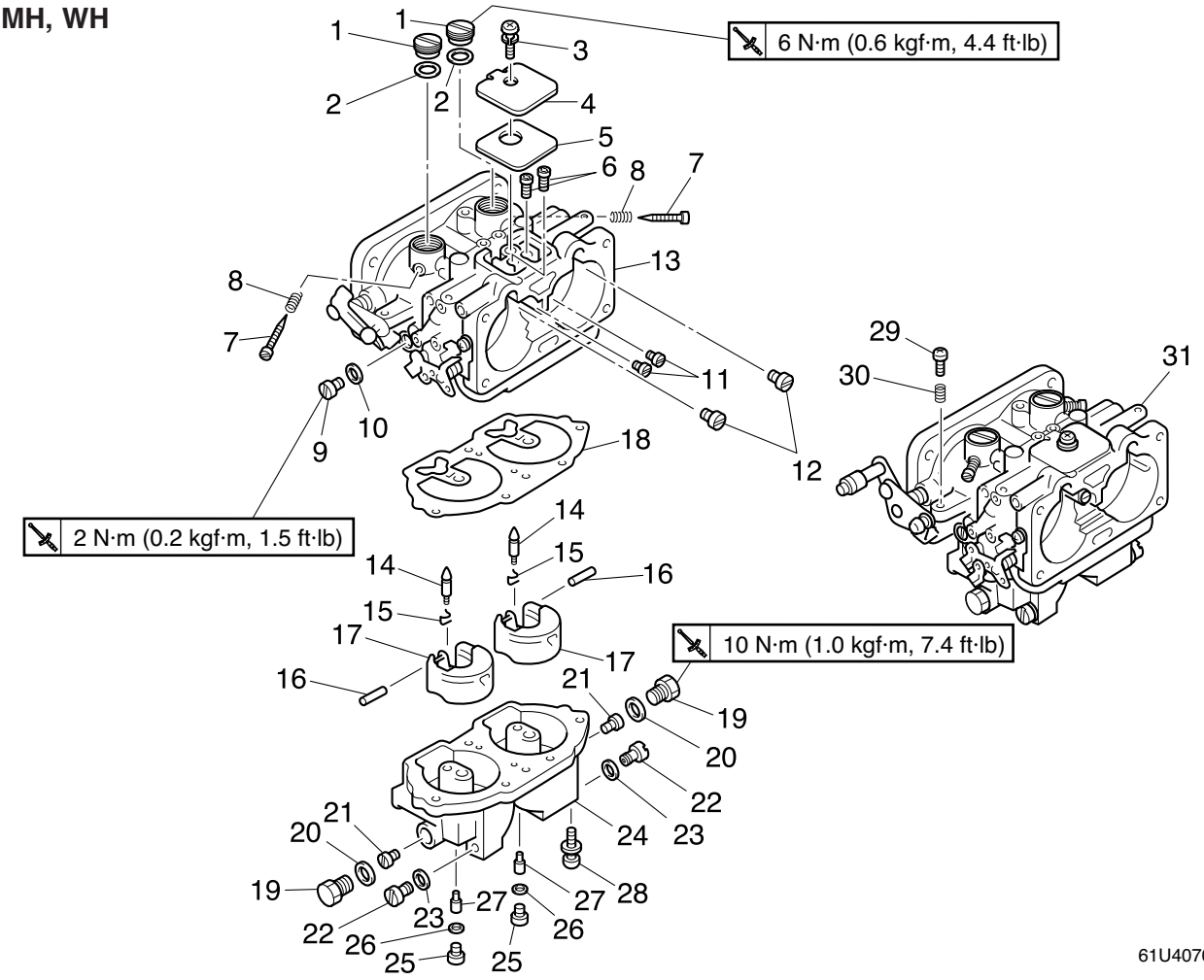


No.	Part name	Q'ty	Remarks
1	Bolt	8	M6 × 20 mm
2	Cover	1	
3	Gasket	1	Not reusable
4	Bolt	8	M6 × 20 mm
5	Intake silencer	1	
6	Bolt	2	M6 × 20 mm
7	Breather hose	1	
8	Gasket	1	Not reusable
9	Upper carburetor assembly	1	
10	Lower carburetor assembly	1	
11	Link rod	1	
12	Nut	8	
13	Gasket	2	Not reusable
14	Rod	1	
15	Joint	3	
16	Choke knob	1	
17	O-ring	1	Not reusable

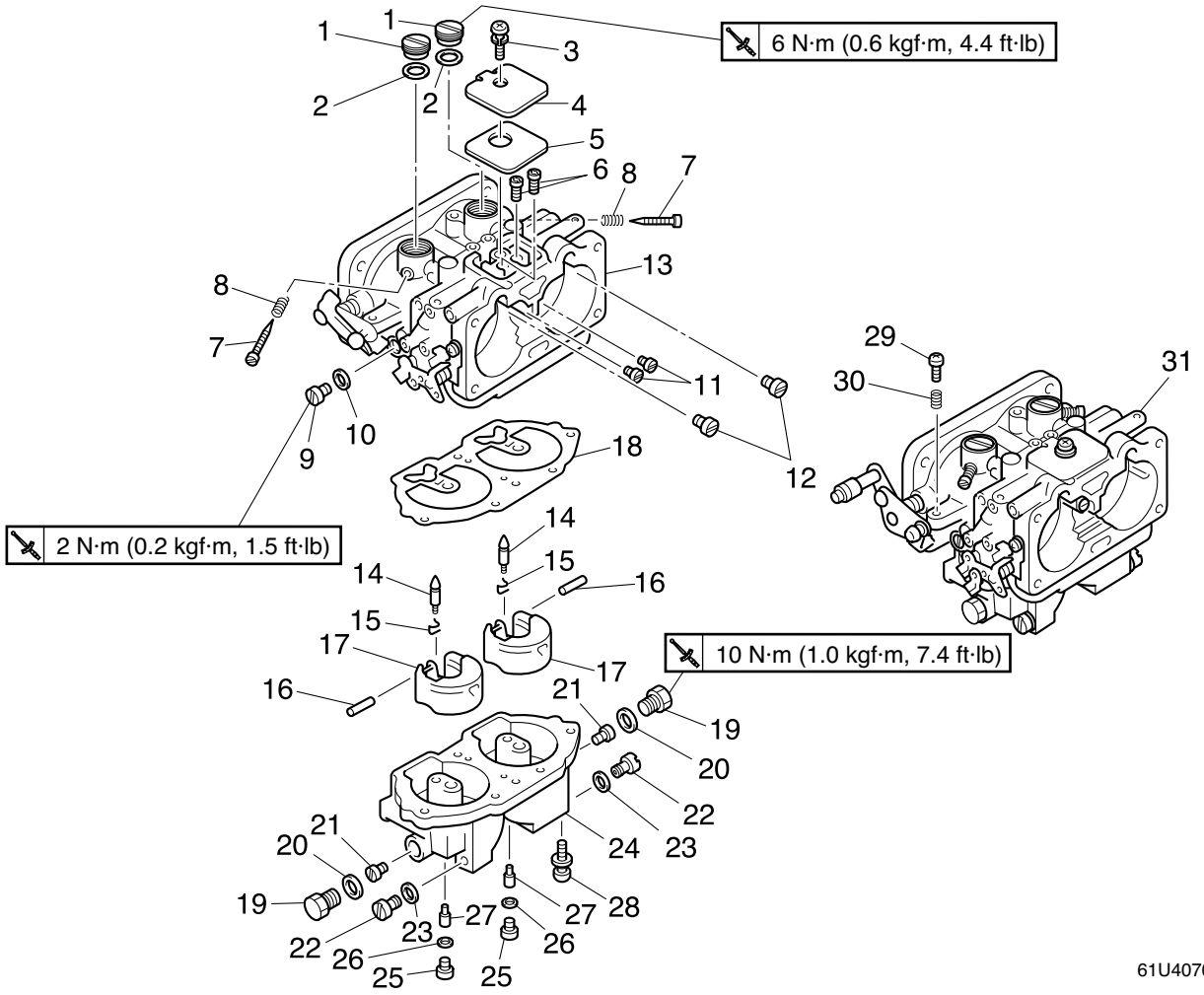


No.	Part name	Q'ty	Remarks
18	Bolt	2	M6 × 16 mm
19	Choke solenoid	1	
20	Intake silencer	1	
21	Grommet	2	

MH, WH

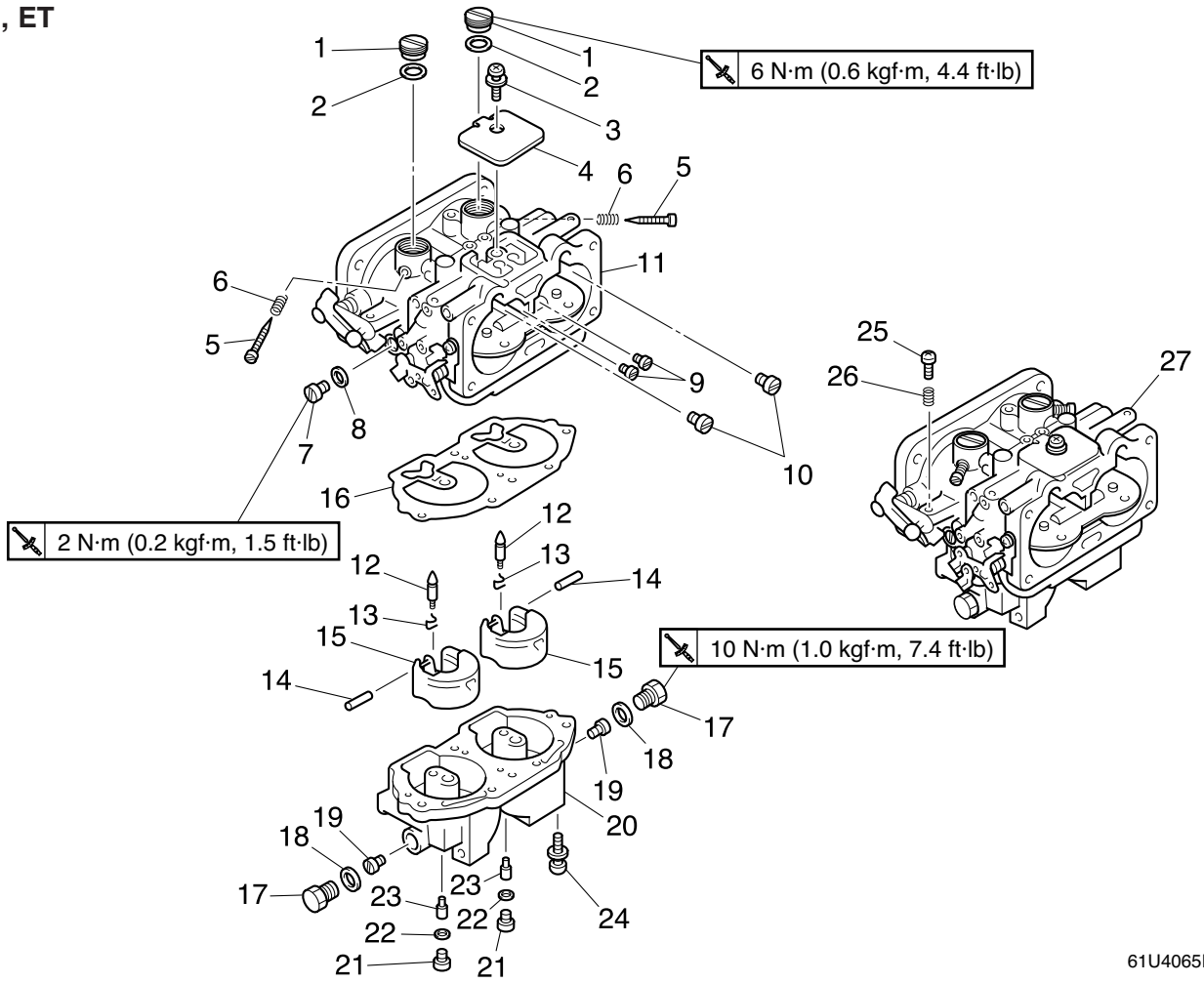


No.	Part name	Q'ty	Remarks
1	Plug	4	
2	Gasket	4	
3	Screw	2	
4	Plate	2	
5	Gasket	2	Not reusable
6	Main air bleed	4	
7	Pilot screw	4	
8	Spring	4	
9	Screw	2	
10	Gasket	2	
11	Air bleed plug	4	
12	Pilot air jet	4	
13	Carburetor body	2	
14	Needle valve	4	
15	Clip	4	
16	Float pin	4	
17	Float	4	

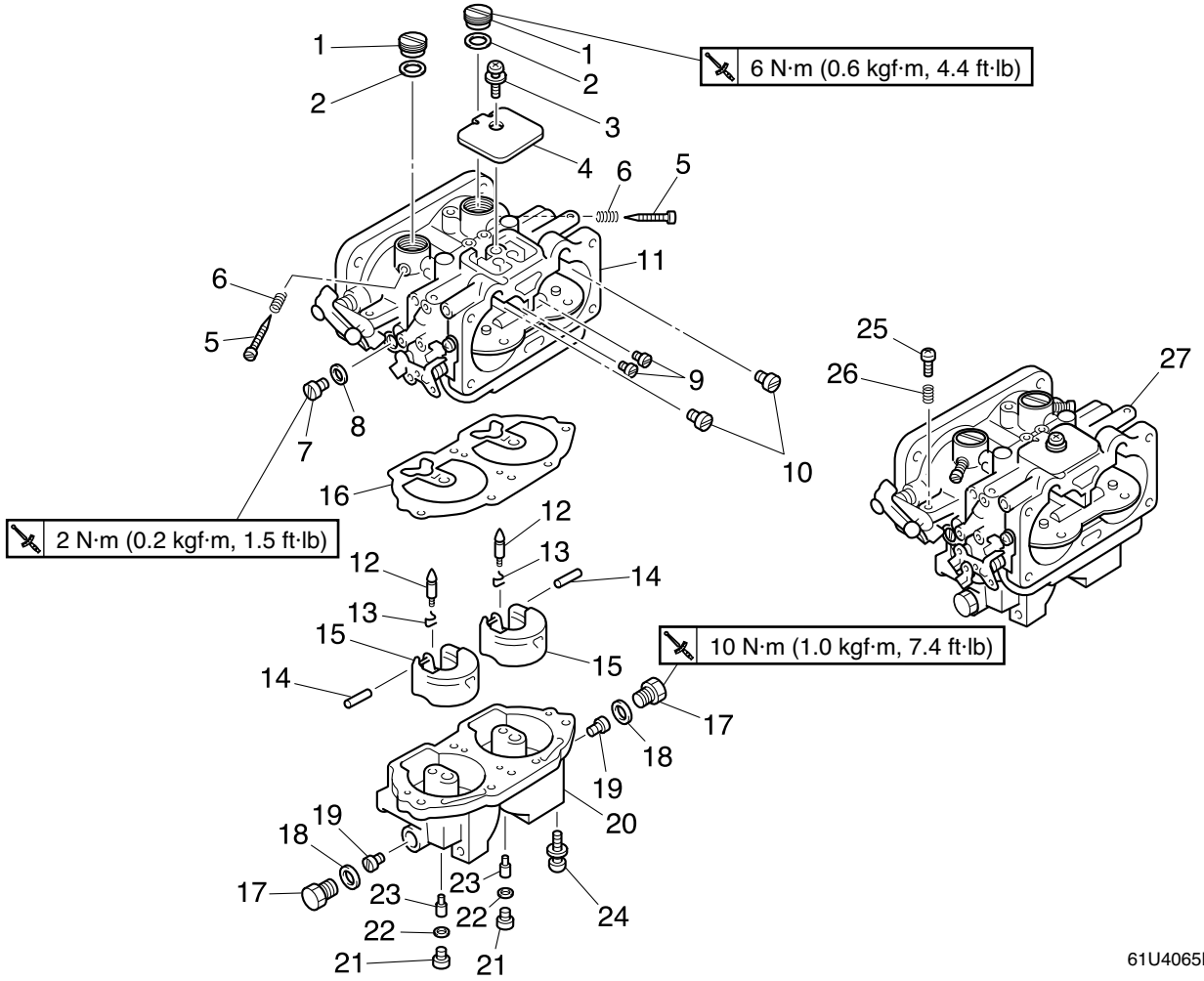


No.	Part name	Q'ty	Remarks
18	Gasket	2	Not reusable
19	Plug	4	
20	Gasket	4	
21	Main jet	4	
22	Drain plug	4	
23	Gasket	4	
24	Float chamber	2	
25	Plug	4	
26	Gasket	4	
27	Pilot jet	4	
28	Screw	8	ø5 × 16 mm
29	Throttle stop screw	1	
30	Spring	1	
31	Lower carburetor assembly	1	

E, ET



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



No.	Part name	Q'ty	Remarks
18	Gasket	4	
19	Main jet	4	
20	Float chamber	2	
21	Plug	4	
22	Gasket	4	
23	Pilot jet	4	
24	Screw	8	ø5 × 16 mm
25	Throttle stop screw	1	
26	Spring	1	
27	Lower carburetor assembly	1	

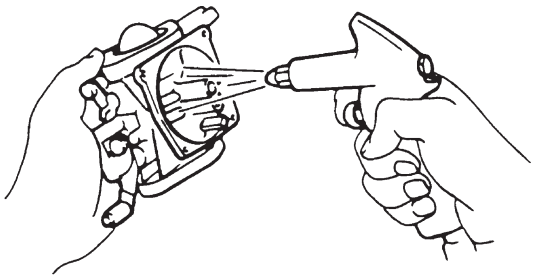
Disassembling the carburetor

NOTE:

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

Checking the carburetor

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

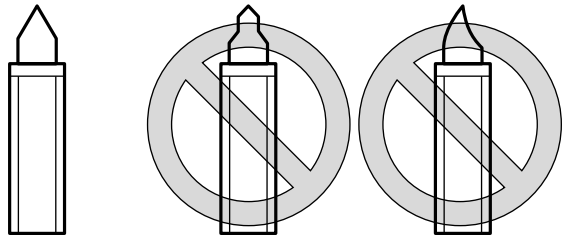


6D440025

CAUTION:

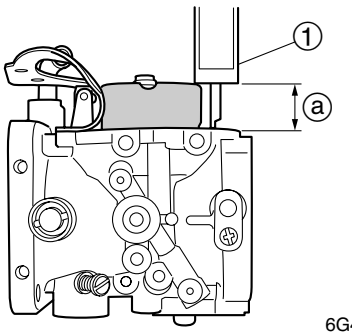
- **Direct the compressed air downward, otherwise cleaning solvent may be blown into your eyes or small parts of the carburetor may be blown off.**
- **Do not use steel wire for cleaning the jets, otherwise the jet diameters may be enlarged, which may seriously affect performance.**

3. Check the main jet, pilot jet, and main nozzle for dirt or residue. Clean if necessary.
4. Check the pilot screw and needle valve for bends or wear. Replace the pilot screw and needle valve if necessary.

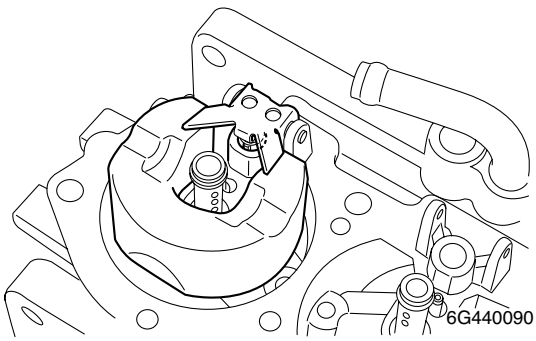


6B440040

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



6G440080



6G440090

NOTE:

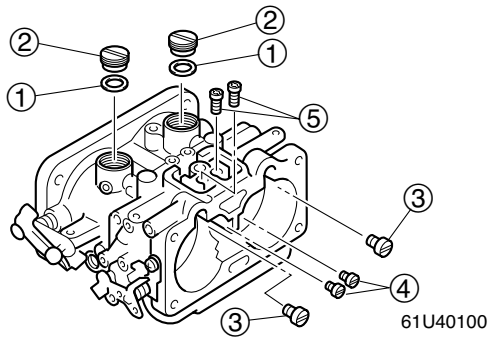
When measure the float height, the float should not be compressing.

	Digital caliper ①: 90890-06704
	Float height ⓐ (without gasket): 16 mm (0.63 in)

Assembling the carburetor

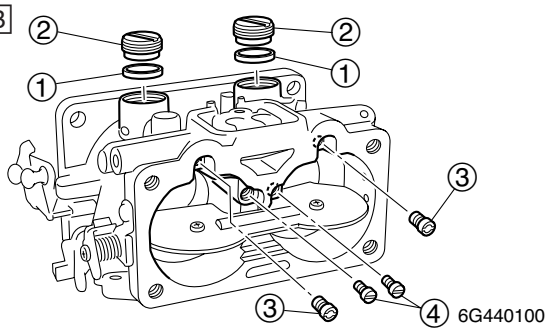
1. Install the gaskets ①, plugs ②, pilot air jets ③, and air bleed plugs ④, main air bleed ⑤ onto the carburetor body.

A



61U40100

B



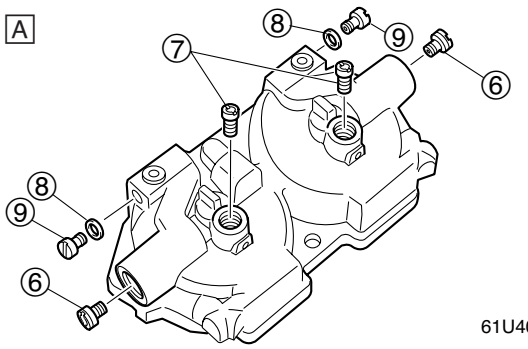
6G440100

A MH, WH
B E, ET

2. Install a new gasket, and then install the needle valves, floats and float pins onto the carburetor body. Check the float for smooth operation, after install them.

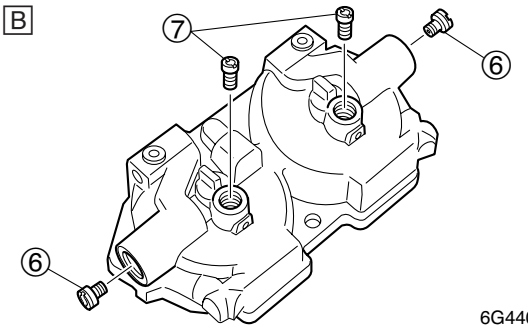
3. Install the main jets ⑥ and pilot jets ⑦, gaskets ⑧, drain plugs ⑨ onto the float chamber.

A



61U40020

B

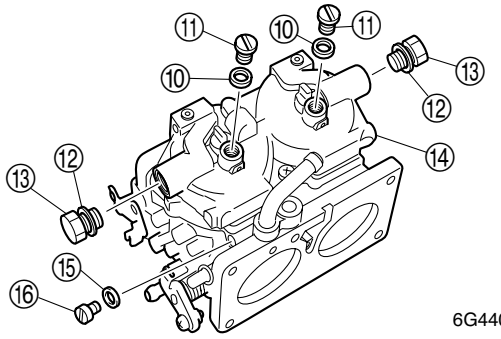


6G440110

A MH, WH
B E, ET

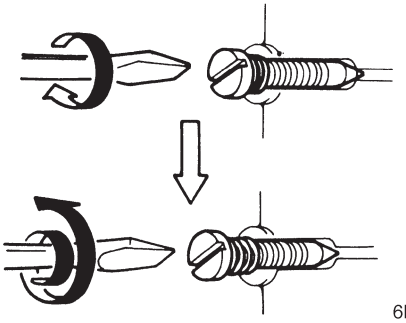
4. Install the gaskets ⑩, plugs ⑪, gaskets ⑫ and plugs ⑬ onto the float chamber ⑭.

5. Install the float chamber ⑭ onto the carburetor body and install the gasket ⑮ and screw ⑯ onto the carburetor body.



6G440130

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



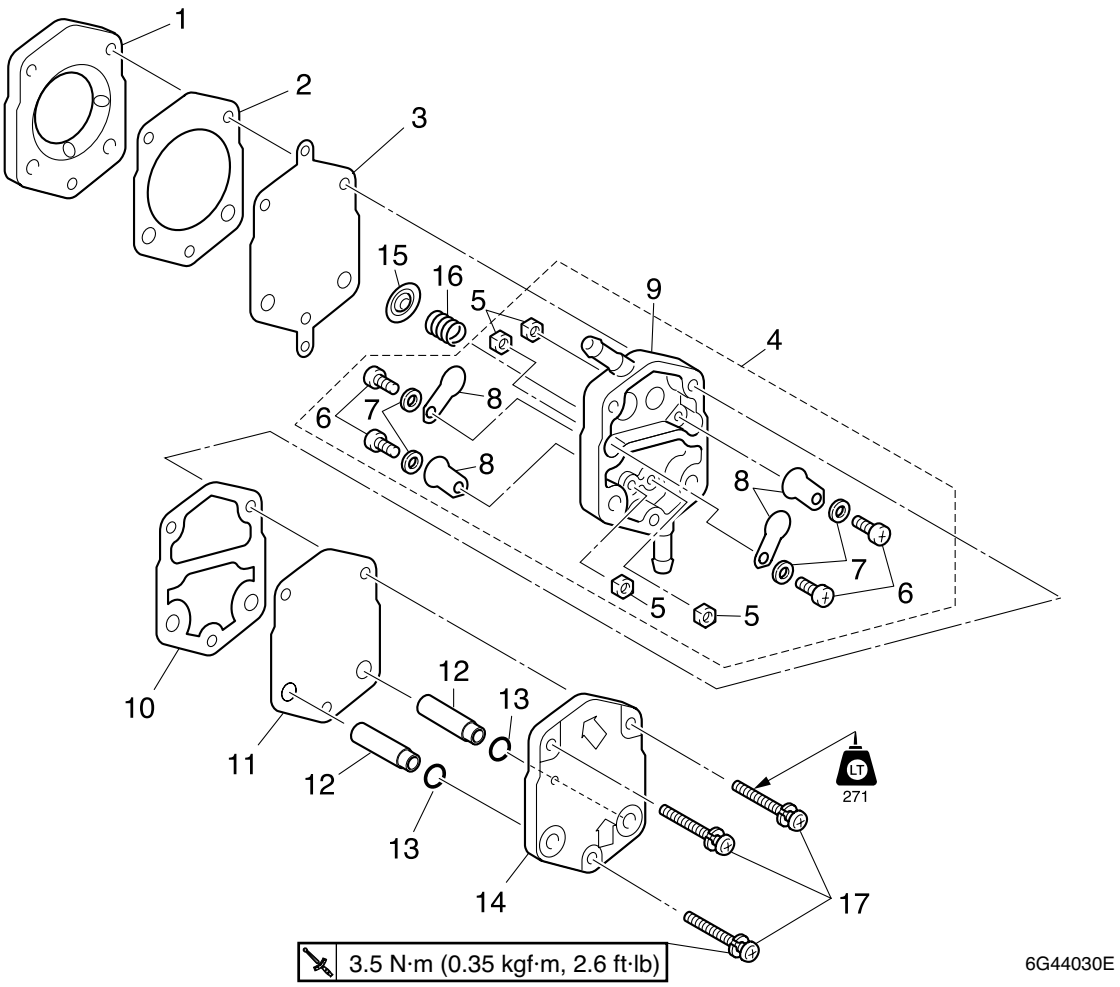
6F640100

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

Pilot screw turns out:
E115A : 1–1 1/2
115B : 3/8–7/8
140B : 5/8–1 1/8

7. Install the carburetor assembly.

Fuel pump



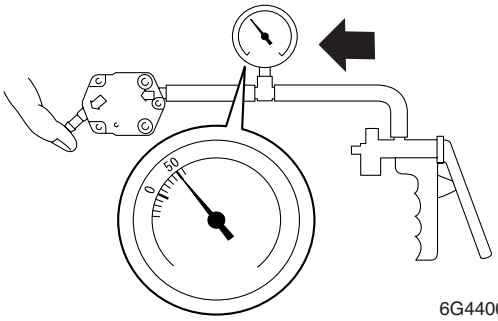
No.	Part name	Q'ty	Remarks
1	Base	1	
2	Gasket	1	Not reusable
3	Diaphragm	1	
4	Body assembly	1	
5	Nut	4	
6	Screw	4	ø5 × 28 mm
7	Washer	4	
8	Check valve	4	
9	Body	1	
10	Gasket	1	Not reusable
11	Diaphragm	1	
12	Collar	2	
13	O-ring	2	Not reusable
14	Cover	1	
15	Plate	1	
16	Spring	1	
17	Screw	3	ø5 × 35 mm

Checking the fuel pump

1. Place a drain pan under the fuel hose connections, and then disconnect the fuel hoses from the fuel pump.

2. Connect the special service tool to the fuel pump inlet.

3. Cover the fuel pump outlet with a finger, and then apply the specified positive pressure. Check that there is no air leakage.

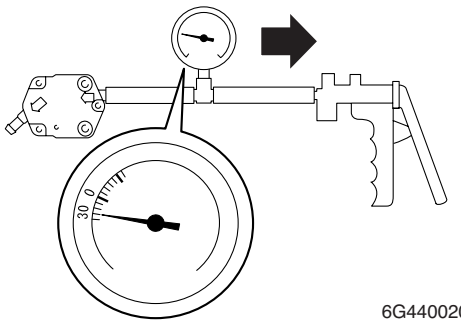


6G440010

Vacuum/pressure pump gauge set:
90890-06756

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

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

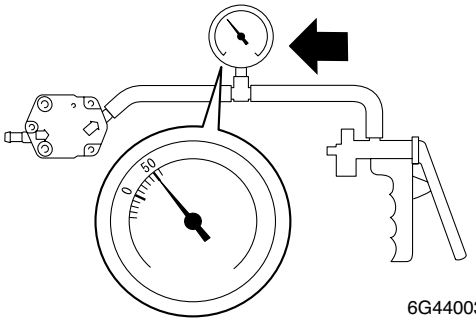


6G440020

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

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

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

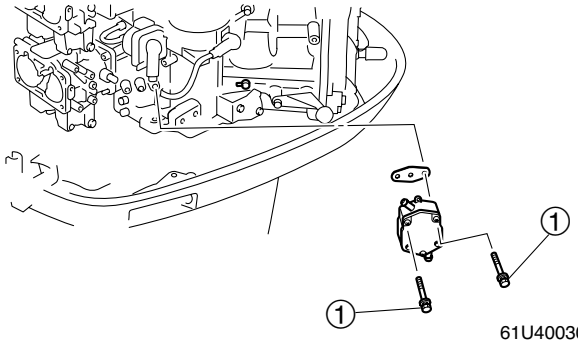


6G440030

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

Disassembling the fuel pump

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



61U40030

3. Remove the 3 screws securing the pump together. Refer to exploded diagram P4-15.

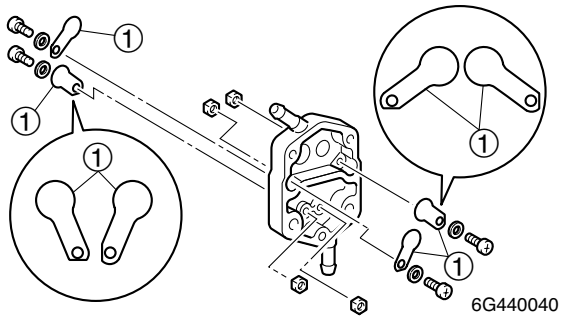
NOTE:
Take care not to let the spring fly out or lose the plate.

4. Check the diaphragm for tears or deterioration. Replace the diaphragm if necessary.
5. Check the valves for bends or damage. Replace the valve if necessary. Also, check the fuel pump body and spring for damage. Replace the fuel pump body and spring if necessary.
6. Clean the fuel pump body.

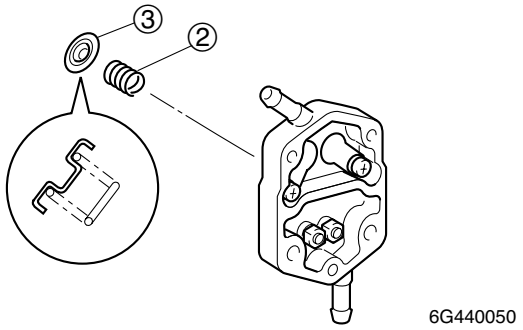
Assembling the fuel pump

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.

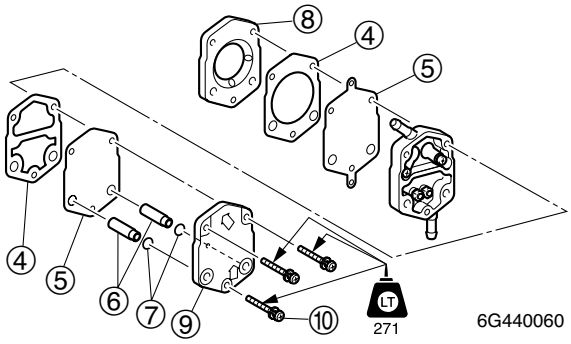
1. Install the check valves ① onto the fuel pump body.



2. Install the spring ② and plate ③.



3. Install the new gaskets ④, diaphragms ⑤, collars ⑥, O-rings ⑦, base ⑧, cover ⑨ on to the fuel pump body, and then tighten the screws ⑩ to specified torque.



	Fuel pump screw ⑩: 3.5 N·m (0.35 kgf·m, 2.6 ft·lb)

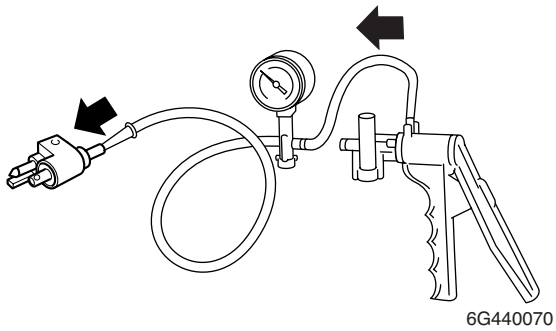
NOTE:
Make sure that the gaskets and diaphragms are kept in place through the assembly process.

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 positive pressure is maintained for 10 seconds. Replace the fuel joint if necessary.



	Vacuum/pressure pump gauge set: 90890-06756
	Specified pressure: 50 kPa (0.5 kgf/cm^2, 7.3 psi)

— MEMO —

Power unit

Power unit 5-1
Checking the compression pressure 5-1
Disassembling the manual starter (MH, WH) 5-14
Checking the spiral spring (MH, WH) 5-15
Checking the drive pawl (MH, WH) 5-15
Checking the starter rope (MH, WH) 5-15
Assembling the manual starter (MH, WH) 5-15
Removing the power unit 5-17
Removing the flywheel magnet 5-19
Removing the electrical component 5-20

Intake manifold 5-22
Removing the intake manifold 5-24
Checking the reed valve 5-24

Exhaust cover 5-25
Removing the exhaust cover 5-26
Checking the exhaust cover 5-26
Checking the PCV 5-26
Installing the PCV 5-26

Cylinder head 5-27
Removing the cylinder head 5-29
Checking the cylinder head 5-29

Crankcase 5-31
Removing the crankcase 5-34
Disassembling the bearing housing 5-34
Disassembling the oil seal housing 5-35
Removing the piston, connecting rod assembly and crankshaft assembly 5-35
Disassembling the piston and connecting rod assembly 5-35
Checking the bearing 5-35
Disassembling the crankshaft 5-36
Checking the piston diameter 5-36
Checking the cylinder bore 5-37
Checking the piston clearance 5-37

Checking the piston ring 5-37
Checking the piston ring side clearance 5-38
Checking the piston pin boss bore 5-38
Checking the piston pin 5-38
Checking the internal anode 5-38
Checking the connecting rod small end axial play 5-39
Checking the connecting rod big end side clearance 5-39
Checking the crankshaft 5-39
Assembling the crankshaft 5-40
Assembling the bearing housing 5-41
Assembling the oil seal housing 5-41
Assembling the piston and connecting rod assembly 5-42
Assembling the power unit 5-42
Installing the power unit 5-49
Adjusting the timing plate 5-52
Adjusting the ignition timing stopper 5-53

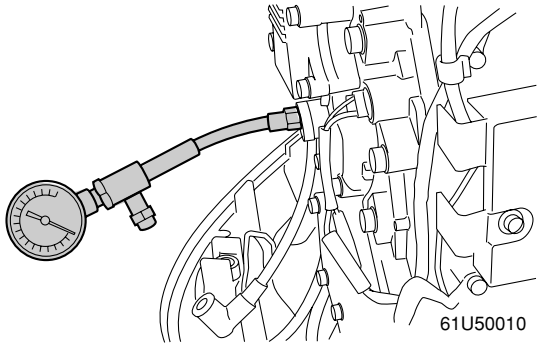
Power unit

Checking the compression pressure

1. Start the engine, warm it up for 5 minutes, and then turn it off.

2. Remove the lock plate from the engine stop lanyard switch on the remote control box or tiller handle.

3. Remove the all 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:

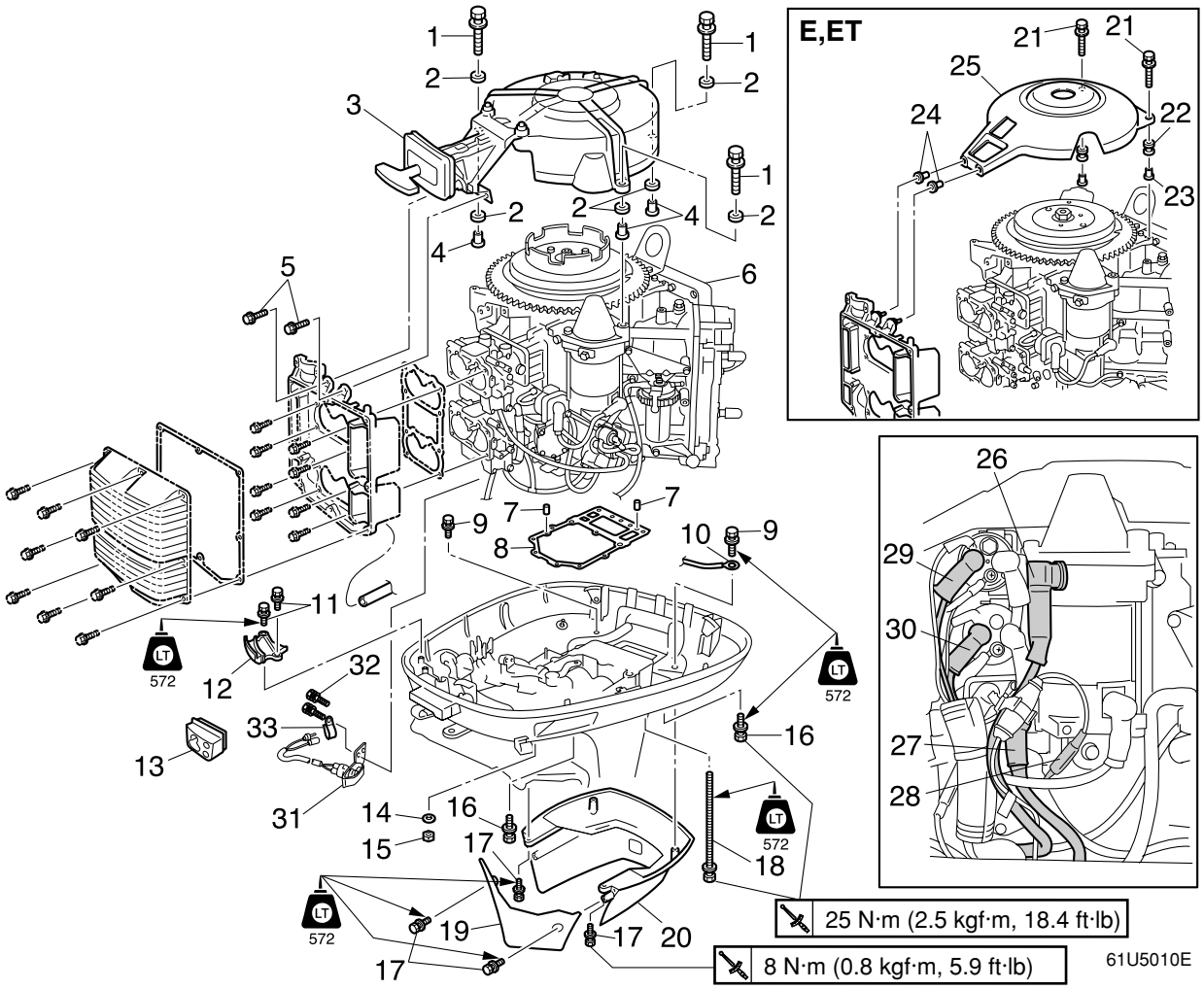
- Do not pull the choke knob when checking the compression pressure.
- Disconnect the choke solenoid blue lead from the wireharness.

Minimum compression pressure (reference data):
Electric start
450 kPa (4.5 kgf/cm², 64 psi)
Manual start
400 kPa (4.0 kgf/cm², 57 psi)

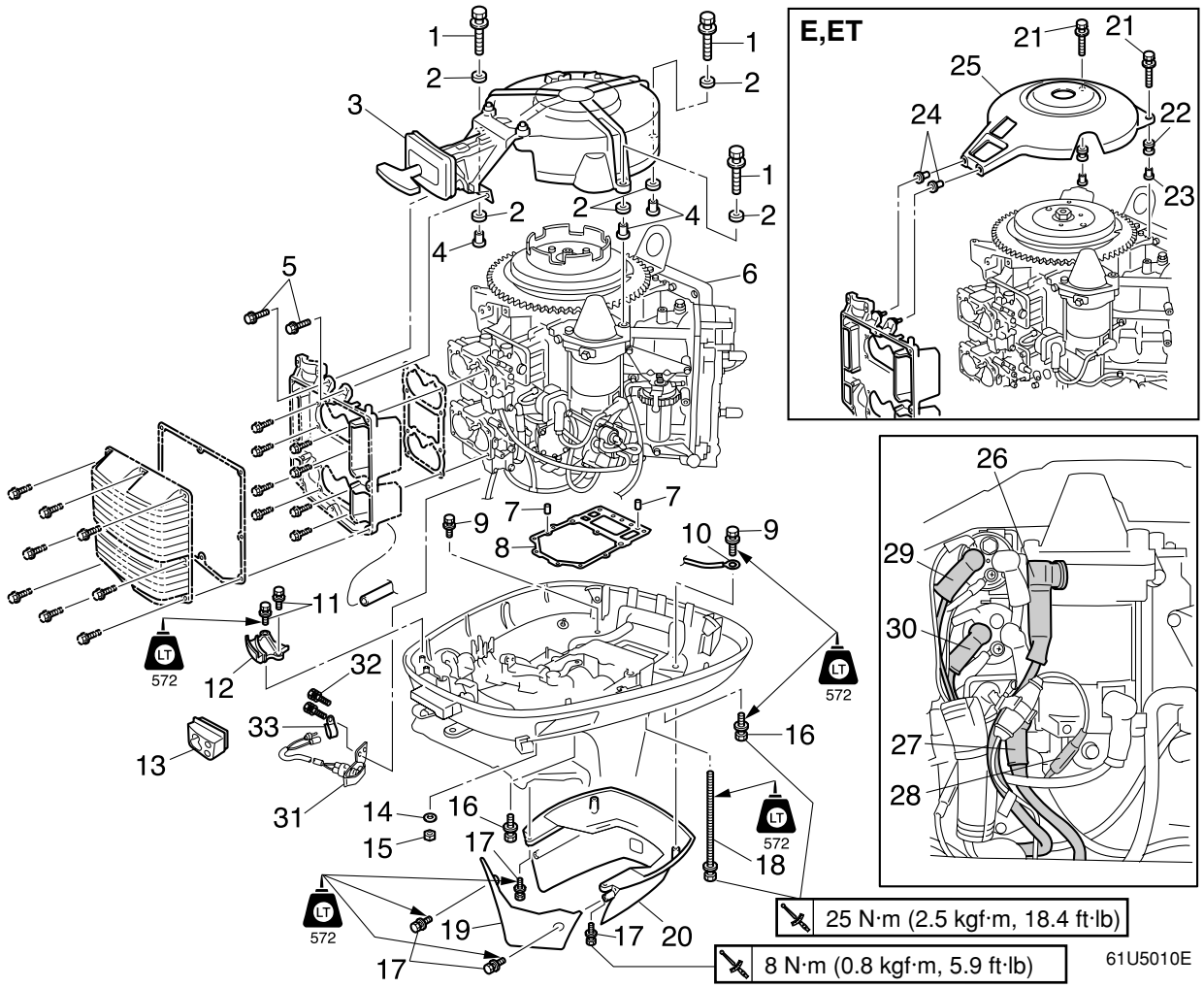
5. If the compression pressure is below specification and the compression pressure for each cylinder is unbalanced, add a small amount of engine oil to the cylinders, and then check the compression pressure again.

NOTE:

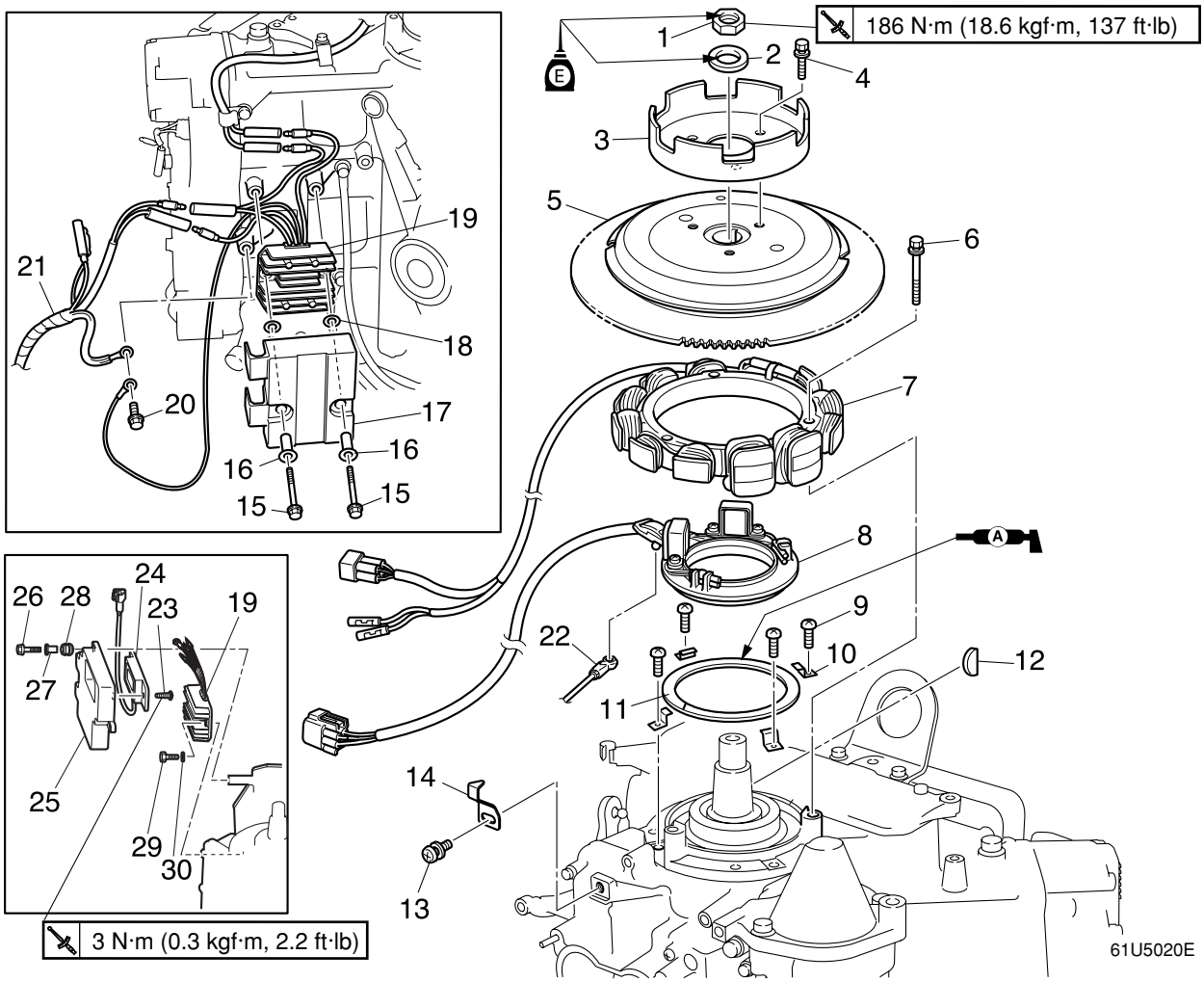
- If the compression pressure increases, check the pistons and piston rings for worn. Replace if necessary.
- If the compression pressure does not increase, check the cylinder head gasket, and cylinder head. Replace if necessary.



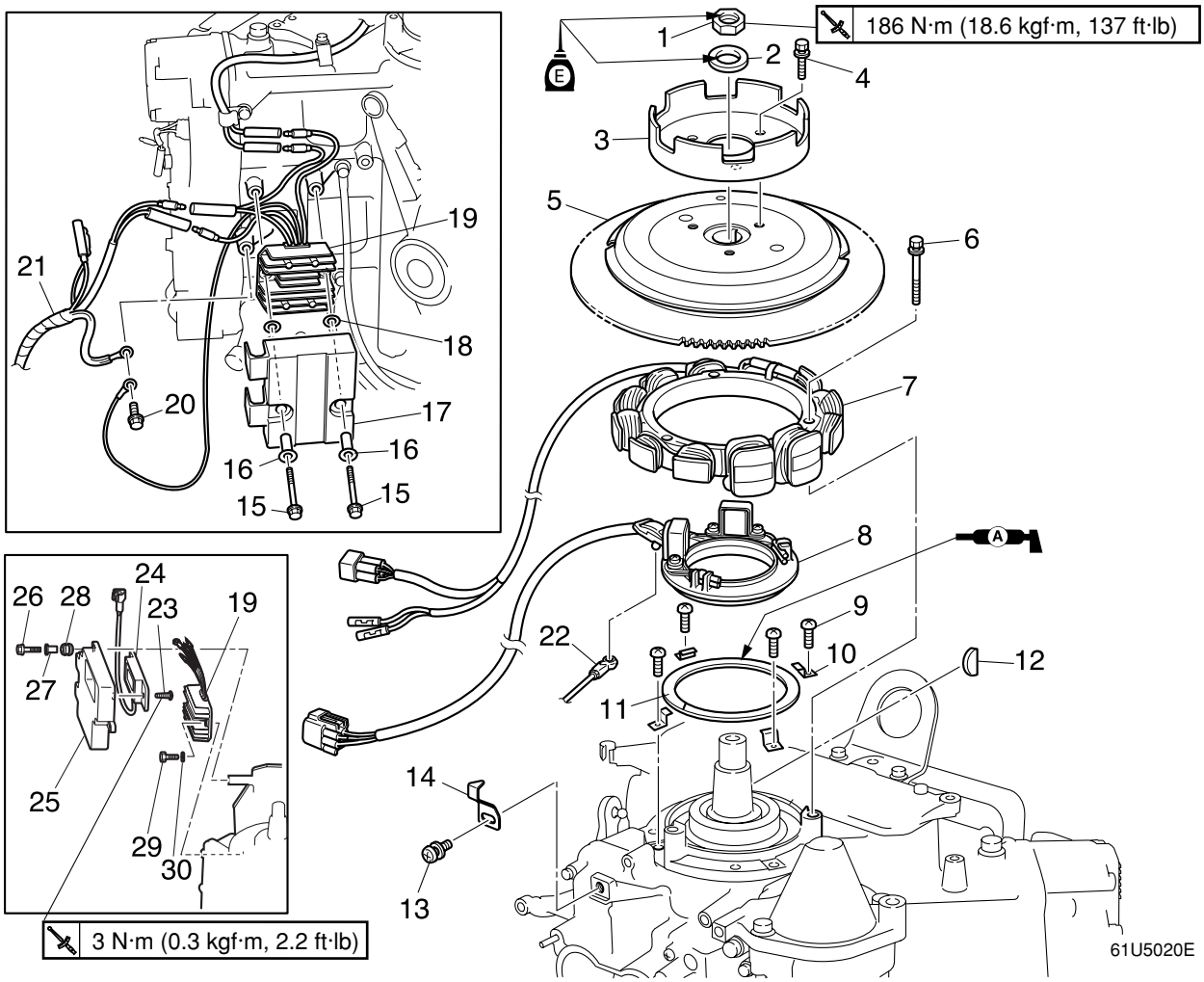
No.	Part name	Q'ty	Remarks
1	Bolt	3	M8 × 35 mm MH, WH
2	Grommet	6	MH, WH
3	Manual starter assembly	1	MH, WH
4	Collar	3	MH, WH
5	Bolt	2	M6 × 20 mm MH, WH
6	Power unit	1	
7	Dowel	2	
8	Gasket	1	Not reusable
9	Bolt	2	M6 × 20 mm
10	Ground lead	1	
11	Bolt	2	M6 × 16 mm
12	Retaining plate	1	
13	Grommet	1	
14	Washer	2	
15	Nut	2	
16	Bolt	4	M8 × 30 mm
17	Bolt	4	M6 × 20 mm



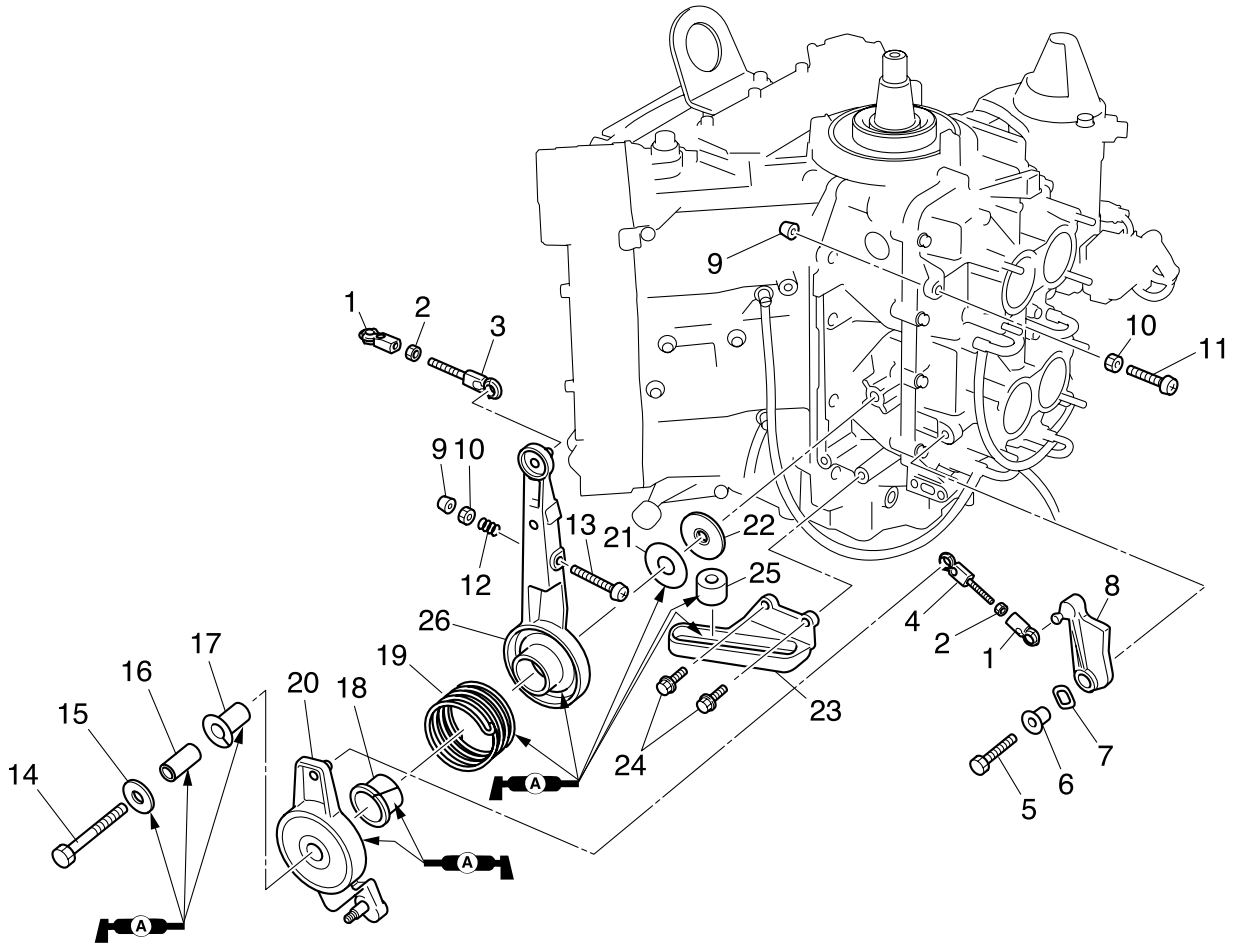
No.	Part name	Q'ty	Remarks
18	Bolt	6	M8 × 135 mm
19	Apron	1	
20	Apron	1	
21	Bolt	2	M6 × 25 mm E, ET
22	Grommet	2	E, ET
23	Collar	2	E, ET
24	Grommet	2	E, ET
25	Flywheel cover	1	E, ET
26	Negative battery cable	1	WH, E, ET
27	Positive battery cable	1	WH, E, ET
28	Positive lead	1	WH, E, ET
29	PTT motor lead (up)	1	ET
30	PTT motor lead (down)	1	ET
31	Neutral switch	1	WH
32	Bolt	2	M6 × 16 mm WH
	Bolt	1	MH, E, ET
33	Clamp	1	



No.	Part name	Q'ty	Remarks
1	Nut	1	
2	Washer	1	
3	Starter pulley	1	MH, WH
4	Bolt	3	M8 × 25 mm MH, WH
5	Flywheel magnet	1	
6	Bolt	3	M6 × 60 mm
7	Stator assembly	1	
8	Pulser coil assembly	1	
9	Screw	4	ø5 × 18 mm
10	Plate	4	
11	Retainer	1	
12	Woodruff key	1	
13	Screw	1	ø6 × 10 mm
14	Timing plate	1	
15	Bolt	2	M6 × 45 mm
16	Collar	2	
17	Case	1	

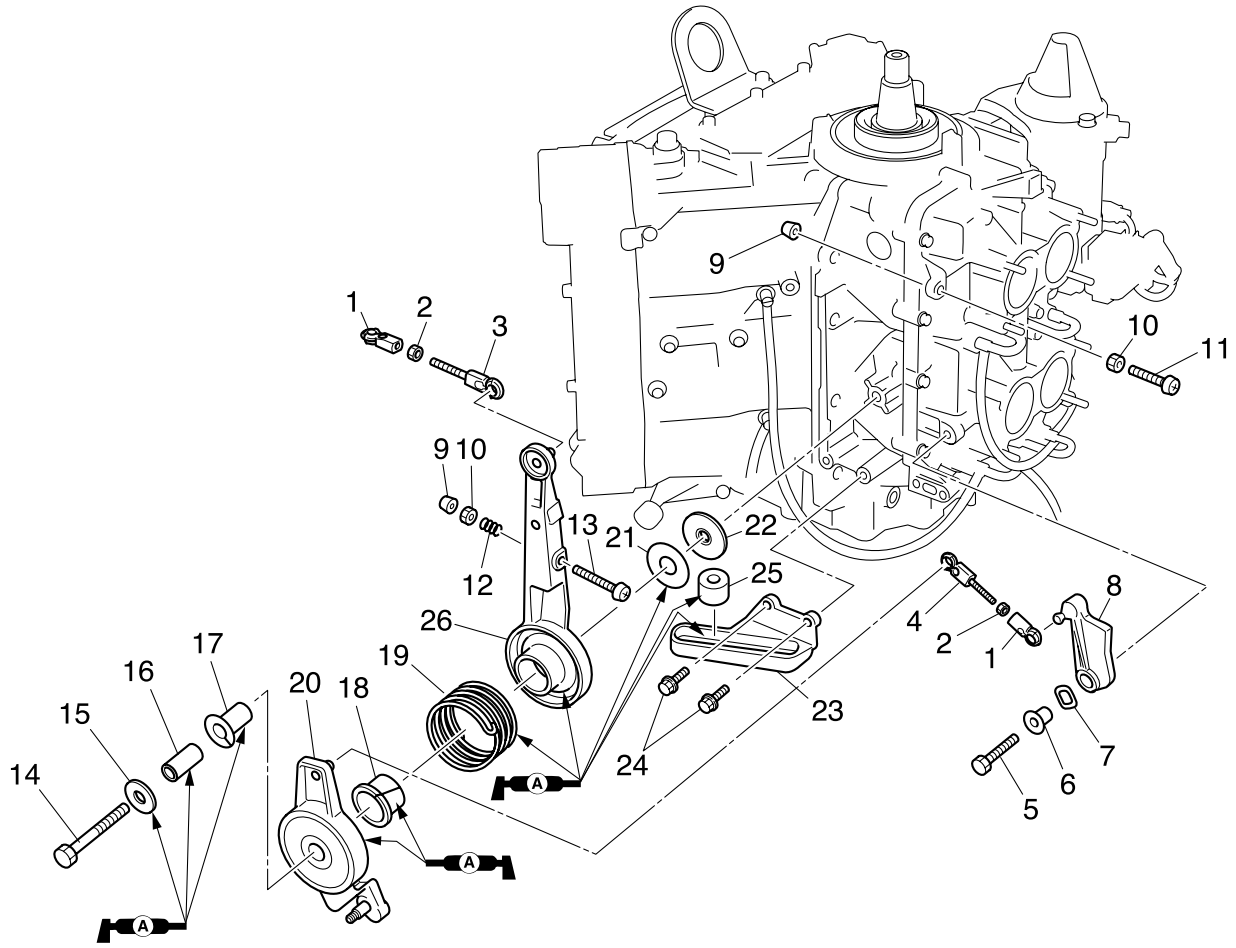


No.	Part name	Q'ty	Remarks
18	Washer	2	
19	Rectifier Regulator	1	
20	Bolt	1	M6 × 12 mm
21	Main harness	1	
22	Control link	1	
23	Screw	2	If equipped ø5 × 20 mm
24	Hour meter	1	If equipped
25	Case	1	If equipped
26	Bolt	2	If equipped M6 × 30 mm
27	Collar	2	If equipped
28	Grommet	2	If equipped
29	Bolt	2	If equipped M6 × 20 mm
30	Washer	2	If equipped



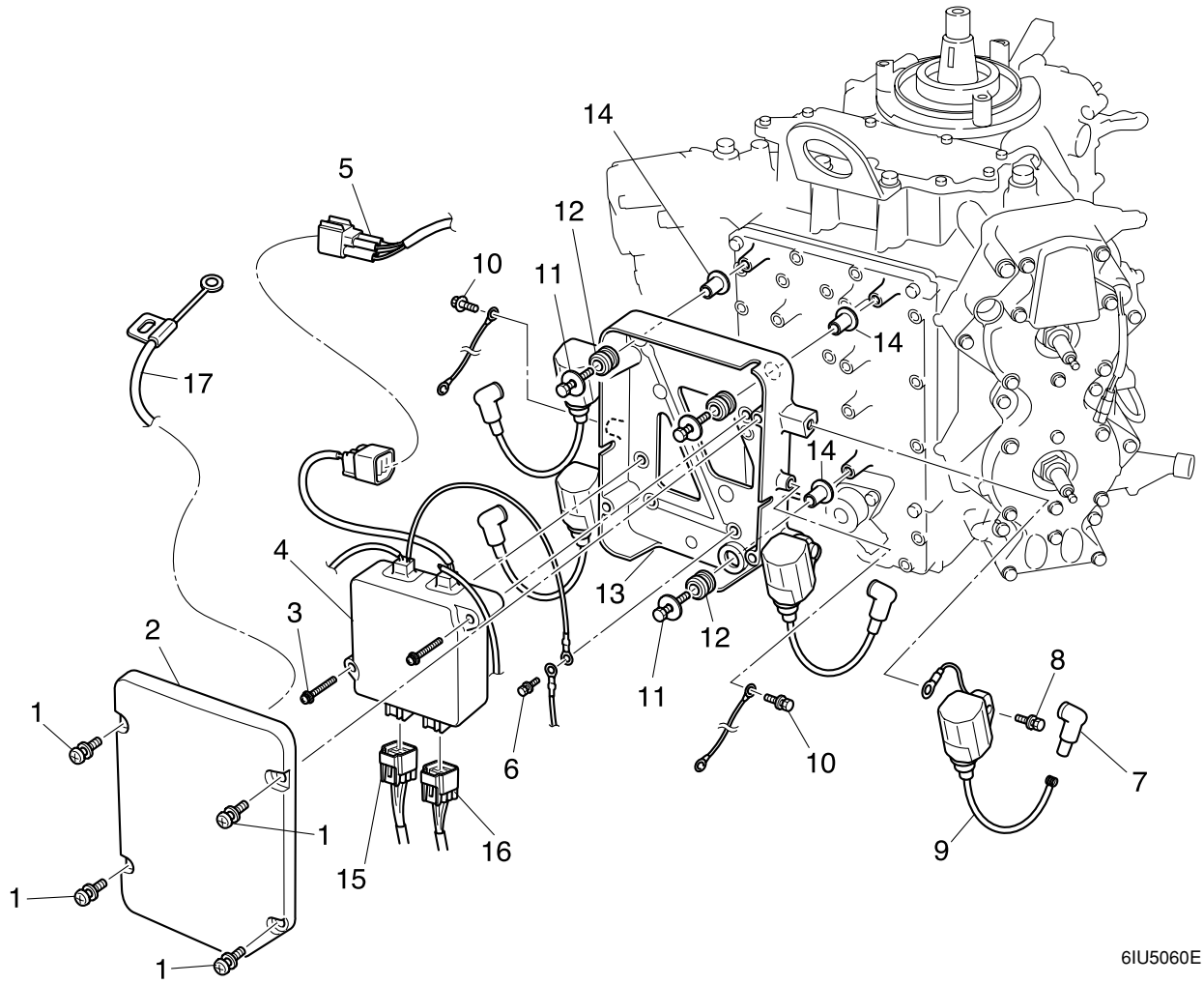
61U5030E

No.	Part name	Q'ty	Remarks
1	Joint	2	
2	Lock nut	2	
3	Control link rod	1	
4	Throttle link rod	1	
5	Bolt	1	M6 × 25 mm
6	Collar	1	
7	Wave washer	1	
8	Cam	1	
9	Cap	2	
10	Lock nut	2	
11	Screw	1	
12	Spring	1	
13	Screw	1	
14	Bolt	1	M8 × 45 mm
15	Washer	1	
16	Collar	1	
17	Bushing	1	



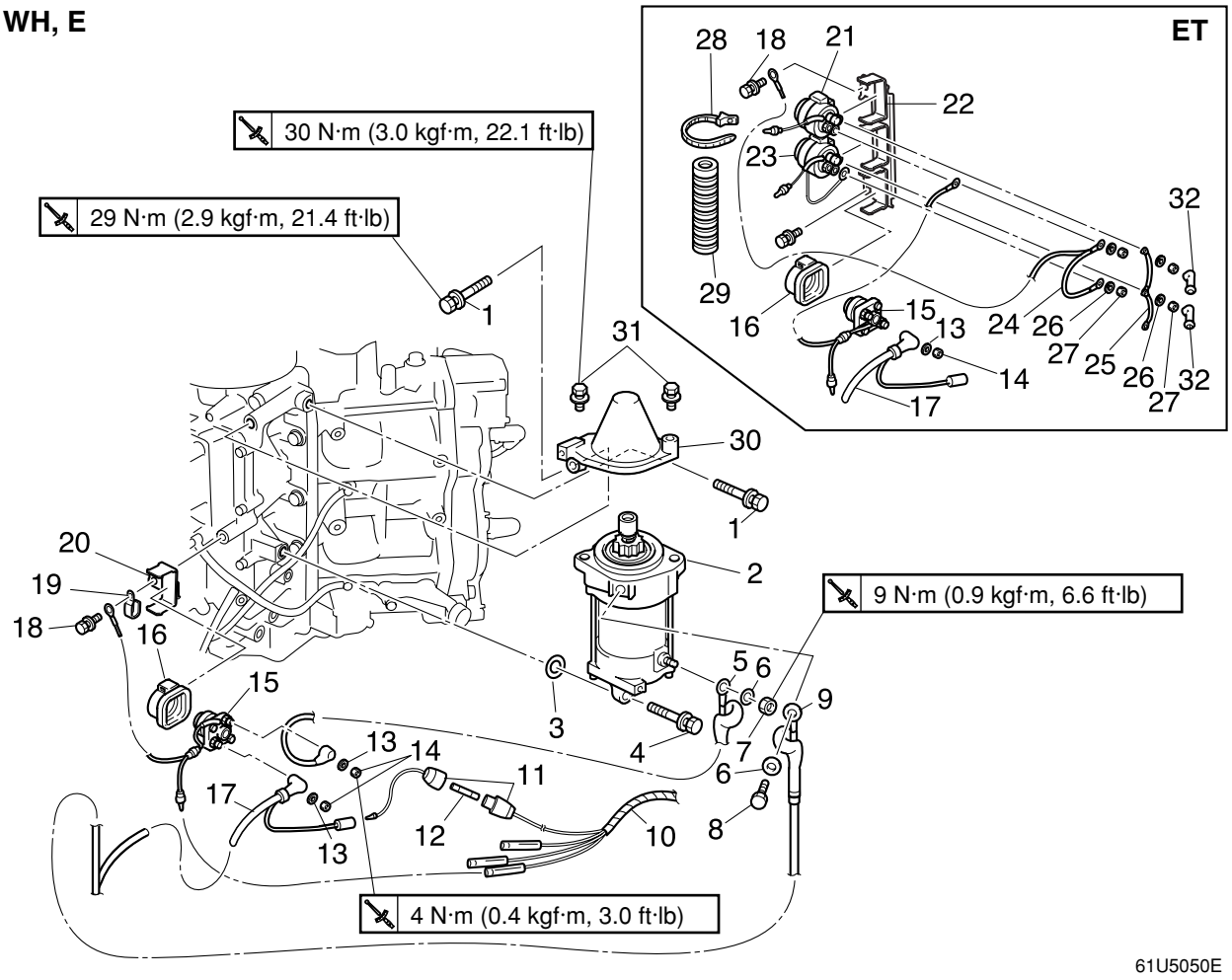
61U5030E

No.	Part name	Q'ty	Remarks
18	Bushing	1	
19	Spring	1	
20	Control lever 1	1	
21	Plastic washer	1	
22	Washer	1	
23	Bracket	1	
24	Bolt	2	M8 × 30 mm
25	Bushing	1	
26	Control lever 2	1	



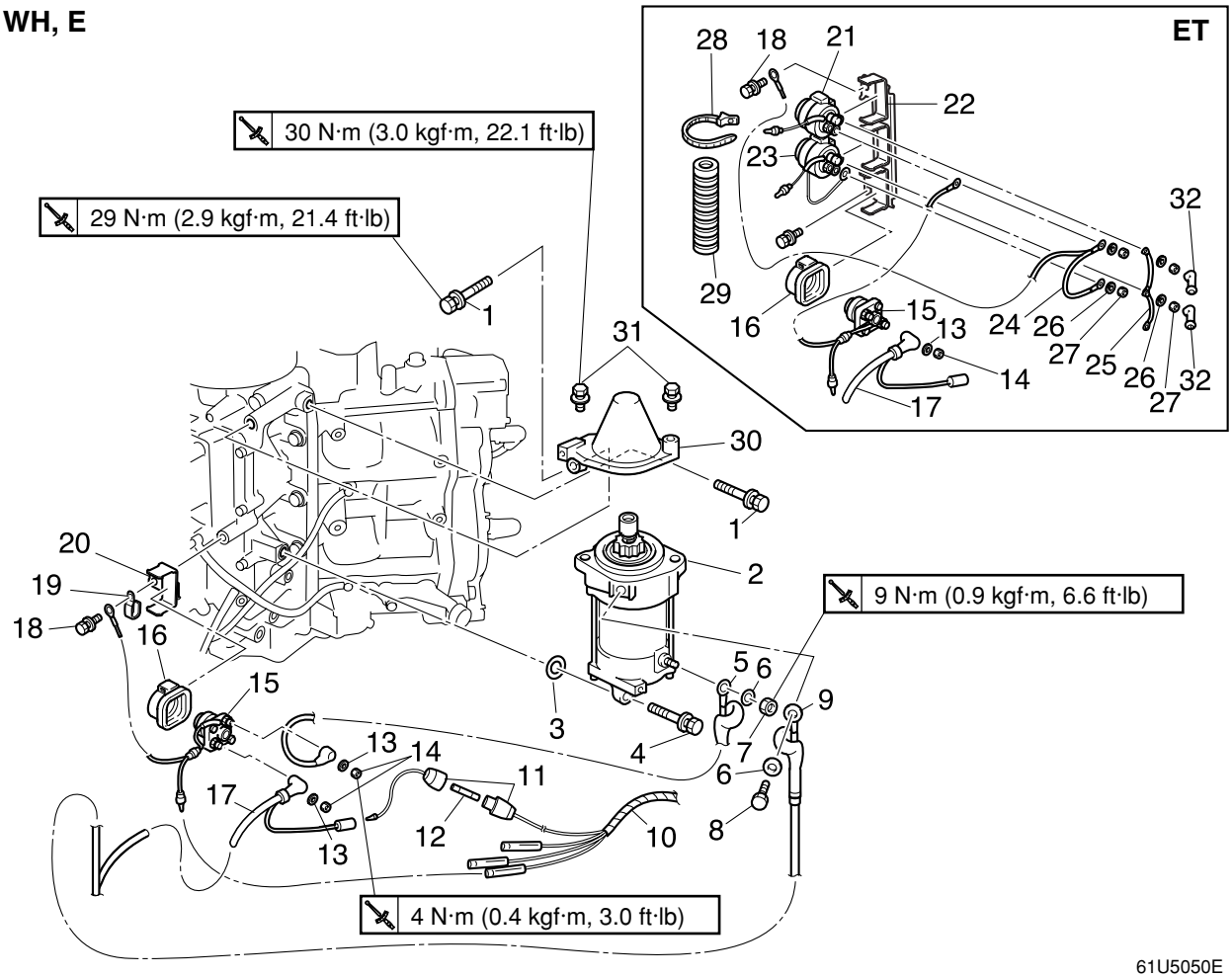
No.	Part name	Q'ty	Remarks
1	Screw	4	ø6 × 16 mm
2	Cover	1	
3	Screw	2	ø6 × 40 mm
4	CDI unit	1	
5	Charge coil coupler	1	
6	Bolt	1	M6 × 12 mm
7	Spark plug cap	4	
8	Bolt	4	M6 × 20 mm
9	Ignition coil	4	
10	Bolt	2	M6 × 12 mm
11	Bolt	3	M6 × 28 mm
12	Grommet	3	
13	Case	1	
14	Collar	3	
15	Pulser coil coupler	1	
16	Main harness coupler	1	
17	Start-in-gear protection cable	1	MH, WH

WH, E



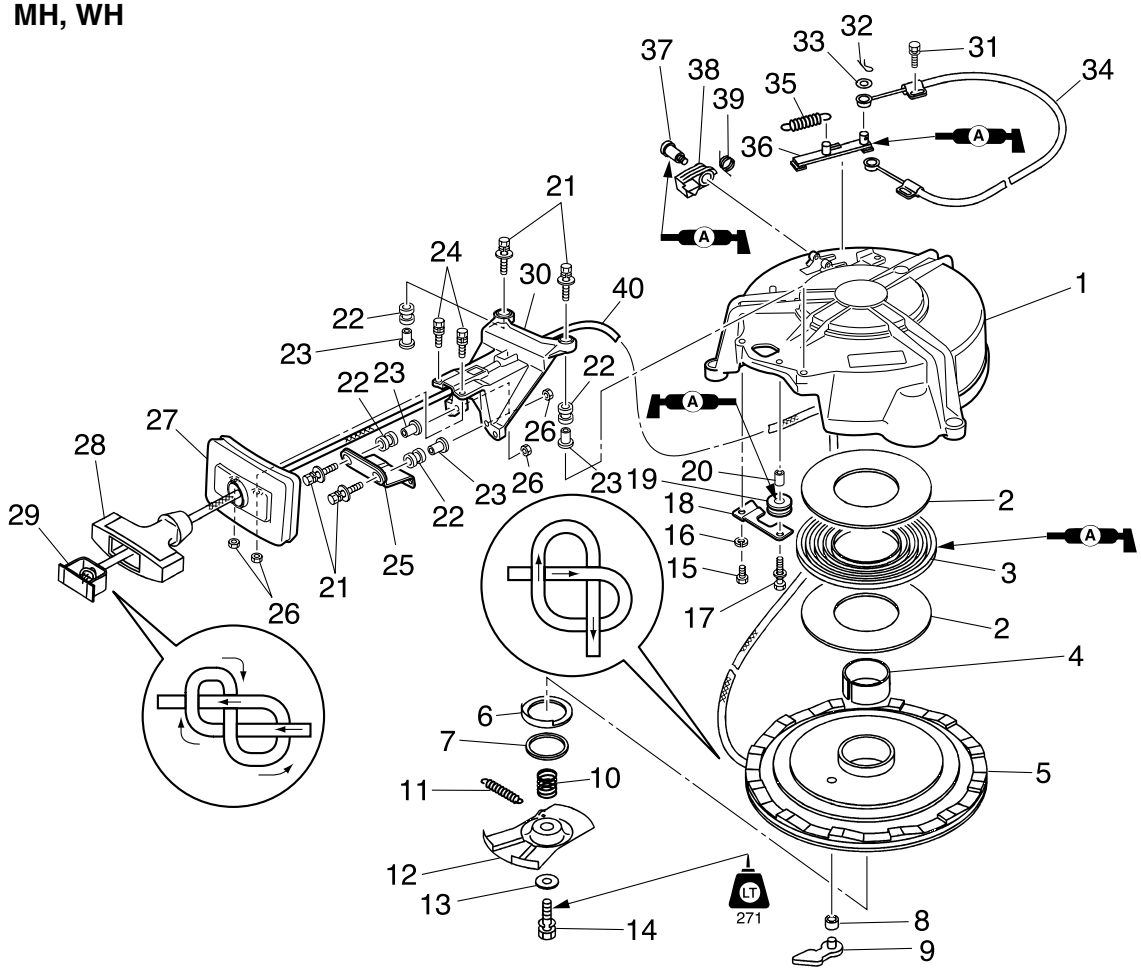
No.	Part name	Q'ty	Remarks
1	Bolt	2	M8 × 45 mm
2	Starter motor	1	
3	Washer	1	
4	Bolt	1	M8 × 35 mm
5	Positive battery lead	1	
6	Washer	2	
7	Nut	1	
8	Bolt	1	M8 × 16 mm
9	Negative battery cable	1	
10	Wireharness	1	
11	Fuse holder	1	
12	Fuse	1	20A
13	Spring washer	2	
14	Nut	2	
15	Starter relay	1	
16	Holder	1	
17	Positive battery cable	1	

WH, E



No.	Part name	Q'ty	Remarks
18	Bolt	1	M6 × 12 mm
19	Clamp	1	
20	Holder	1	
21	PTT relay (up)	1	ET
22	Holder	1	ET
23	PTT relay (down)	1	ET
24	PTT relay lead	1	ET
25	Connector	1	ET
26	Spring washer	4	ET
27	Nut	4	ET
28	Lock tie	1	ET
29	Tube	1	ET
30	Starter motor bracket	1	
31	Bolt	2	M8 × 25 mm
32	Cap	2	ET

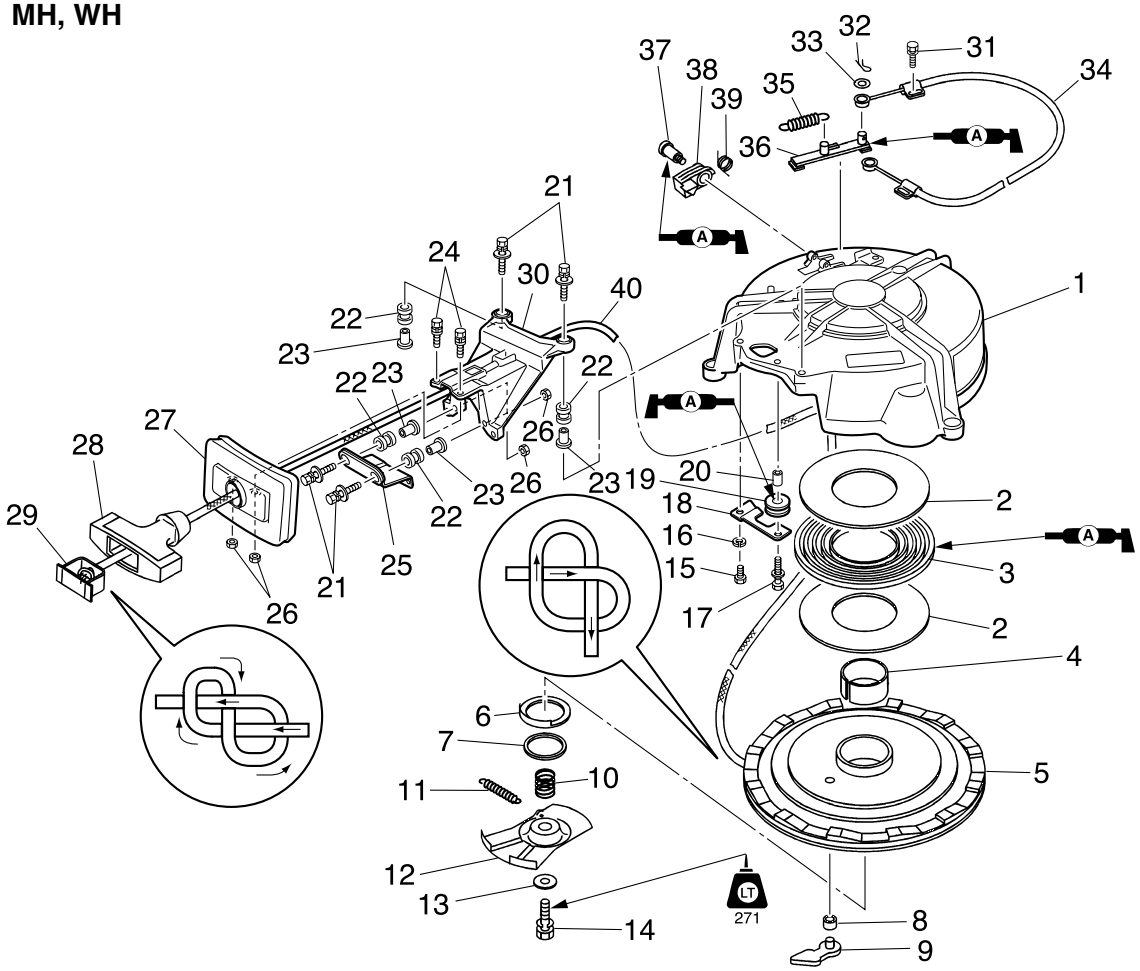
MH, WH



61U5040E

No.	Part name	Q'ty	Remarks
1	Manual starter case	1	
2	Plastic washer	2	
3	Spiral spring	1	
4	Collar	1	
5	Sheave drum	1	
6	Washer	1	
7	Clip	1	
8	Collar	1	
9	Drive pawl	1	
10	Spring	1	
11	Spring	1	
12	Drive plate	1	
13	Washer	1	
14	Bolt	1	M6 × 16 mm
15	Bolt	1	M6 × 12 mm
16	Washer	1	
17	Bolt	1	M6 × 25 mm

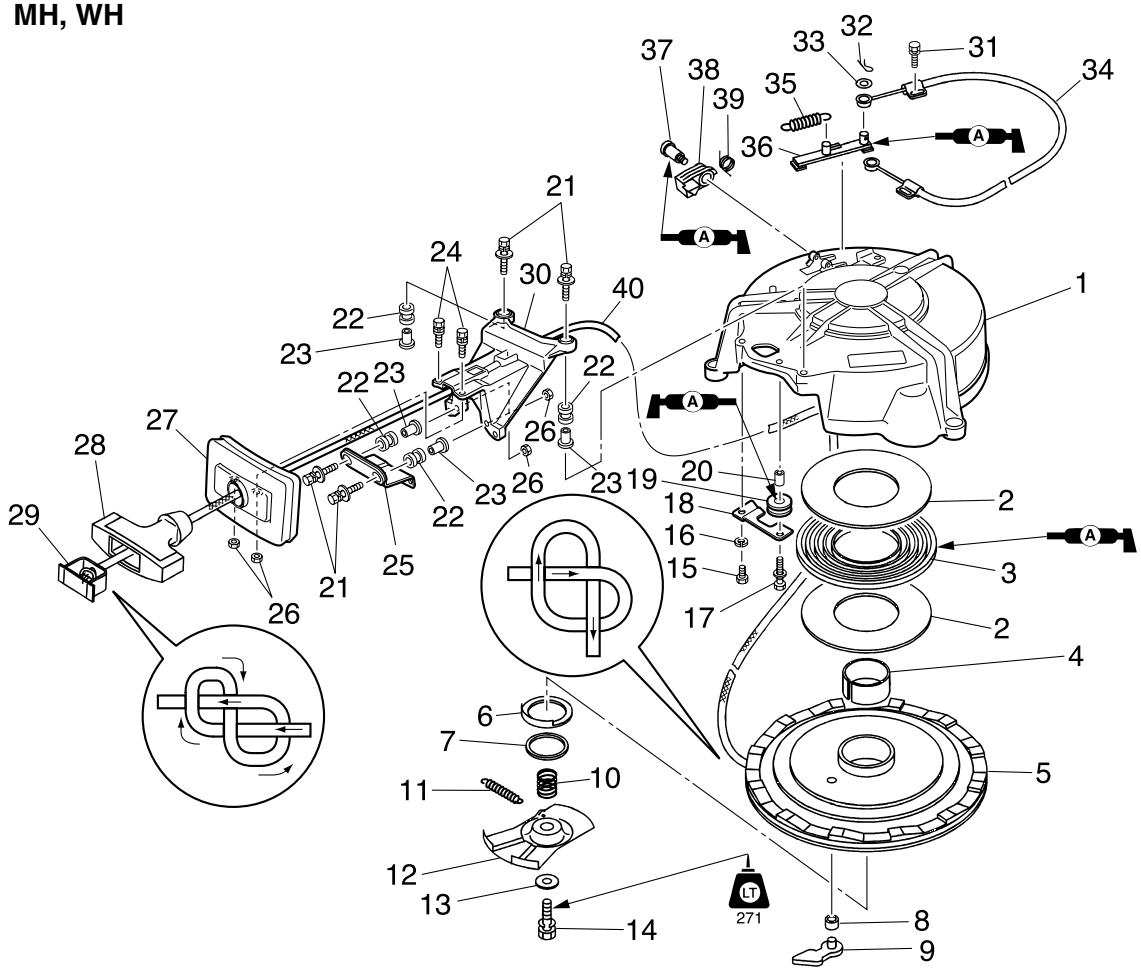
MH, WH



61U5040E

No.	Part name	Q'ty	Remarks
18	Rope guide	1	
19	Roller	1	
20	Bushing	1	
21	Bolt	4	M6 × 30 mm
22	Grommet	4	
23	Collar	4	
24	Bolt	2	M6 × 20 mm
25	Bracket	1	
26	Nut	4	
27	Damper	1	
28	Starter handle	1	
29	Cap	1	
30	Bracket	1	
31	Bolt	1	M6 × 12 mm
32	Cotter pin	1	
33	Washer	1	
34	Start-in-gear protection cable	1	

MH, WH



61U5040E

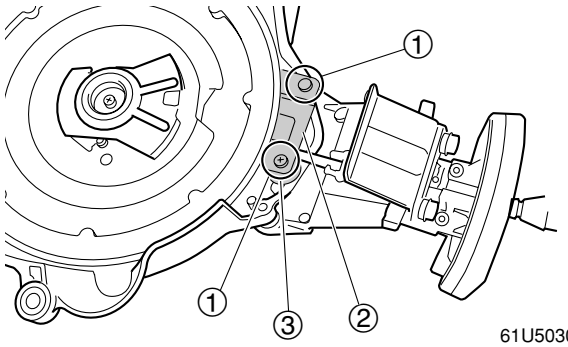
No.	Part name	Q'ty	Remarks
35	Spring	1	
36	Guide	1	
37	Bolt	1	
38	Stopper	1	
39	Spring	1	
40	Starter rope	1	

Disassembling the manual starter (MH, WH)

⚠WARNING

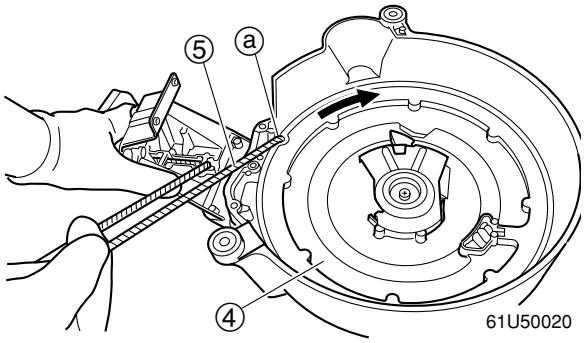
- **The sheave drum can pop out. Hold the sheave drum with your hand, then pull it out.**
- **The spiral spring can pop out. Wear suitable protective gloves and cover the spiral spring with cloths, then pull out the sheave drum.**

1. Remove the bolts ①, rope guide ② and roller ③.



61U50300

2. Turn the sheave drum ④ clockwise until the spiral spring is free.

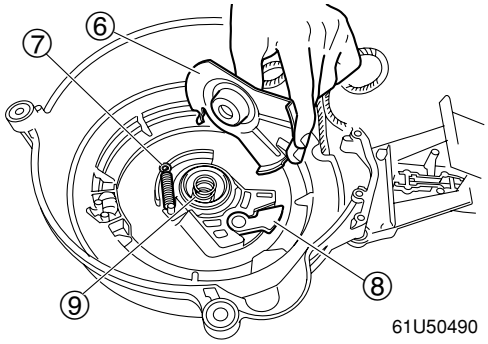


61U50020

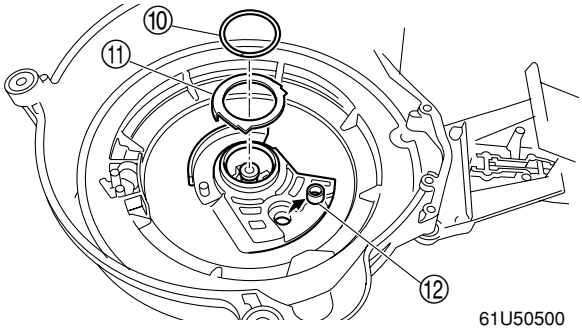
NOTE:

- Turn the sheave drum to hook the starter rope with the notch on the sheave drum easily.
- Pass the starter rope ⑤ through the notch ⓐ.

3. Remove the bolt, drive plate ⑥, spring ⑦, drive pawl ⑧, spring ⑨, clip ⑩, washer ⑪ and collar ⑫.



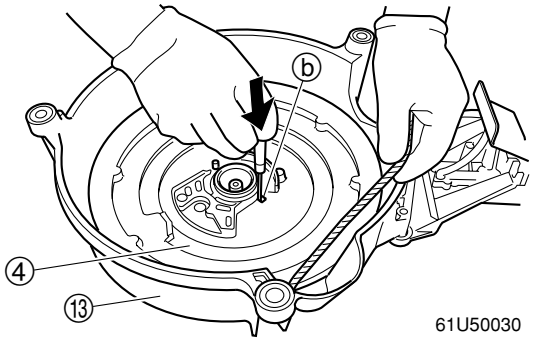
61U50490



61U50500

4. Insert a flat-head screwdriver into the hole ⓑ in the sheave drum and push down on the spiral spring so that it release from the sheave drum.

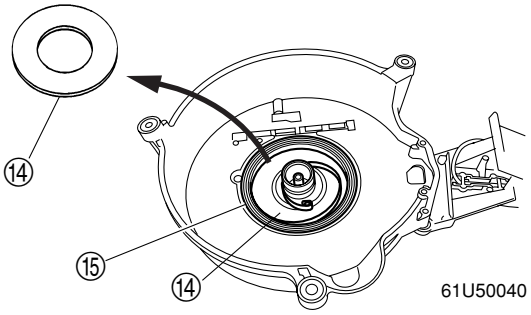
5. Remove the sheave drum ④ from the manual starter case ⑬.



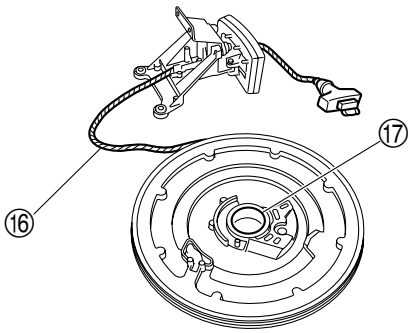
61U50030

5

6. Remove the plastic washers ⑭, spiral spring ⑮ from the manual starter case.



7. Remove the starter rope ⑯ and collar ⑰.



Checking the spiral spring (MH, WH)

1. Check the spiral spring. Replace if cracked, bent or damaged.

Checking the drive pawl (MH, WH)

1. Check the drive pawl. Replace if worn or damaged.

Checking the starter rope (MH, WH)

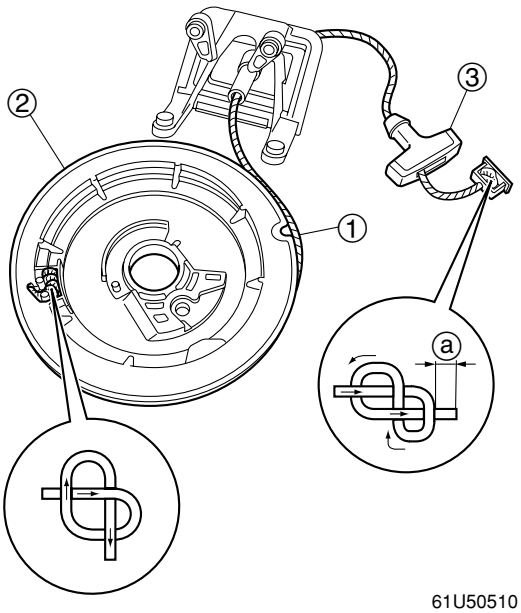
1. Measure the starter rope length. Replace if the starter rope is worn or damaged.

Starter rope length: (Reference data) 2,300 mm (90.6 in)

Assembling the manual starter (MH, WH)

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

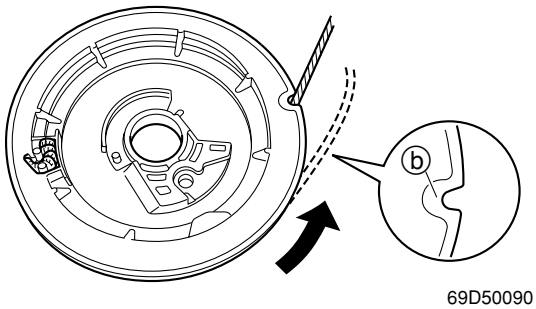
2. Install the manual starter handle ③.



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 ⓐ of the starter rope.

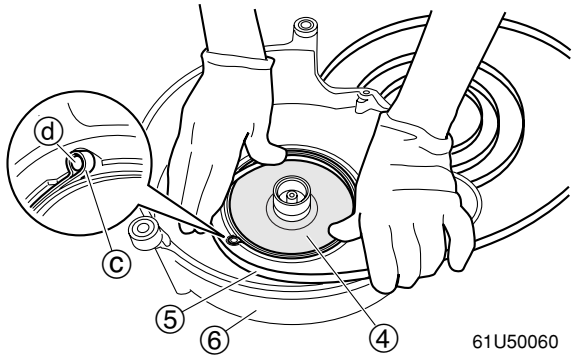
3. Wind the starter rope 1 1/2 around the sheave drum in the direction of the arrow shown in the illustration.



NOTE:

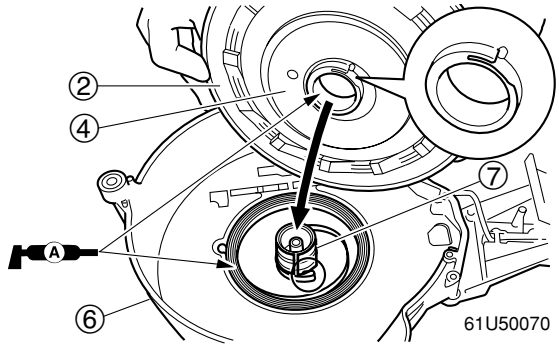
After winding the starter rope around the sheave drum, install the starter rope in the notch ⓑ.

4. Install the plastic washer ④ and spiral spring ⑤ into the manual starter case ⑥.



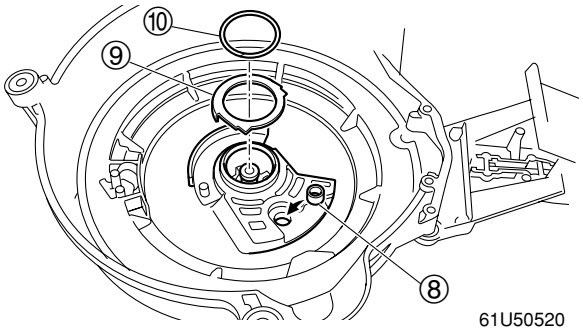
NOTE:
Install the outer end ⓒ of the spiral spring onto the pin ⓓ of the starter case.

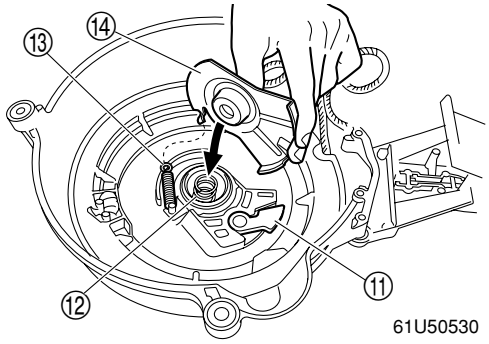
5. Install the collar ⑦, plastic washer ④ and the sheave drum ② into the manual starter case ⑥.



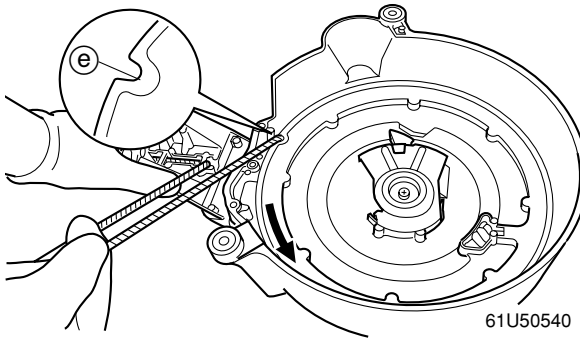
NOTE:
Install the sheave drum in the direction of arrow shown, and then set the spiral spring by turning the sheave drum.

6. Install the collar ⑧, washer ⑨, clip ⑩, drive pawl ⑪, spring ⑫, spring ⑬, and drive plate ⑭.

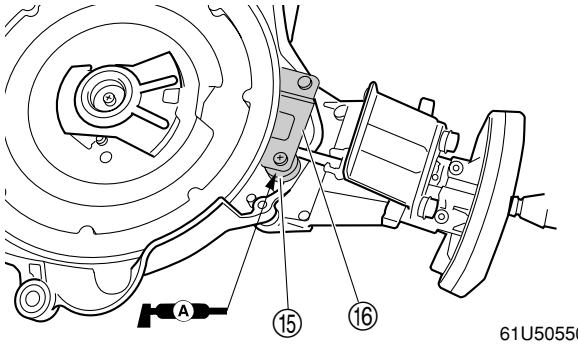




7. Turn the sheave drum 5 times in the direction of the arrow shown, and then remove the starter rope from the notch ⓔ.

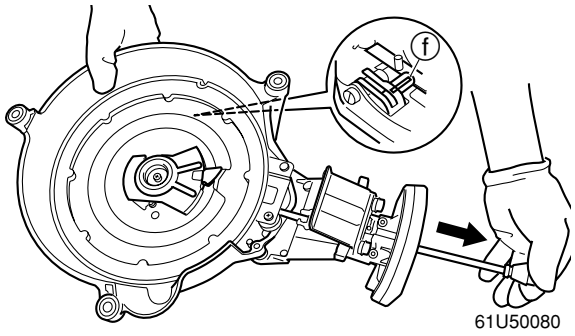


8. Install the roller ⑮ and rope guide ⑯.



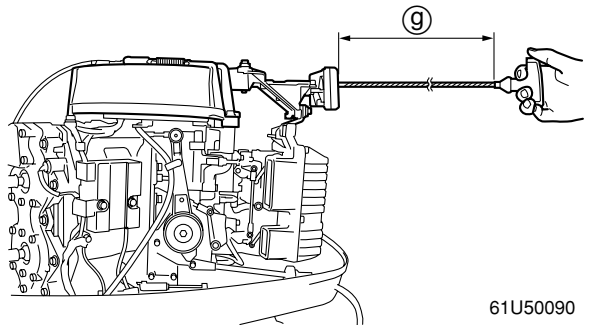
5

9. Pull the manual starter handle several times in the direction of the arrow to check that the sheave drum turns smoothly and to check the starter rope for slack. Repeat steps 3–8 if necessary.



NOTE:
Align the mark ⓕ on the stopper with guide, and then turn the sheave drum.

10. Pull the manual starter handle completely, then measure the starter rope length. If the starter rope length is out of specification, refer to the step 7 and adjust the starter rope by rewind times.

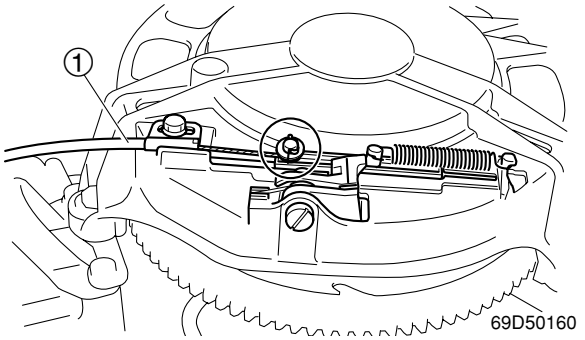


Starter rope length ⓖ:
(Reference data)
1,700–1,900 mm (66.9–74.8 in)

Removing the power unit

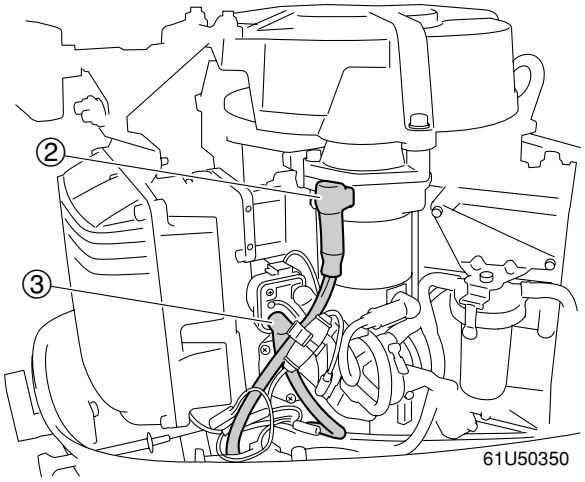
NOTE:
It is recommended to loosen the flywheel magnet nut before removing the power unit to improve working efficiency.

1. Remove the CDI unit cover, start-in-gear protection cable ①, then remove the manual starter and starter pully (MH, WH).

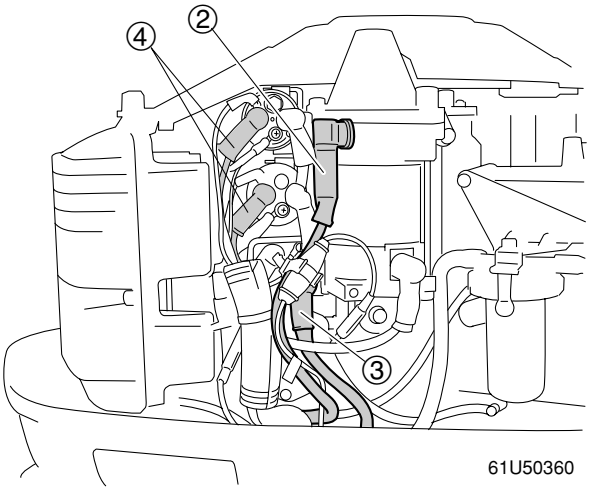


2. Disconnect the negative battery cable ②, positive battery cable ③ and PTT motor lead ④.

A

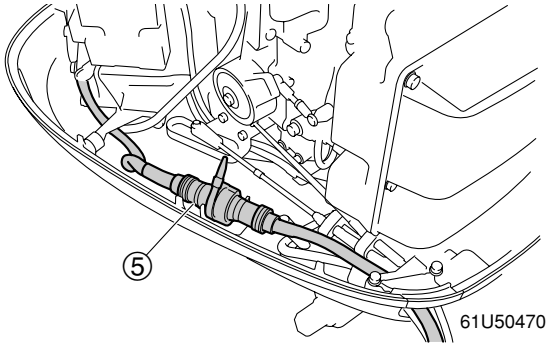


B

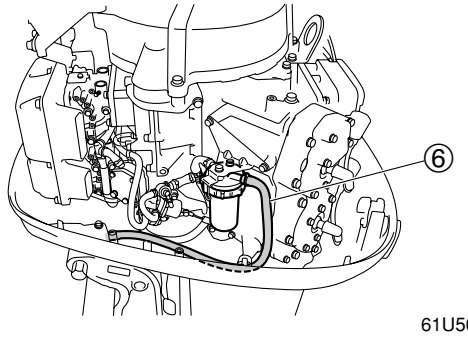


A WH, E
B ET

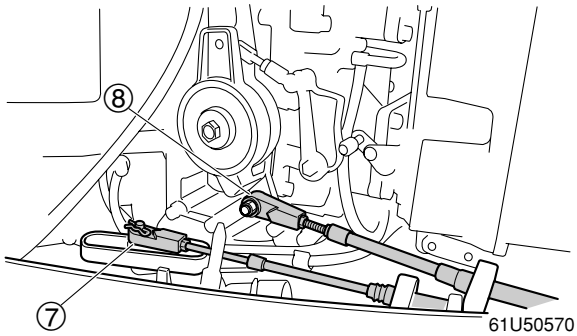
3. Disconnect the 10-pin main harness coupler ⑤.



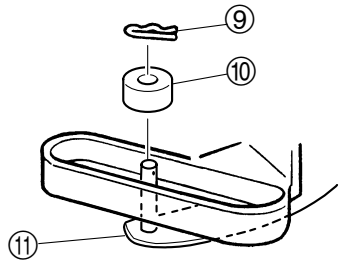
4. Disconnect the fuel hose ⑥.



5. Set the shift lever or remote control lever in the neutral position, and then disconnect the shift cable ⑦, throttle cable ⑧.

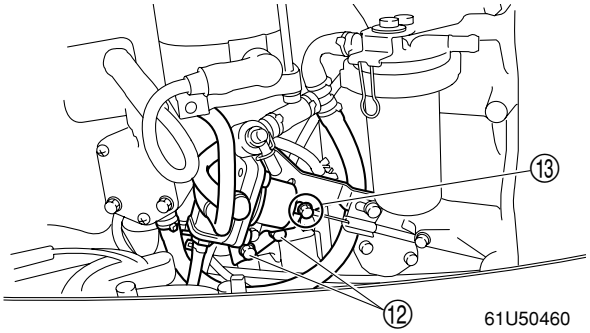


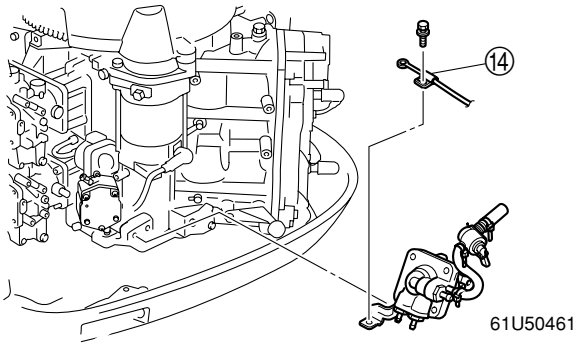
6. Remove the clip ⑨ and bushing ⑩ and then, push the shift lever ⑪ down.



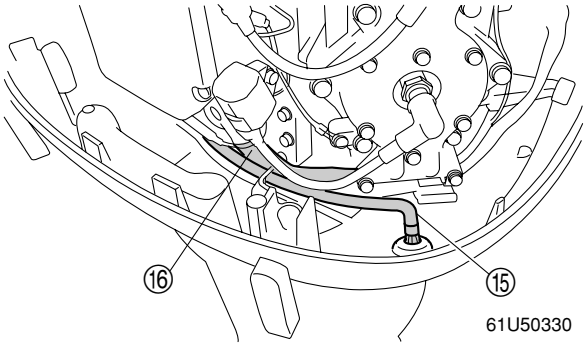
7. Disconnect the choke link rod.

8. Remove the bracket bolt ⑫ manual injection pump cable end ⑬ and start-in-gear protection cable end ⑭.

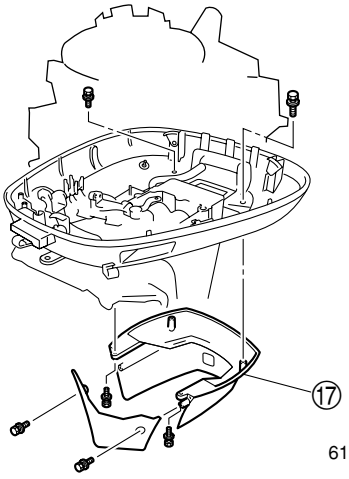




9. Disconnect the cooling water pilot hose ⑮ and PCV hose ⑯.

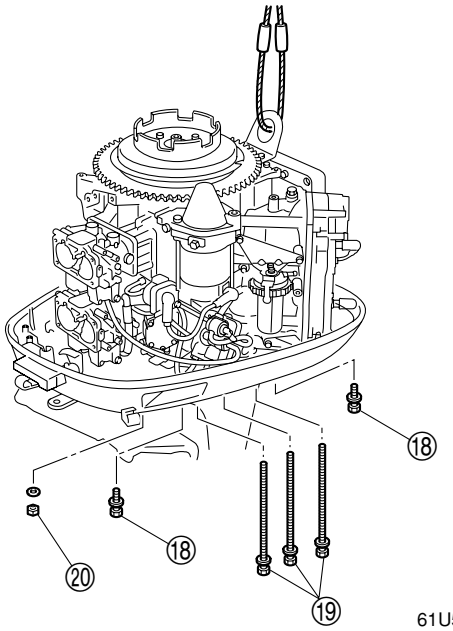


10. Remove the apron ⑰.



5

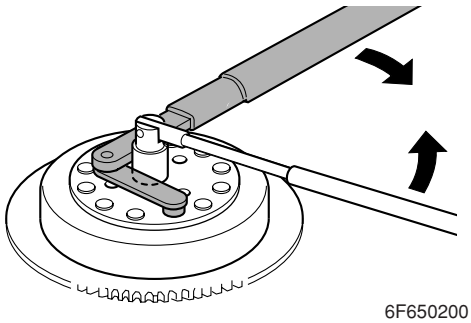
11. Remove the power unit by removing the bolts ⑱, bolts ⑲ and nuts ⑳.



61U50590

Removing the flywheel magnet

1. Loosen the flywheel magnet nut.

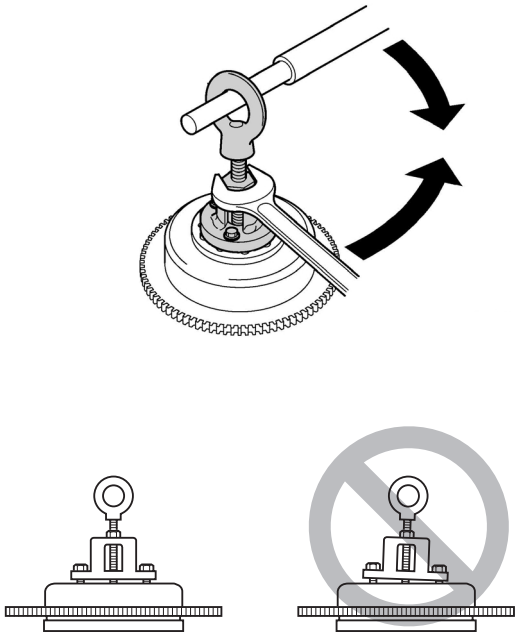

6F650200

CAUTION:

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

Flywheel holder: 90890-06522

2. Remove the flywheel magnet.


6B450090

CAUTION:

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

NOTE:

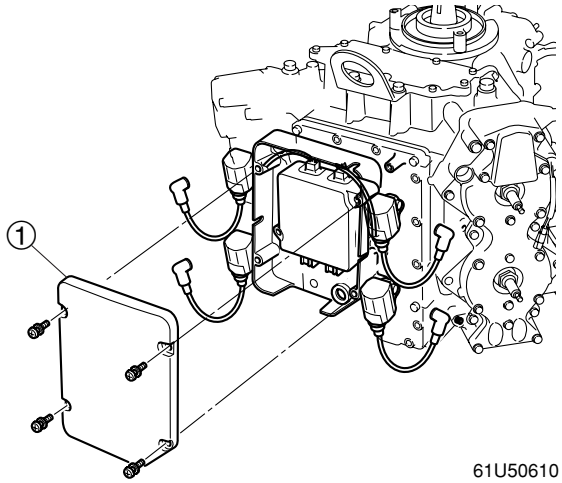
Apply force to the crankshaft end until the flywheel magnet comes off the tapered portion of the crankshaft.

Flywheel puller: 90890-06521

3. Remove the Woodruff key.

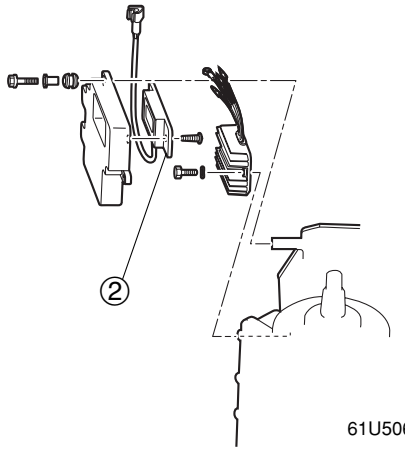
Removing the electrical component

1. Remove the cover ① and disconnect the coupler.



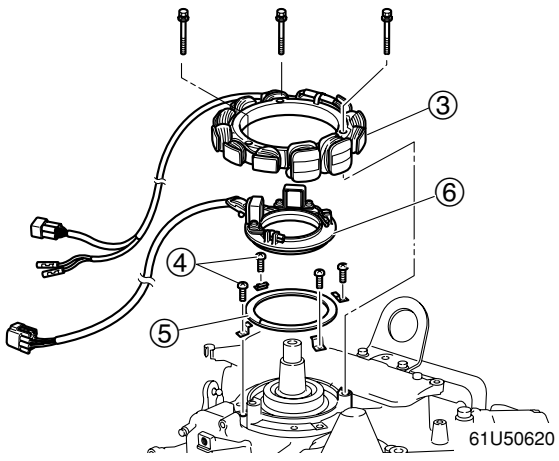
61U50610

2. Remove the hour meter ②.

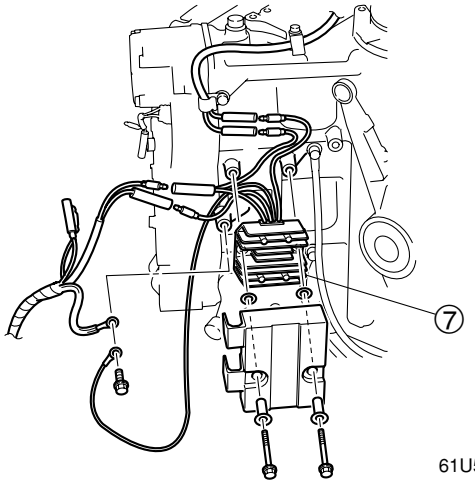


61U50615

3. Remove the stator assembly ③, retainer screw ④, retainer ⑤, pulser coil assembly ⑥, and Rectifier Regulator ⑦.

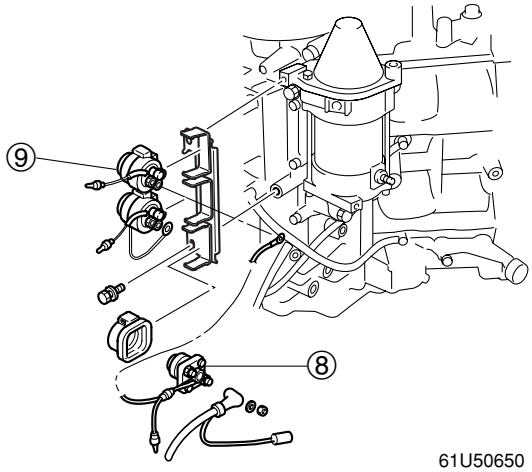


61U50620



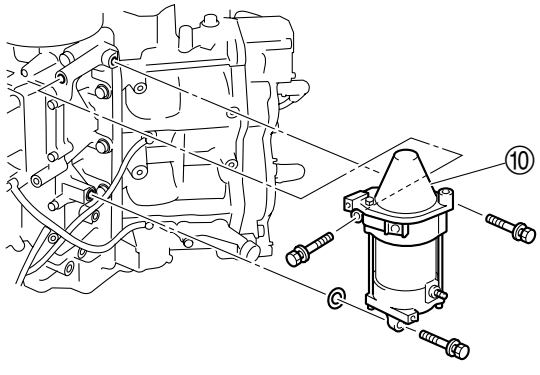
61U50630

4. Remove the starter relay ⑧ and the PTT relay assembly ⑨.



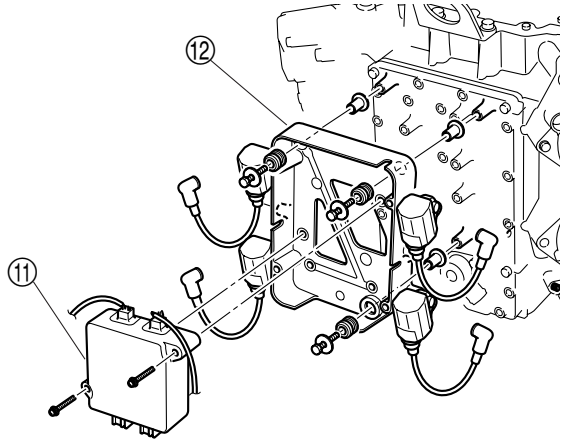
61U50650

5. Remove the starter motor ⑩.



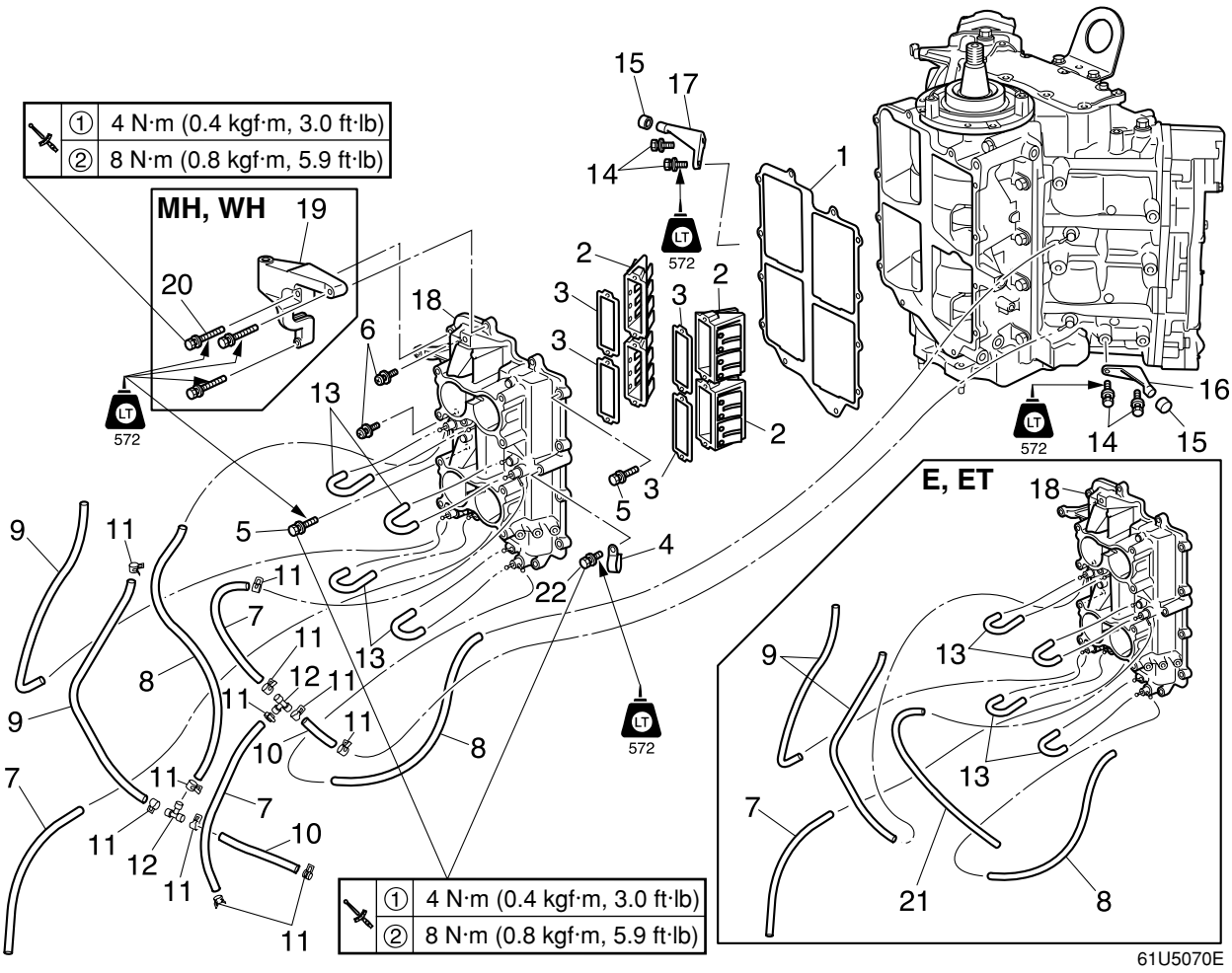
61U50640

6. Disconnect the ignition coil leads, and then remove the CDI unit ⑪ and case ⑫.

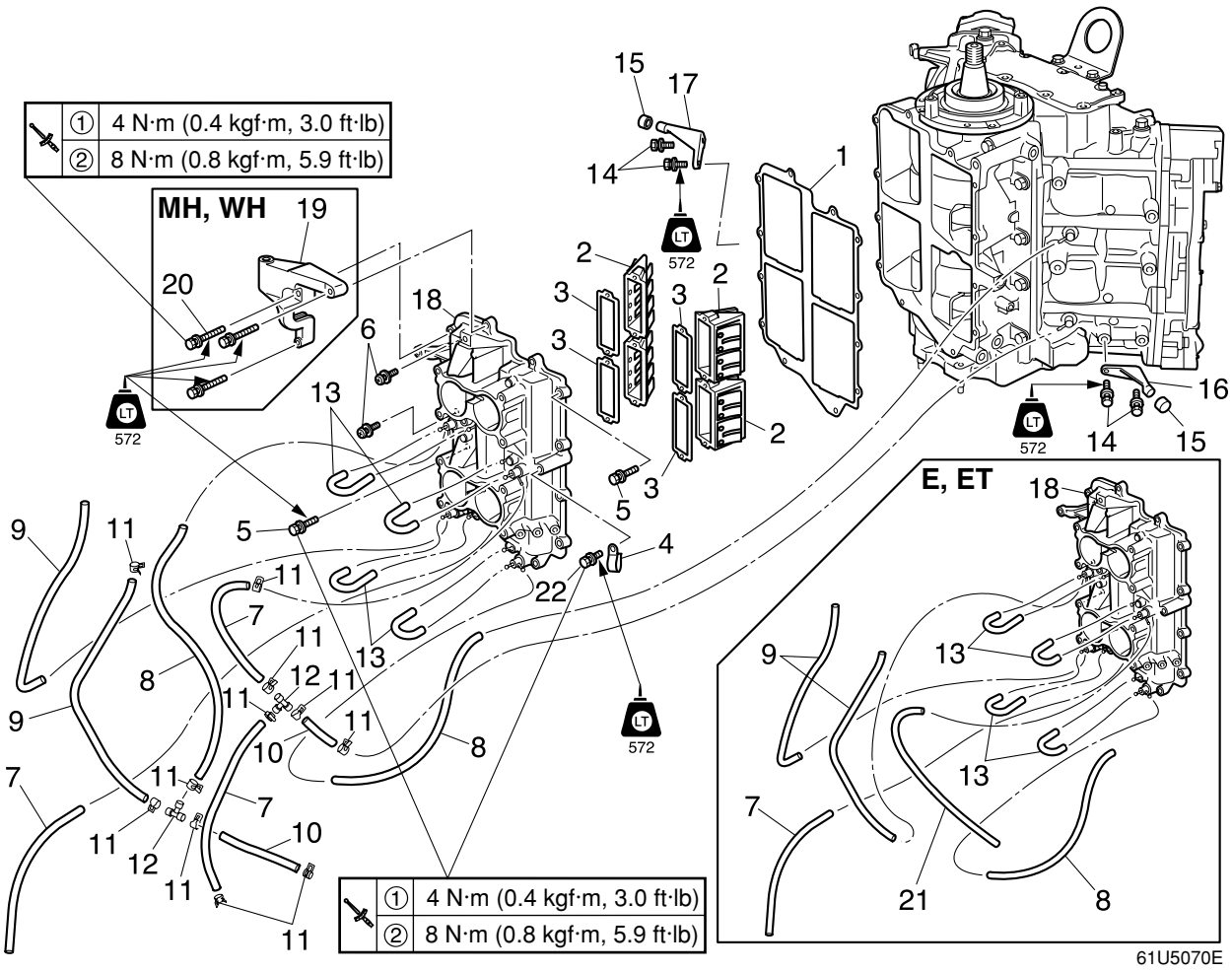


61U50600

Intake manifold



No.	Part name	Q'ty	Remarks
1	Gasket	1	Not reusable
2	Reed valve	4	
3	Gasket	4	Not reusable
4	Clamp	1	
5	Bolt	9	M6 × 25 mm
	Bolt	12	E, ET
6	Screw	8	ø5 × 15 mm
7	Hose	3	
	Hose	1	E, ET
8	Hose	2	MH, WH
	Hose	1	E, ET
9	Hose	2	
10	Hose	2	
11	Clip	11	MH, WH
12	Joint	2	MH, WH
13	Hose	4	
14	Bolt	4	M6 × 20 mm

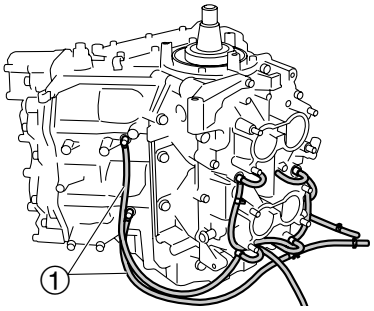


No.	Part name	Q'ty	Remarks
15	Cap	2	
16	Bracket	1	
17	Bracket	1	
18	Intake manifold	1	
19	Bracket	1	MH, WH
20	Bolt	3	M6 × 45 mm MH, WH
21	Hose	1	E, ET
22	Bolt	1	M6 × 12 mm

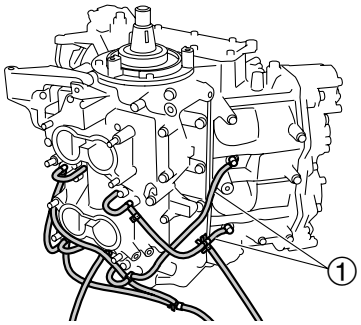
Removing the intake manifold

1. Remove the carburetor assemblies and the fuel hoses.

2. Disconnect the breather hoses ①.



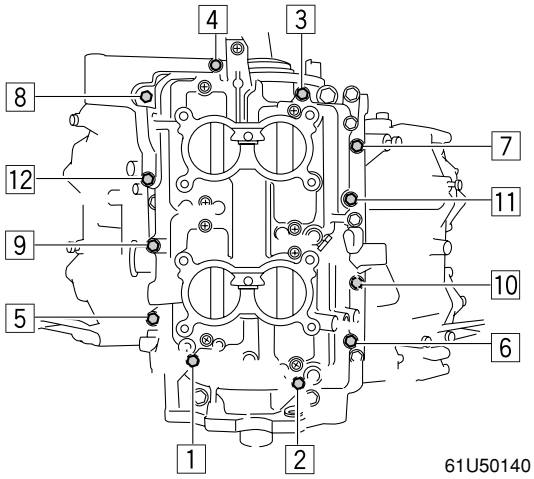
61U50370



61U50380

NOTE:
Mark the hoses connecting position, before disconnect.

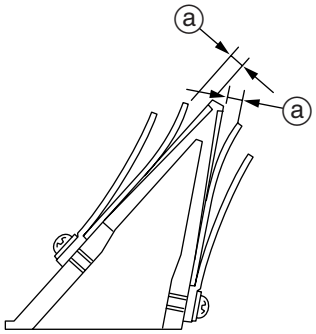
3. Remove the intake manifold bolts in the sequence shown.



61U50140

Checking the reed valve

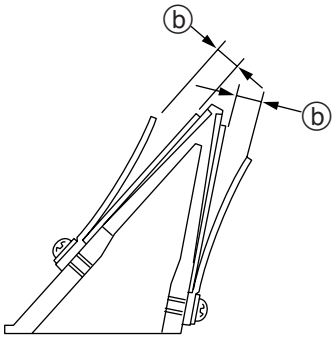
1. Check the reed valves for bends ⓐ. Replace the reed valves if above specification.



6G450180

Valve bending limit ⓐ:
0.2 mm (0.0079 in)

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

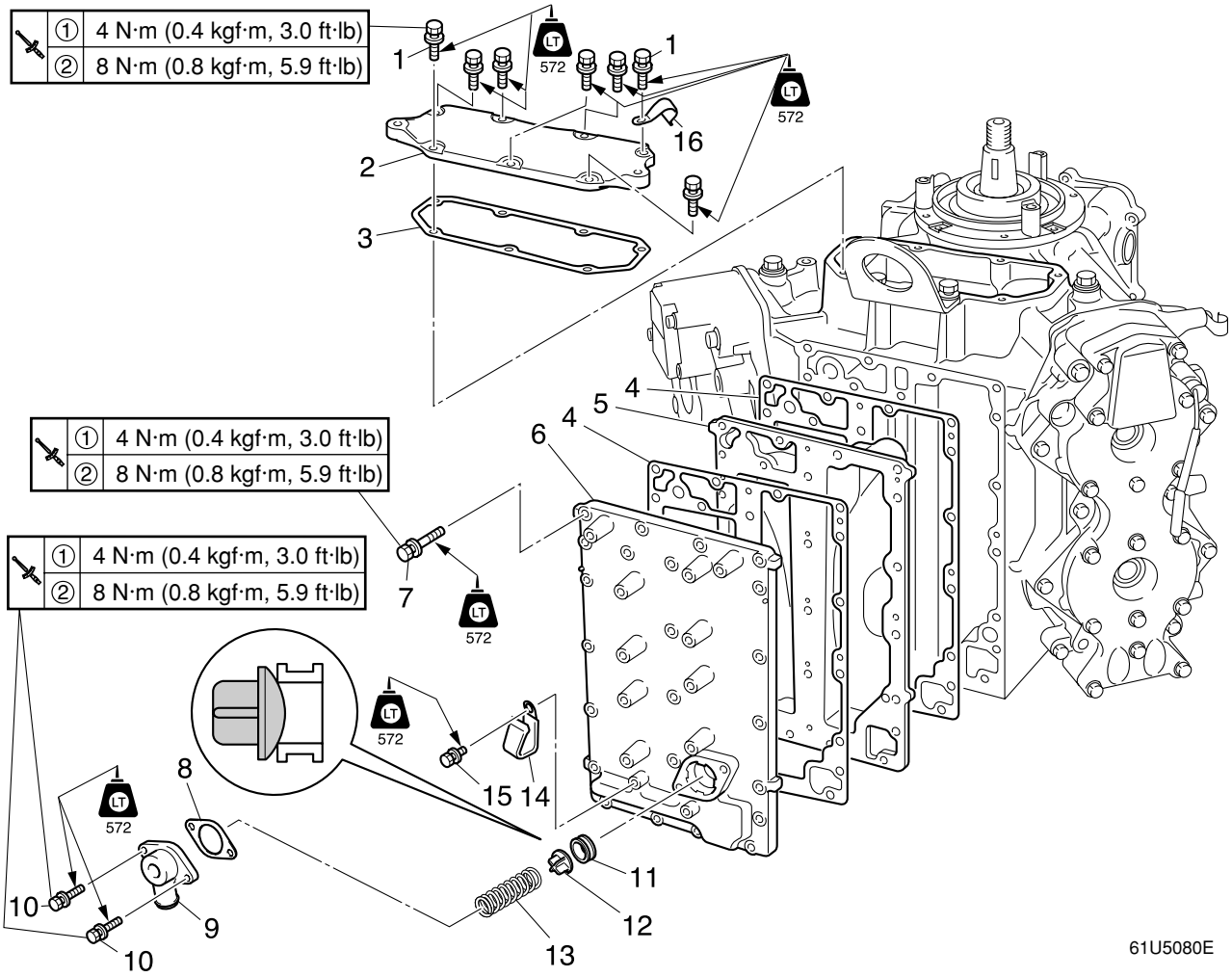


6G450200

Valve stopper height ⓑ:
6.2–6.8 mm (0.24–0.26 in)

5

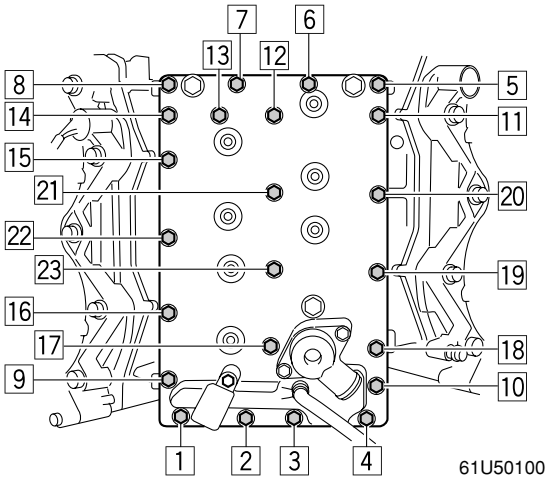
Exhaust cover

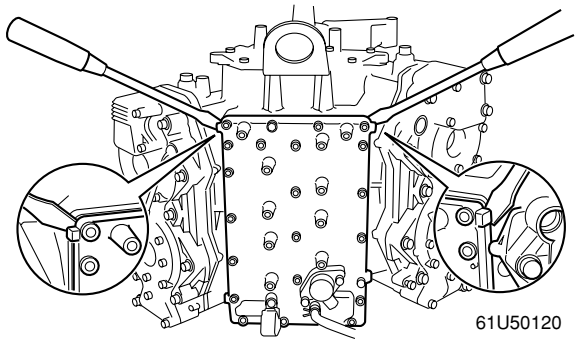


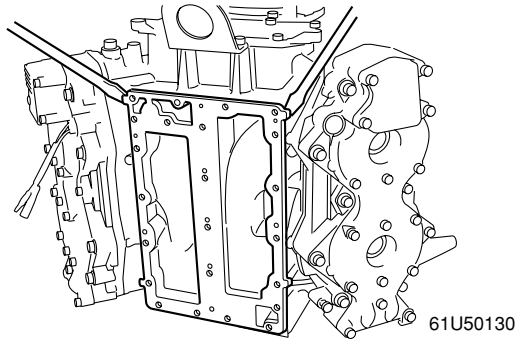
No.	Part name	Q'ty	Remarks
1	Bolt	7	M6 × 20 mm
2	Cover	1	
3	Gasket	1	Not reusable
4	Gasket	2	Not reusable
5	Exhaust inner cover	1	
6	Exhaust outer cover	1	
7	Bolt	23	M6 × 35 mm
8	Gasket	1	Not reusable
9	PCV cover	1	
10	Bolt	2	M6 × 20 mm
11	Grommet	1	
12	PCV	1	
13	Spring	1	
14	Clamp	1	
15	Bolt	1	M6 × 12 mm
16	Clamp	1	

Removing the exhaust cover

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







NOTE:
Insert a flat-head screw driver between the pry tabs to pry off the exhaust cover.

Checking the exhaust cover

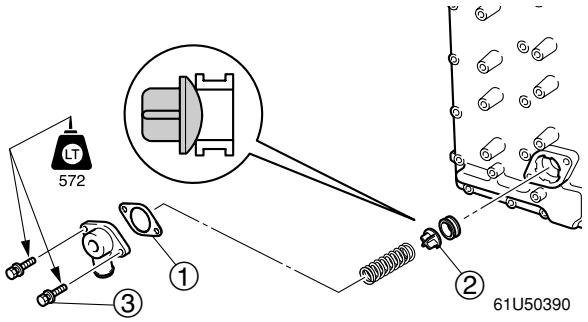
1. Check the exhaust cover for distortion or corrosion. Replace the exhaust cover if necessary.

Checking the PCV

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

Installing the PCV

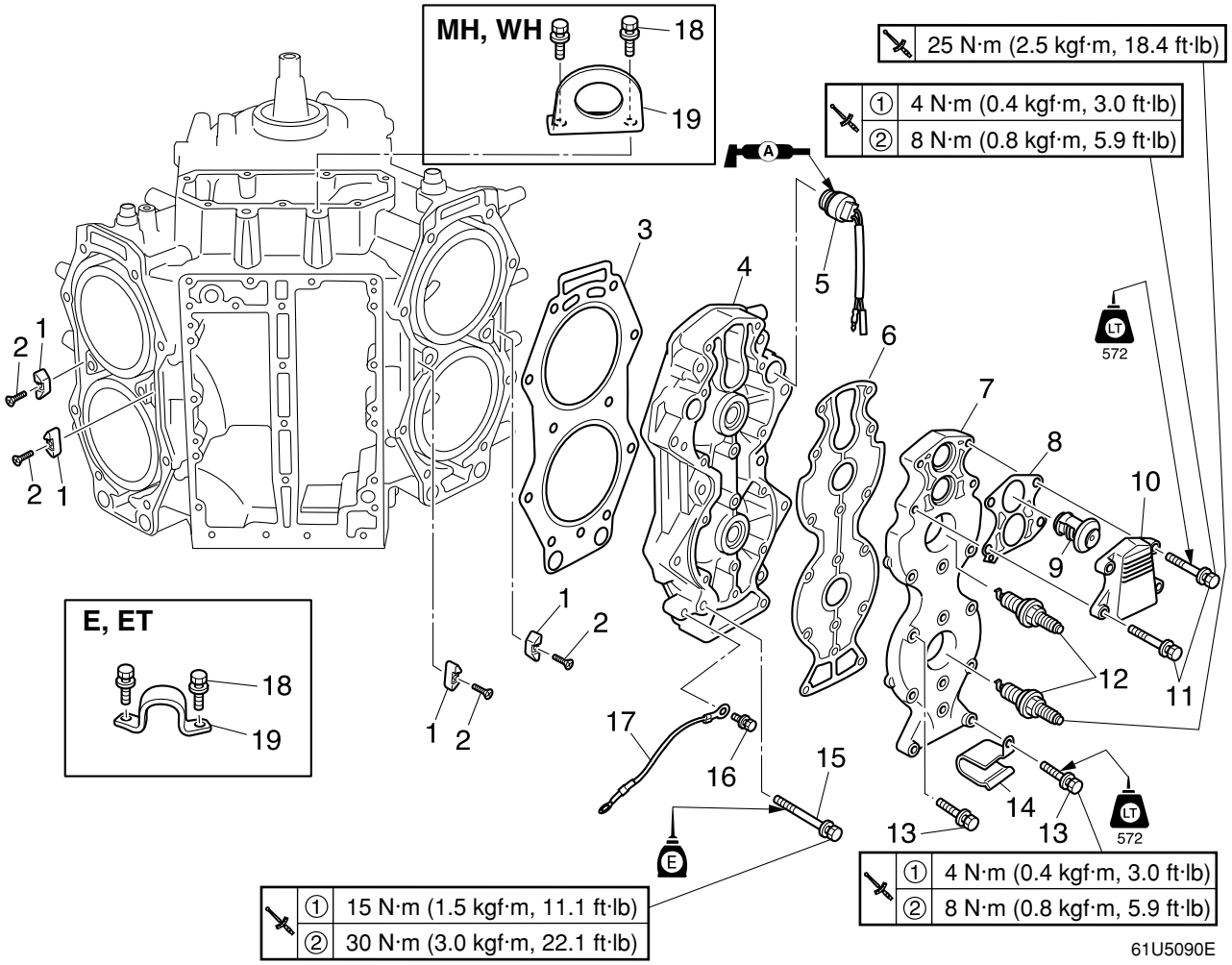
1. Install a new gasket ① and the PCV ② with the its rounded side facing towards the exhaust cover, and then tighten the bolts ③ to the specified torque.



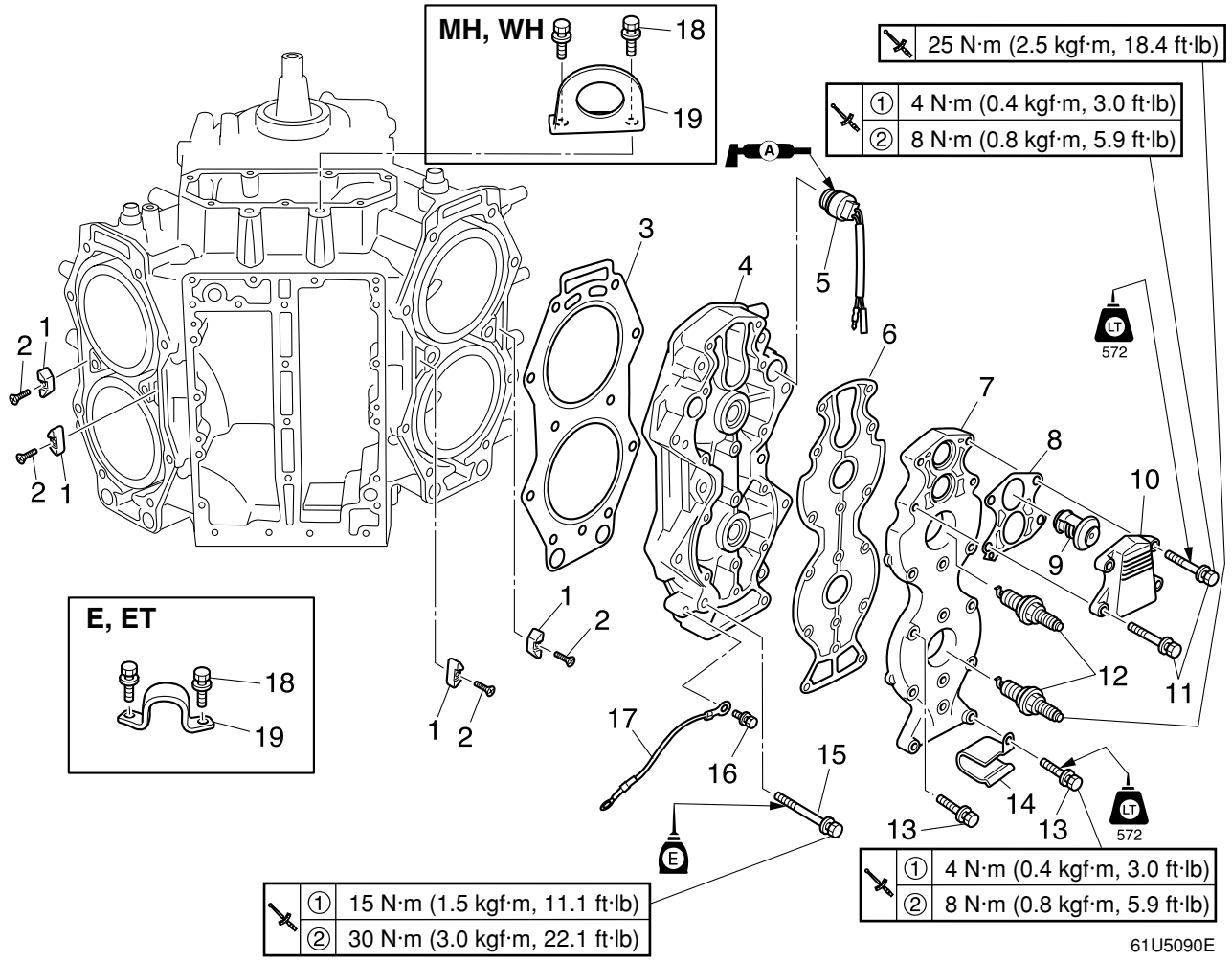
PCV cover bolts ③:
1st: 4 N·m (0.4 kgf·m, 3.0 ft·lb)
2nd: 8 N·m (0.8 kgf·m, 5.9 ft·lb)

5

Cylinder head



No.	Part name	Q'ty	Remarks
1	Anode	4	
2	Screw	4	
3	Gasket	2	Not reusable
4	Cylinder head	2	
5	Thermoswitch	2	
6	Gasket	2	Not reusable
7	Cylinder head cover	2	
8	Gasket	2	Not reusable
9	Thermostat	2	
10	Thermostat cover	2	
11	Bolt	8	M6 × 40 mm
12	Spark plug	4	
13	Bolt	24	M6 × 30 mm
14	Clamp	2	
15	Bolt	20	M8 × 60 mm
16	Bolt	2	M6 × 12 mm
17	Ground lead	2	

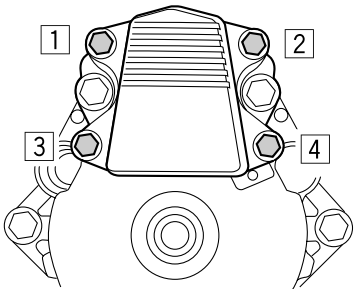


No.	Part name	Q'ty	Remarks
18	Bolt	2	M8 × 20 mm
19	Engine hanger	1	

Removing the cylinder head

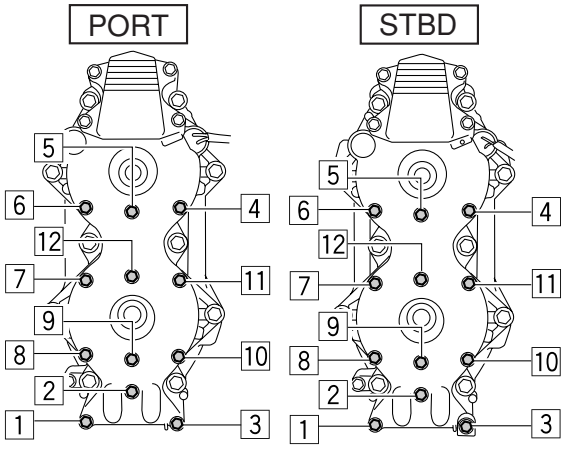
1. Remove the spark plugs.

2. Remove the thermostat cover bolts in the sequence as shown, and then remove the thermostat.

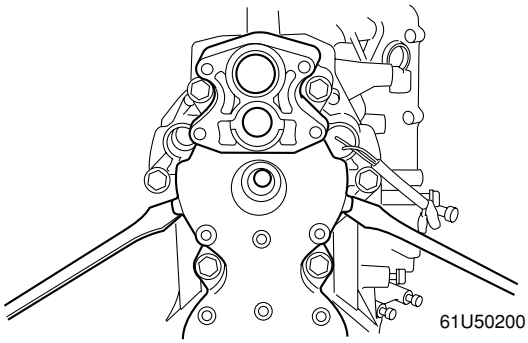


61U50170

3. Remove the cylinder head cover bolts in the sequence shown.

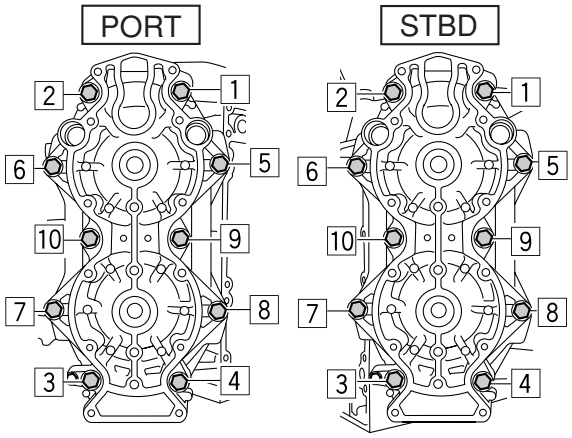


61U50180

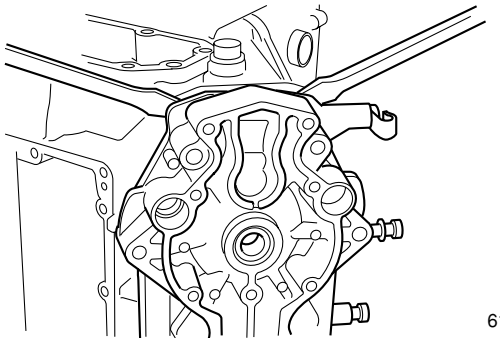

61U50200

4. Remove the thermoswitch.

5. Remove the cylinder head bolts in the sequence shown.



61U50210


61U50230

CAUTION:

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

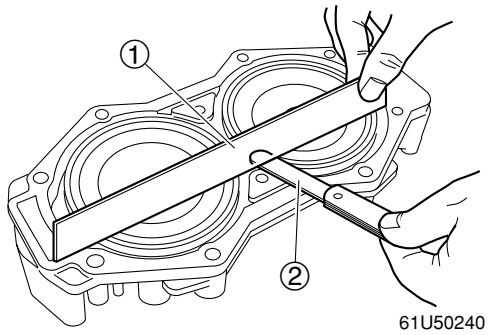
NOTE:

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

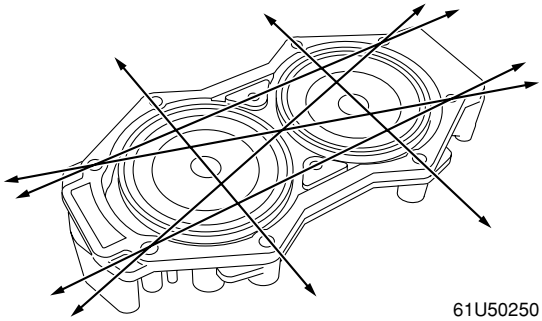
Checking the cylinder head

1. Eliminate carbon deposits from the combustion chambers and check for deterioration.

2. Check the cylinder head warpage using a straightedge ① and thickness gauge ② in 4 directions as shown. Replace the cylinder head if above specification.

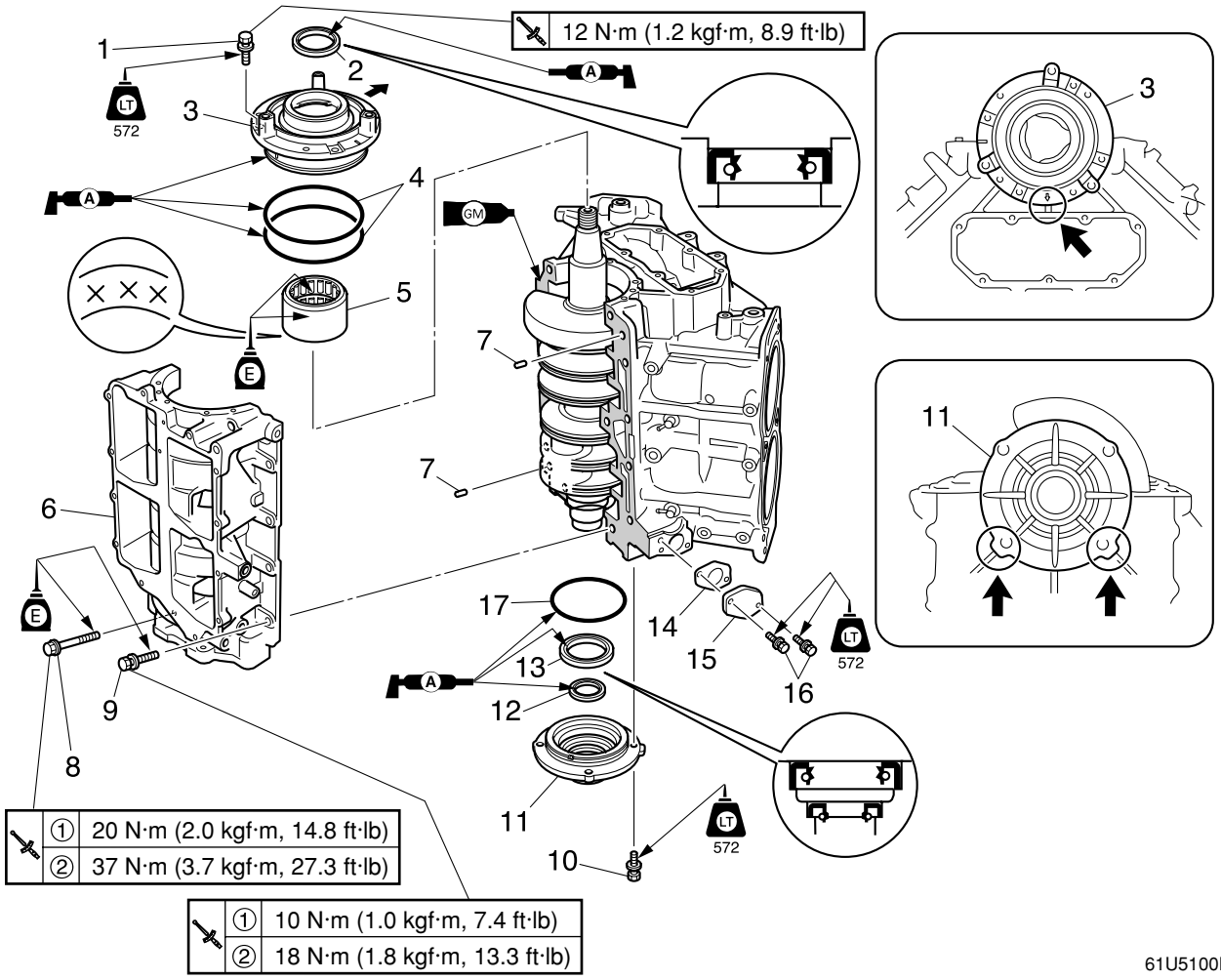


61U50240

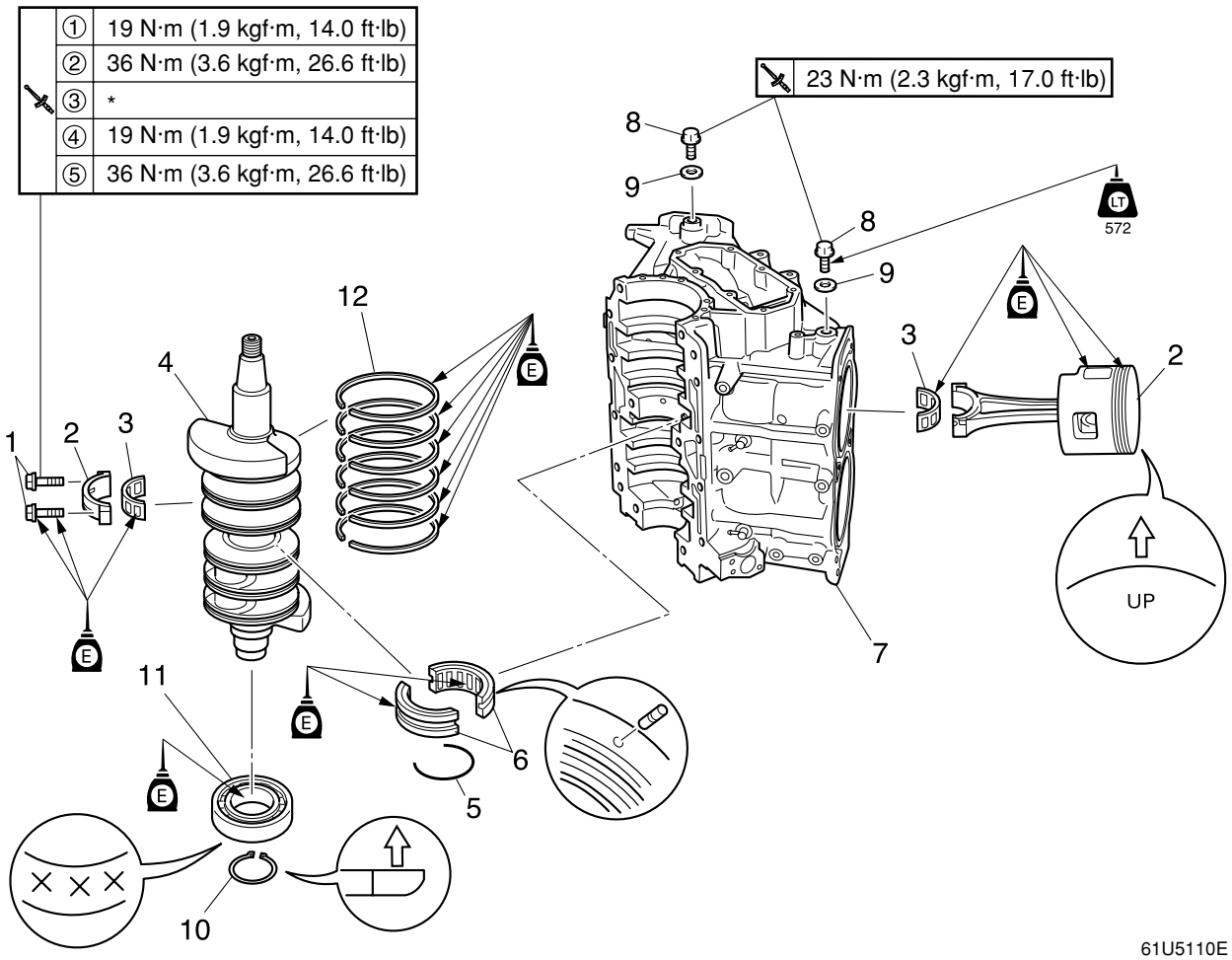

61U50250

Cylinder head warpage limit:
0.10 mm (0.0039 in)

Crankcase

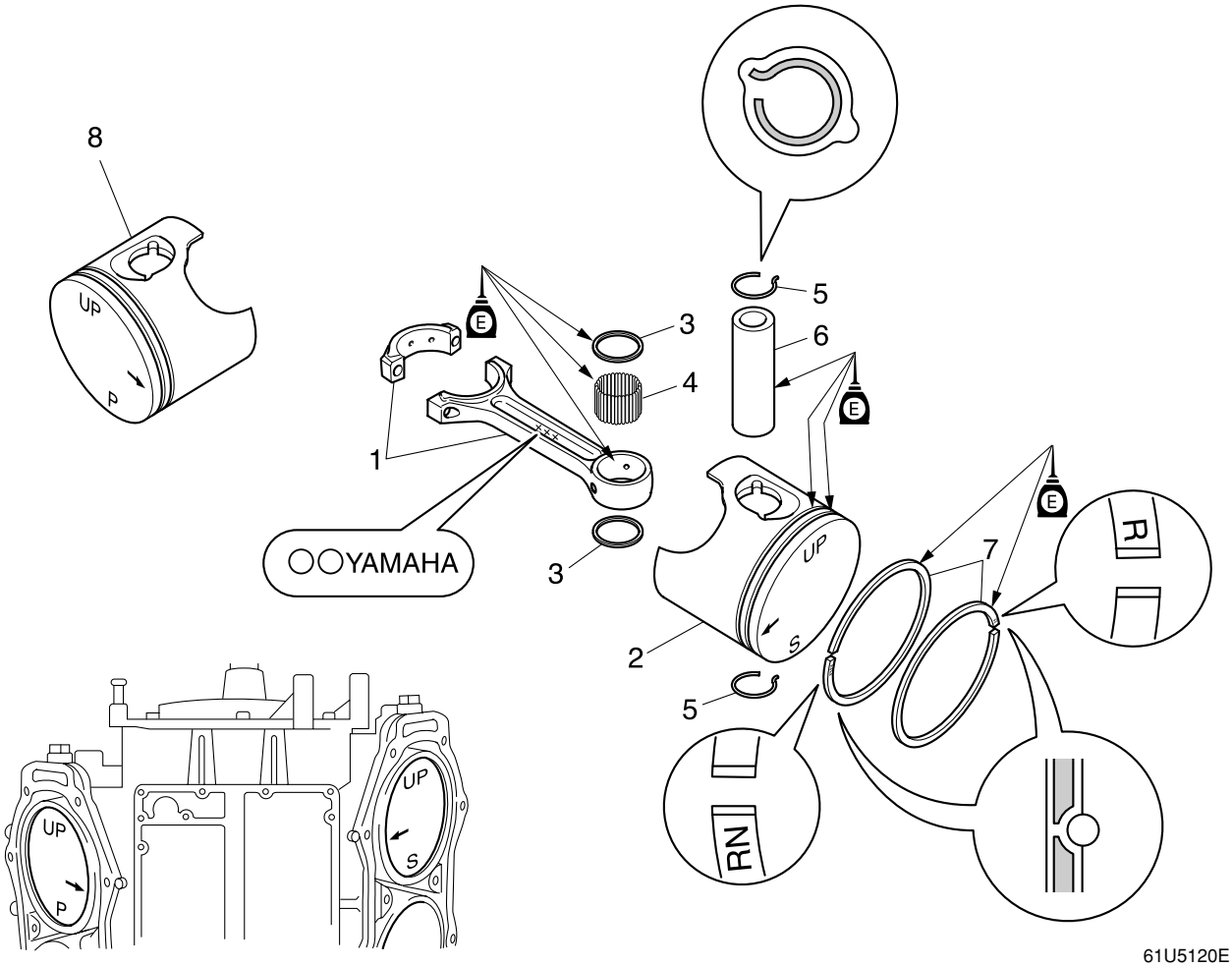


No.	Part name	Q'ty	Remarks
1	Bolt	4	M6 × 25 mm
2	Oil seal	1	Not reusable
3	Bearing housing	1	
4	O-ring	2	Not reusable
5	Needle bearing	1	
6	Crankcase	1	
7	Dowel	2	
8	Bolt	6	M10 × 60 mm
9	Bolt	8	M8 × 30 mm
10	Bolt	4	M6 × 20 mm
11	Oil seal housing	1	
12	Oil seal	1	Not reusable
13	Oil seal	1	Not reusable
14	Gasket	1	Not reusable
15	Cover	1	
16	Bolt	2	M6 × 16 mm
17	O-ring	1	Not reusable



No.	Part name	Q'ty	Remarks
1	Bolt	8	M8 × 22 mm
2	Piston and connecting rod assembly	4	
3	Roller bearing	4 set	
4	Crankshaft	1	
5	Circlip	1	
6	Main bearing	1 set	
7	Cylinder block	1	
8	Plug	2	
9	Gasket	2	Not reusable
10	Circlip	1	
11	Ball bearing	1	
12	Seal ring	6	

*: Loosen completely

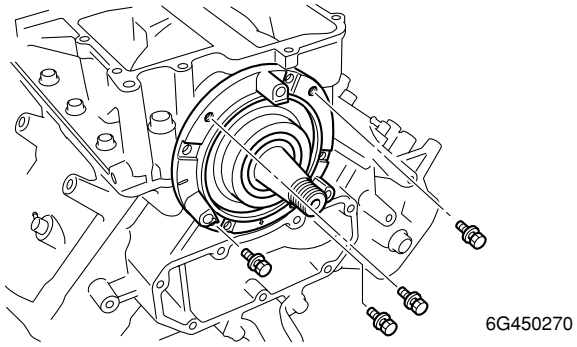


61U5120E

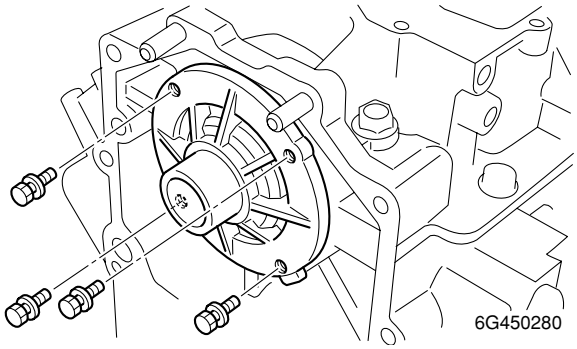
No.	Part name	Q'ty	Remarks
1	Connecting rod	4	
2	Piston (starboard side)	2	
3	Washer	8	
4	Needle bearing	120	
5	Clip	8	Not reusable
6	Piston pin	4	
7	Piston ring set	4	
8	Piston (port side)	2	

Removing the crankcase

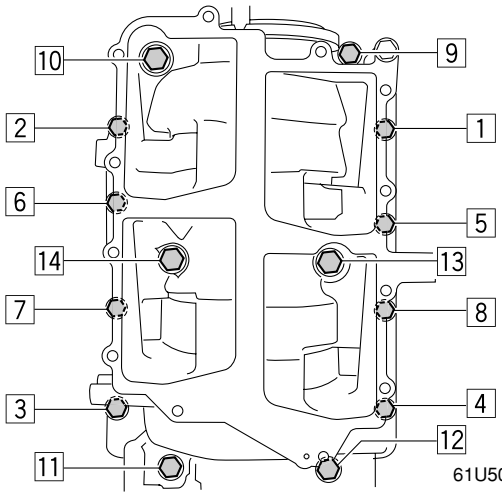
1. Remove the bearing housing bolts.

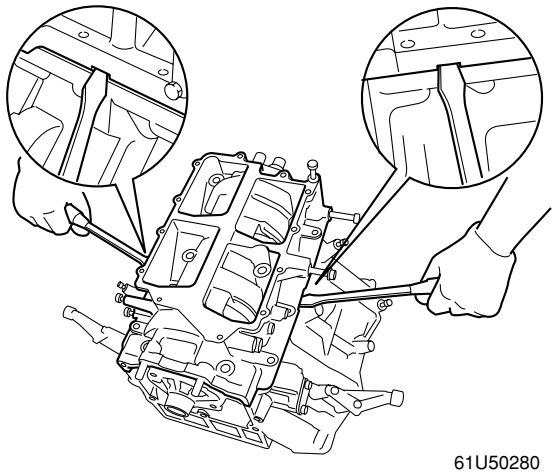


2. Remove the oil seal housing bolts.



3. Remove the crankcase bolts in the sequence shown.



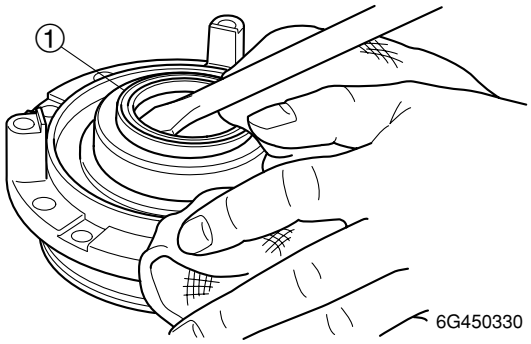


NOTE:

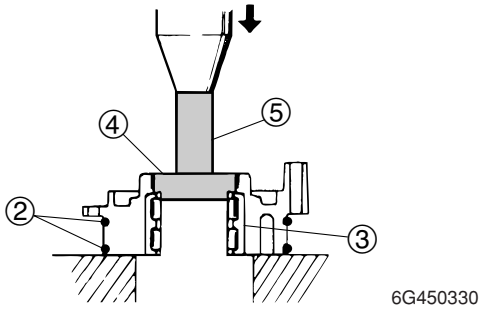
Insert a flat-head screw driver between the pry tabs to pry off the crankcase.

Disassembling the bearing housing

1. Remove the oil seal ① and O-rings ②.



2. Remove the needle bearing ③ using a press.

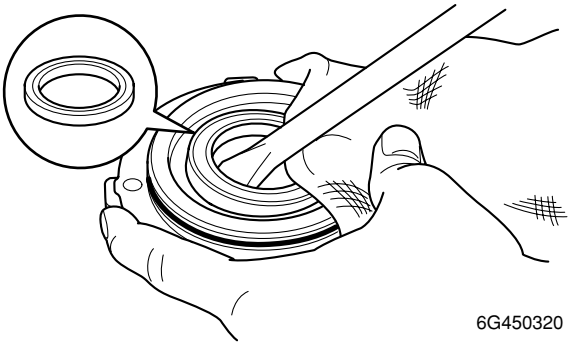


	Ball bearing attachment ④: 90890-06663 Driver rod LS ⑤: 90890-06606

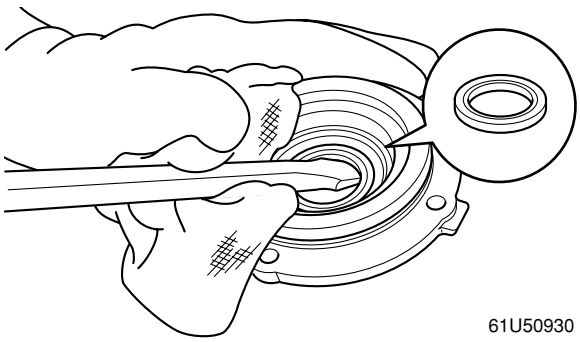
5

Disassembling the oil seal housing

1. Remove the oil seals and O-ring.



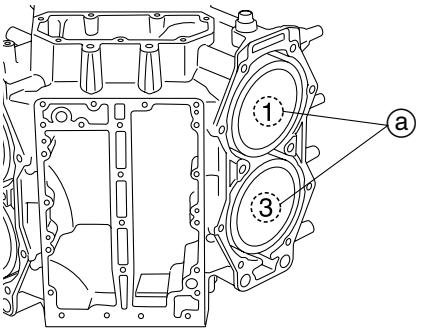
6G450320



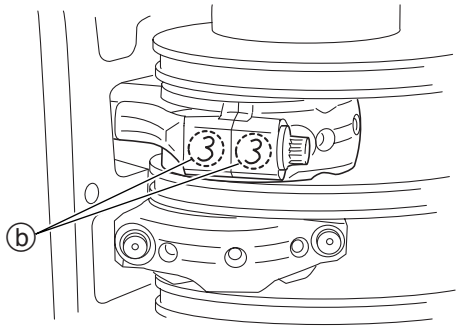
61U50930

Removing the piston, connecting rod assembly and crankshaft assembly

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



61U50660

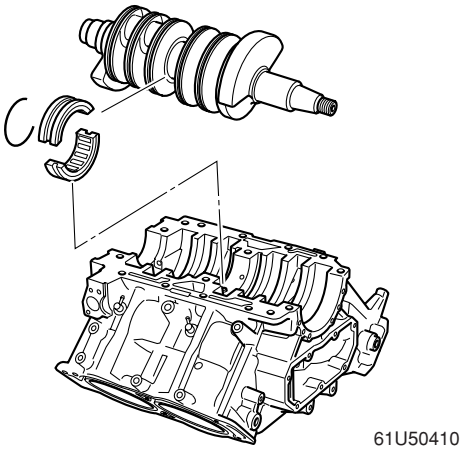


61U50400

NOTE:

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

2. Remove the crankshaft assembly.

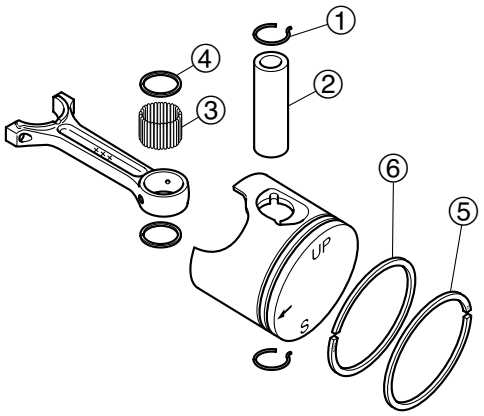


61U50410

Disassembling the piston and connecting rod assembly

1. Remove the piston pin clips ① with pliers, and then remove the piston pin ②, needle bearings ③ and washers ④.

2. Remove the top ring ⑤ and 2nd piston ring ⑥.



61U50420

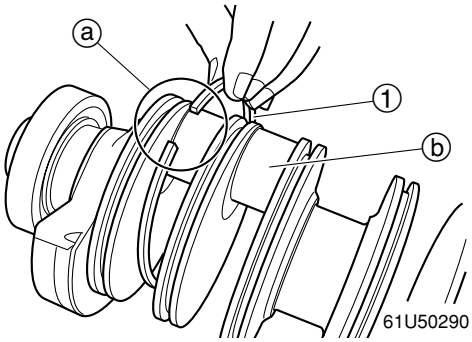
Checking the bearing

1. Check the needle bearings, main bearing and ball bearing for pitting or rumbling.

61U5H11

Disassembling the crankshaft

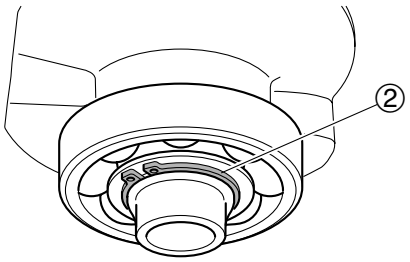
1. Remove the seal rings ①.

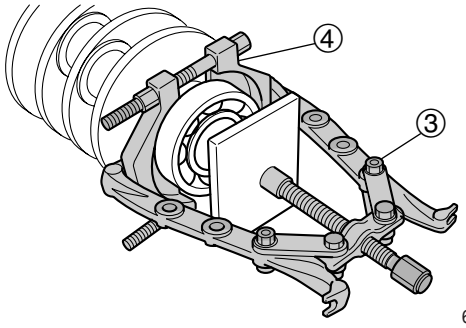


NOTE:

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

2. Remove the circlip ②, and then remove the ball bearing.





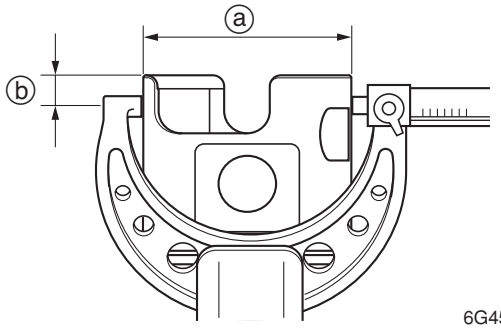
CAUTION:

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

Gear puller ③: 90890-06540
Bearing separator ④:
90890-06534

Checking the piston diameter

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

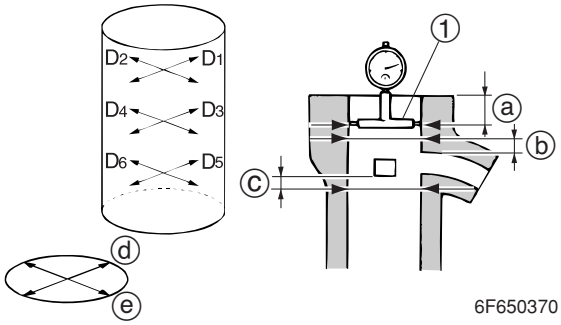


Piston diameter ⓐ:
89.920–89.935 mm
(3.5402–3.5407 in)
Measuring point ⓑ:
10.0 mm (0.39 in)
Oversize piston diameter ⓐ:
1st:
90.170–90.185 mm
(3.5500–3.5506 in)
2nd:
90.420–90.435 mm
(3.5598–3.5604 in)

5

Checking the cylinder bore

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



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

Cylinder bore (D_1–D_6):
90.000–90.020 mm
(3.5433–3.5441 in)

Cylinder gauge ①:
90890-06759

Checking the piston clearance

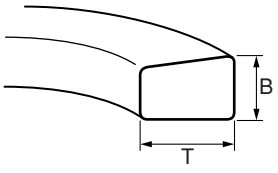
1. Calculate the piston clearance using the piston outside diameter and the cylinder bore specifications. Replace the piston and piston rings as a set or the cylinder block or all parts, or rebore the cylinder if out of specification.

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

Piston clearance:
0.080–0.085 mm
(0.0032–0.0033 in)

Checking the piston ring

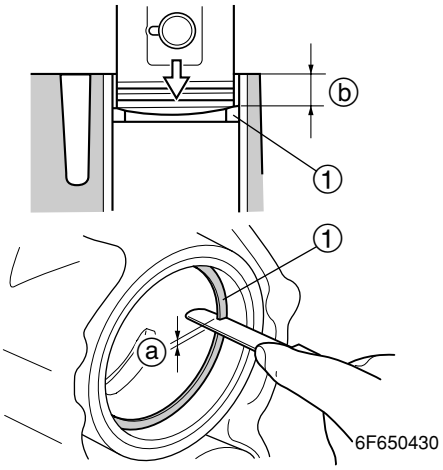
1. Check the piston ring dimensions of B and T. Replace the piston and piston rings as a set if out of specification.



Piston ring dimension
Top ring and 2nd piston ring:
B: 1.970–1.990 mm
(0.0776–0.0783 in)
T: 2.700–2.900 mm
(0.1063–0.1142 in)

2. Level the piston ring ① in a cylinder with a piston crown.

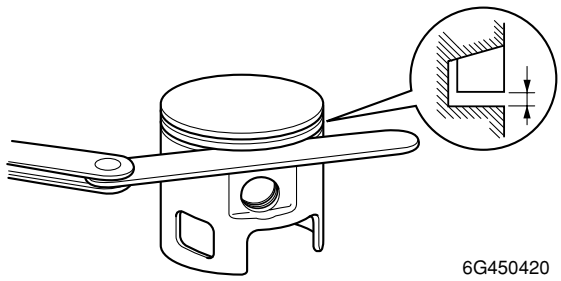
3. Check the piston ring end gap ⓐ at the specified measuring point ⓑ. Replace the piston ring set if out of specification.



Piston ring end gap ⓐ:
E115A:
0.30–0.40 mm (0.0118–0.0157 in)
115B, 140B:
Top:
0.30–0.50 mm (0.0118–0.0197 in)
2nd:
0.30–0.40 mm (0.0118–0.0157 in)
Measuring point ⓑ: 10 mm (0.39 in)

Checking the piston ring side clearance

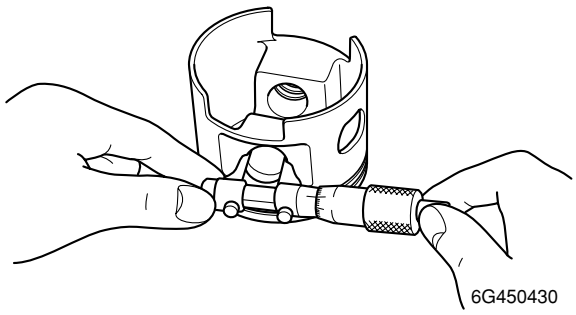
1. Measure the piston ring side clearance. Replace the piston and piston rings as a set if out of specification.



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

Checking the piston pin boss bore

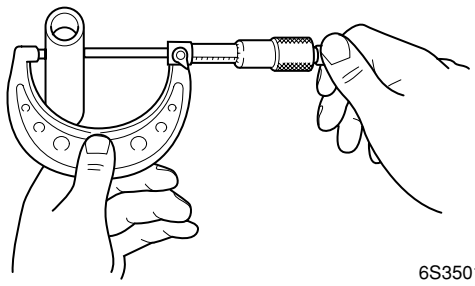
1. Measure the piston pin boss bore. Replace the piston if out of specification.



Piston pin boss bore:
E115A:
21.504–21.515 mm
(0.8466–0.8470 in)
115B, 140B:
23.074–23.085 mm
(0.9084–0.9089 in)

Checking the piston pin

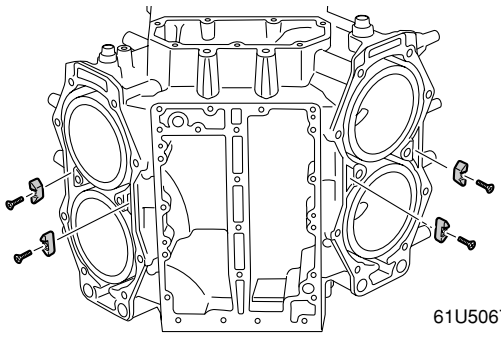
1. Measure the piston pin outside diameter. Replace the piston pin if out of specification.



Piston pin diameter:
E115A:
21.495–21.500 mm
(0.8463–0.8465 in)
115B, 140B:
23.065–23.070 mm
(0.9081–0.9083 in)

Checking the internal anode

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.



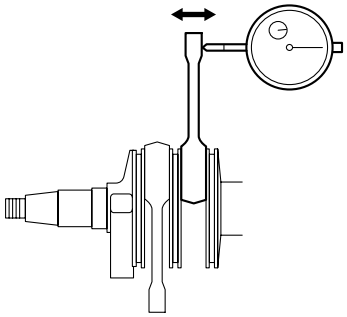
CAUTION:

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

5

Checking the connecting rod small end axial play

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

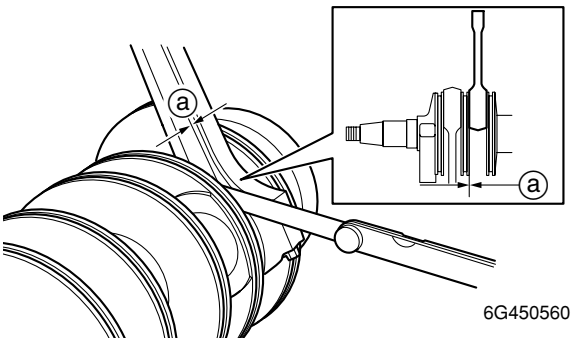

6G450550

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

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

Checking the connecting rod big end side clearance

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

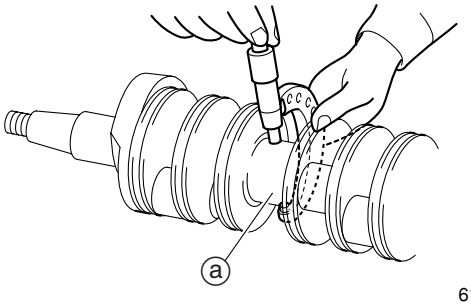


6G450560

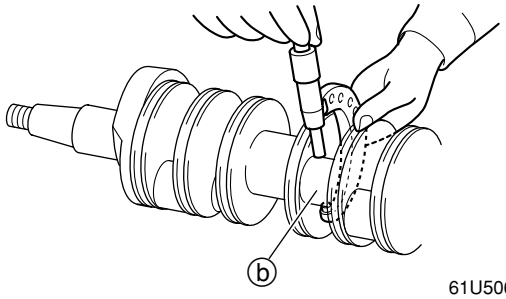
Connecting rod big end side clearance ⓐ:
0.120–0.260 mm
(0.0047–0.0102 in)

Checking the crankshaft

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



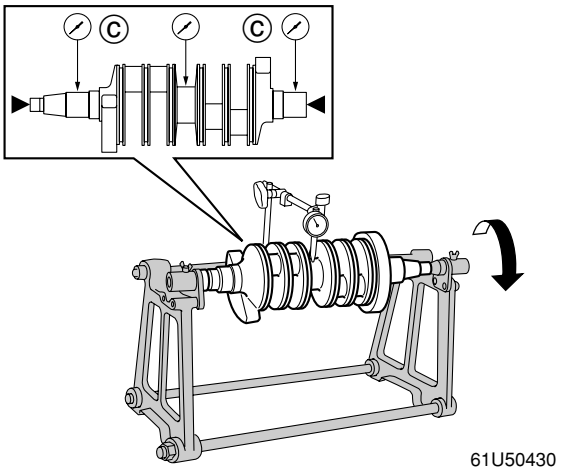
61U50680



61U50690

Crankshaft journal diameter ⓐ:
53.975–53.991 mm
(2.1250–2.1256 in)
Crankpin diameter ⓑ:
35.985–36.000 mm
(1.4167–1.4173 in)

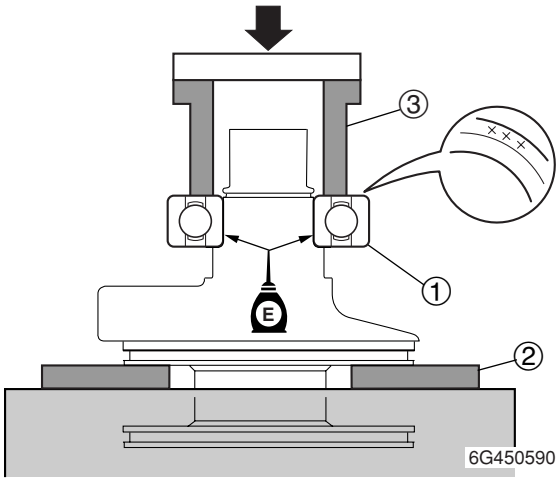
2. Measure the crankshaft runout. Replace the crankshaft if above specification.



Crankshaft runout limit ⓒ:
0.02 mm (0.0008 in)

Assembling the crankshaft

1. Installing the ball bearing ① into the crankshaft using a press, then the circlip.

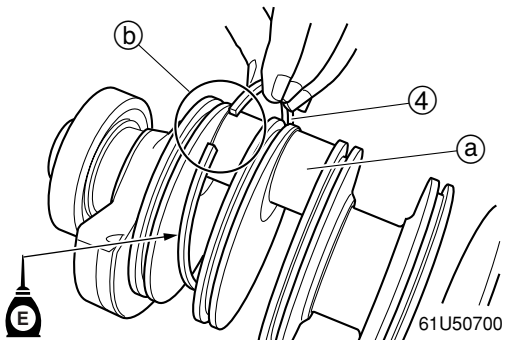


CAUTION:

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

Support ②:
90890-02394
Bearing inner race attachment ③:
90890-06662

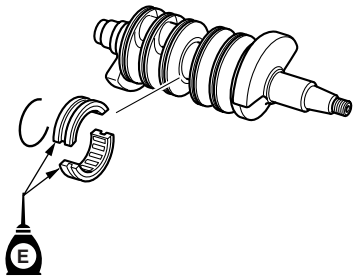
2. Install the seal rings ④.



NOTE:

First pass the seal ring ④ over the crankpin ⓐ, and then widen the seal ring end gap ⓑ to install the ring into the crankshaft groove.

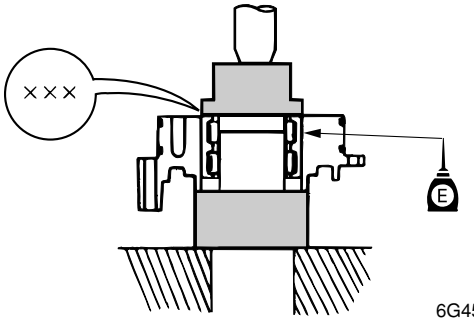
3. Install the main bearings onto the crankshaft.



5

Assembling the bearing housing

1. Install the needle bearing.

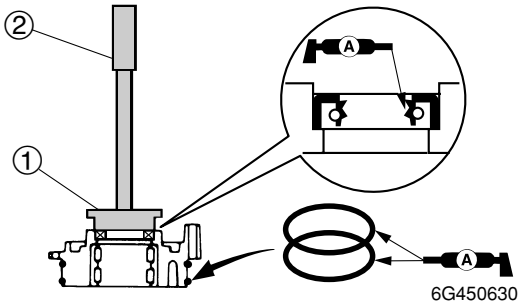


CAUTION:

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

Needle bearing attachment:
90890-06654

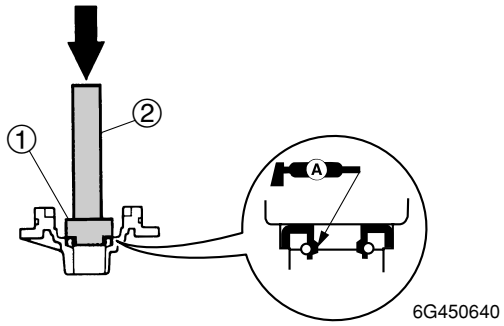
2. Apply grease to the new oil seal, new O-rings and then install it into the bearing housing.

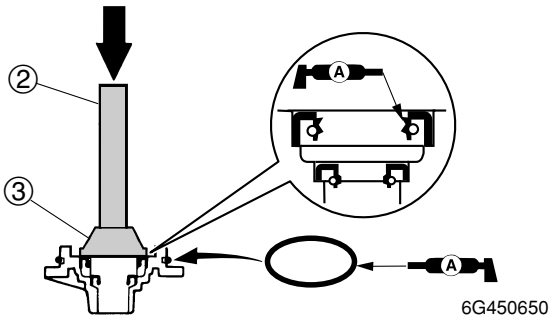


Needle bearing attachment ①:
90890-06654
Driver rod L3 ②: 90890-06652

Assembling the oil seal housing

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

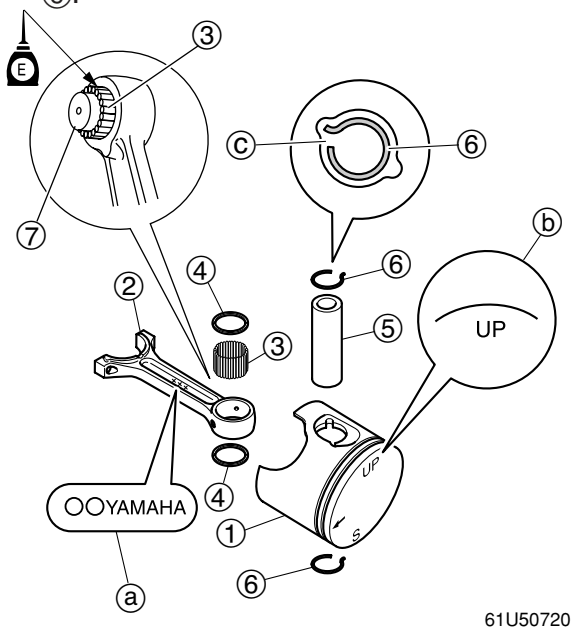




Ball bearing attachment ①:
90890-06637
Driver rod LS ②: 90890-06606
Bearing outer race attachment ③:
90890-06624

Assembling the piston and connecting rod assembly

1. Assemble the pistons ①, connecting rods ②, needle bearings ③, washers ④, piston pins ⑤, and new piston pin clips ⑥.

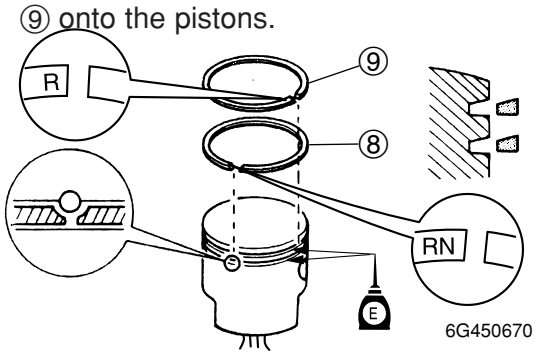


NOTE:

- Face the embossed "YAMAHA" mark ⓐ on the connecting rod in the same direction as the "UP" mark ⓑ on the piston.
- Use the small end bearing installer ⑦ to install the needle bearings.
- Always use new piston pin clips.
- Be sure to align the piston pin clip end with the piston pin slot ⓒ.

	Small end bearing installer ⑦: 90890-06528

2. Install the 2nd piston ring ⑧ and top ring ⑨ onto the pistons.



CAUTION:

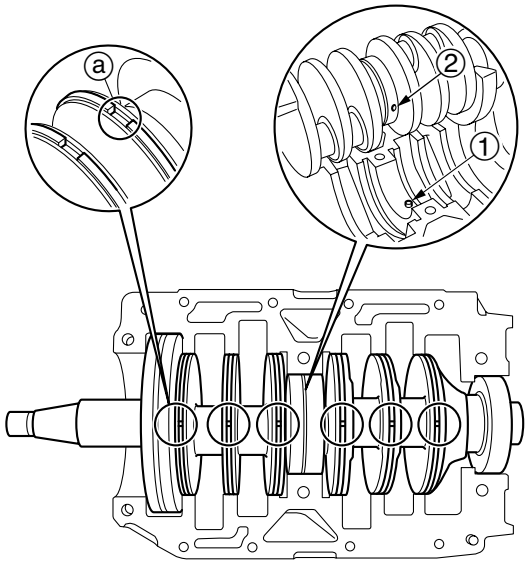
Do not scratch the pistons or break the piston rings.

NOTE:

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

Assembling the power unit

1. Set the crankshaft in the cylinder block.

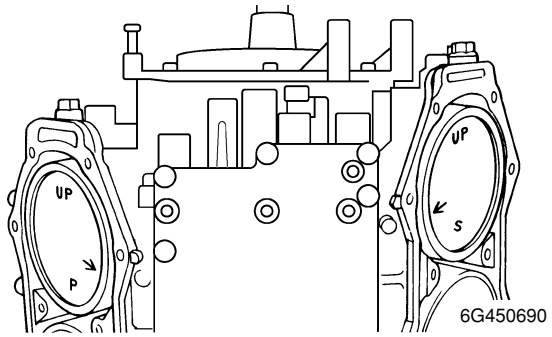


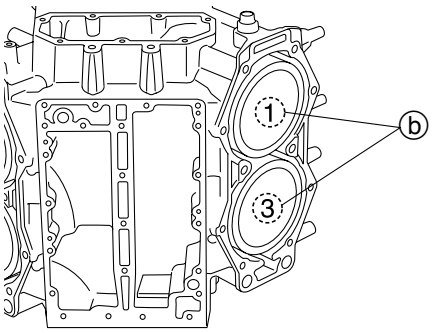
NOTE:

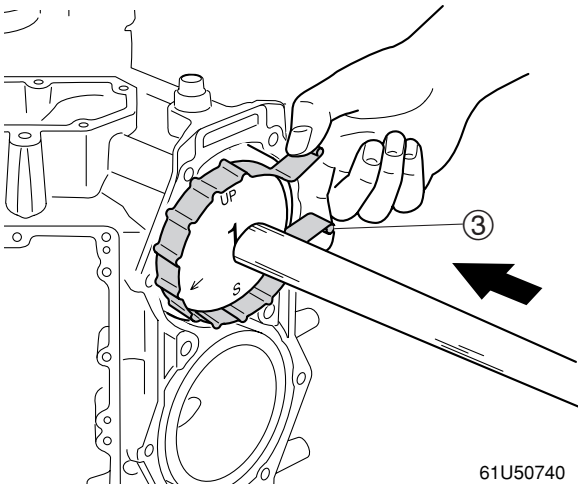
- Fit dowels ① on the cylinder block into the dowel holes ② in the main bearings.
- Align the seal ring end gaps ⓐ with the crankcase center line.

5

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



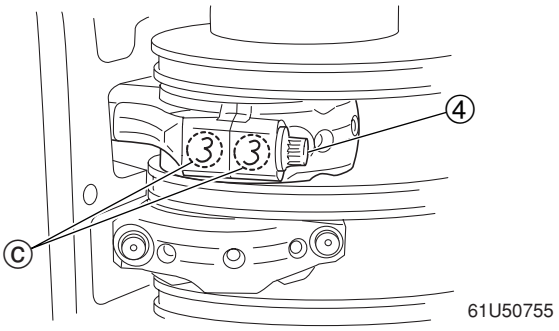




NOTE:
- Apply engine oil to the pistons and piston rings before installation.
- Be sure to install the piston and connecting rod assemblies into the corresponding cylinders according to the marks ⓑ made during disassembly. Also, be sure to install the assemblies with an “S” mark on the starboard side, and the assemblies with a “P” mark on the port side.

Piston slider ③:
90890-06530

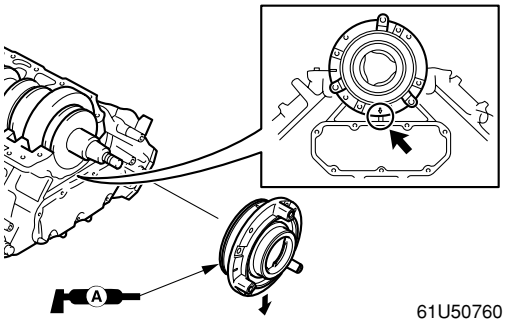
3. Install the connecting rod bearings and connecting rod caps onto the connecting rods, and then tighten the connecting rod bolts ④ to the specified torques in 5 stages.



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

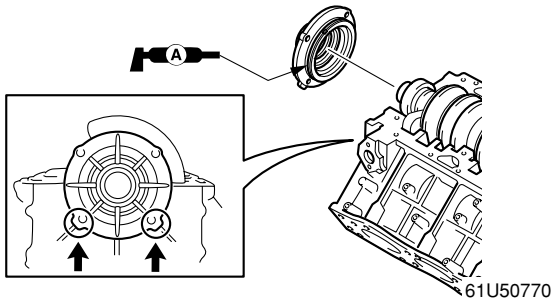
Connecting rod bolt ④:
1st: 19 N·m (1.9 kgf·m, 14.0 ft·lb)
2nd: 36 N·m (3.6 kgf·m, 26.6 ft·lb)
3rd: Loosen completely
4th: 19 N·m (1.9 kgf·m, 14.0 ft·lb)
5th: 36 N·m (3.6 kgf·m, 26.6 ft·lb)

4. Install the bearing housing onto the cylinder block.



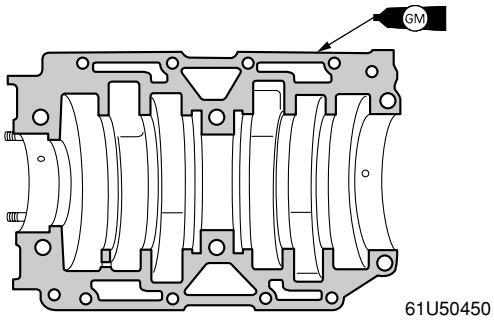
NOTE:
Install the bearing housing with the arrow mark facing toward the cylinder block.

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



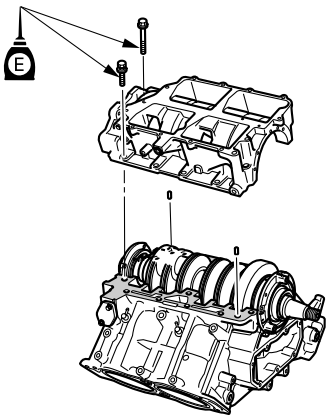
NOTE:
Install the oil seal housing with the projections facing toward the cylinder block.

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



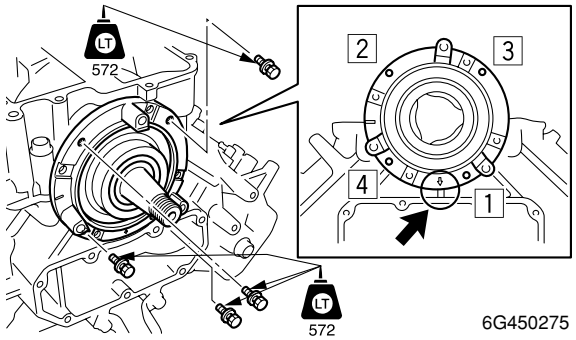
NOTE:
Do not get any sealant on the journals.

7. Install the dowels, crankcase onto the cylinder block, and then temporarily tighten the crankcase bolts.

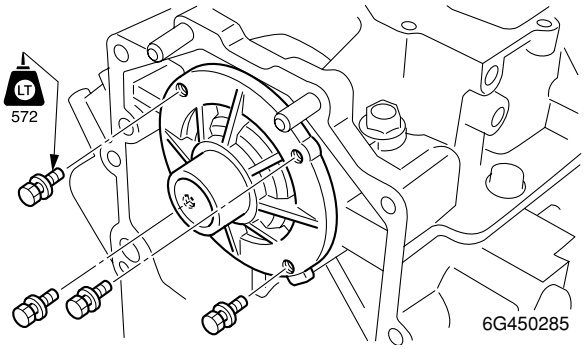


NOTE:
Apply engine oil to the crankcase bolts before installation.

8. Install the bearing housing bolts temporary tight.

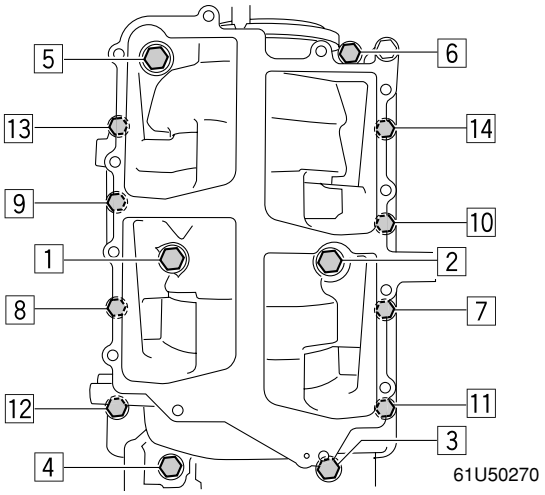


9. Install the oil seal housing bolts temporary tight.



5

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



NOTE:

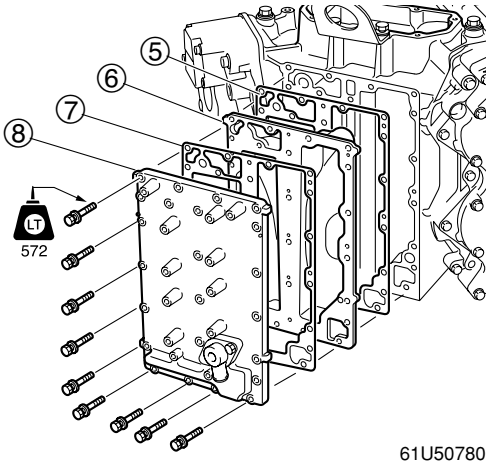
Tighten crankcase bolts 1–6 to the specified torques in 2 stages first, and then tighten crankcase bolts 7–14 to the specified torques in 2 stages.

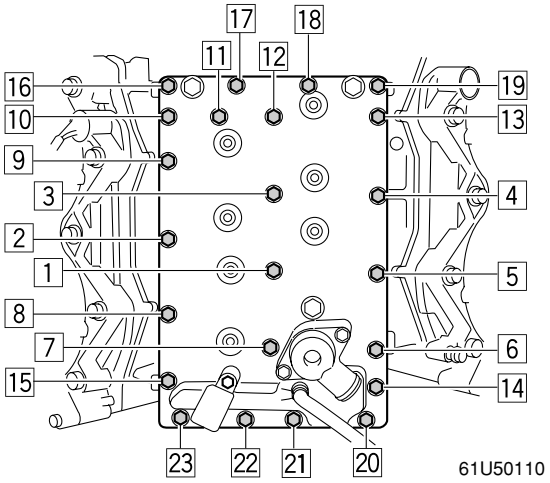
1–6: Crankcase bolt (M10):
1st: 20 N·m (2.0 kgf·m, 14.8 ft·lb)
2nd: 37 N·m (3.7 kgf·m, 27.3 ft·lb)
7–14: Crankcase bolt (M8):
1st: 10 N·m (1.0 kgf·m, 7.4 ft·lb)
2nd: 18 N·m (1.8 kgf·m, 13.3 ft·lb)

11. Tighten the bearing housing bolts and oil seal housing bolts.

Bearing housing bolt:
12 N·m (1.2 kgf·m, 8.9 ft·lb)

12. Install the new gasket ⑤, exhaust inner cover ⑥, new gasket ⑦, exhaust outer cover ⑧, and then tighten the exhaust cover bolts to the specified torques in 2 stages and in the sequence shown.



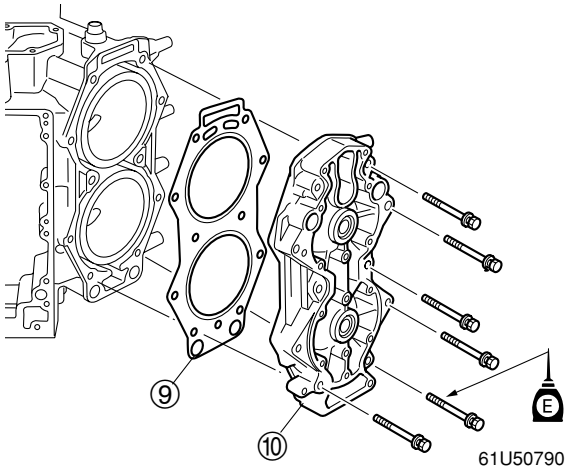


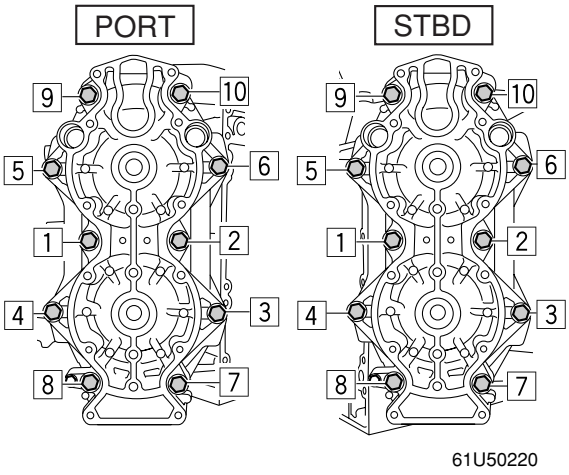
NOTE:

Apply LOCTITE 572 to the exhaust cover bolts before installation.

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

13. Install the new gaskets ⑨ and the cylinder head ⑩, and then tighten the cylinder head bolts to the specified torques in 2 stages and in the sequence shown.

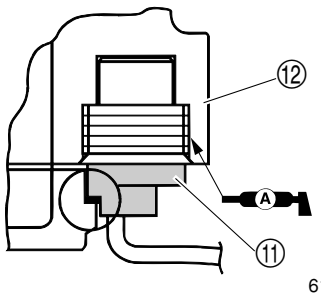




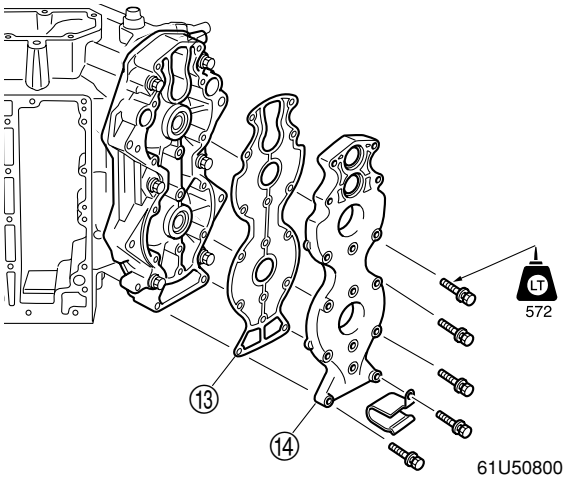
NOTE:
Apply engine oil to the cylinder head bolts before installation.

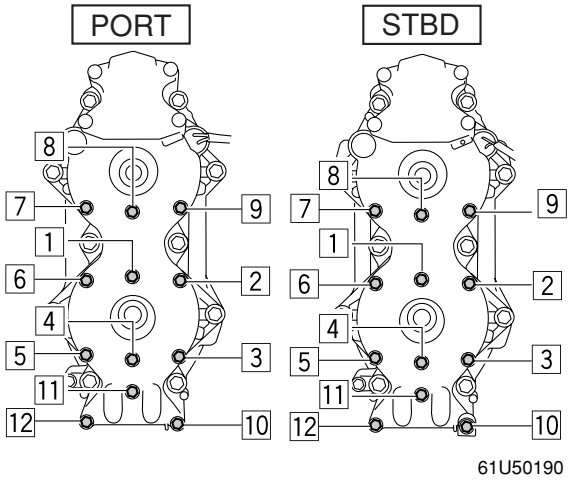
Cylinder head bolt:
1st: 15 N·m (1.5 kgf·m, 11.1 ft·lb)
2nd: 30 N·m (3.0 kgf·m, 22.1 ft·lb)

14. Install the thermoswitches ⑪ onto the cylinder head ⑫.



15. Install the new gaskets ⑬ and the cylinder head covers ⑭, and then tighten the cylinder head cover bolts to the specified torques in 2 stages and in the sequence shown.



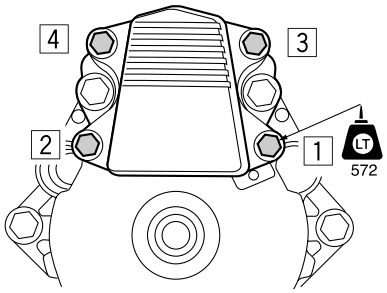


NOTE:
Apply LOCTITE 572 to the cylinder head cover bolts before installation.

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

5

16. Install the new gaskets, thermostats and the thermostat covers, and then tighten the thermostat cover bolts to the specified torques in 2 stages and in the sequence shown.

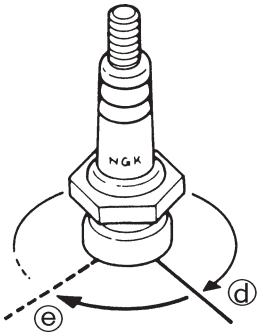


61U50160

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

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

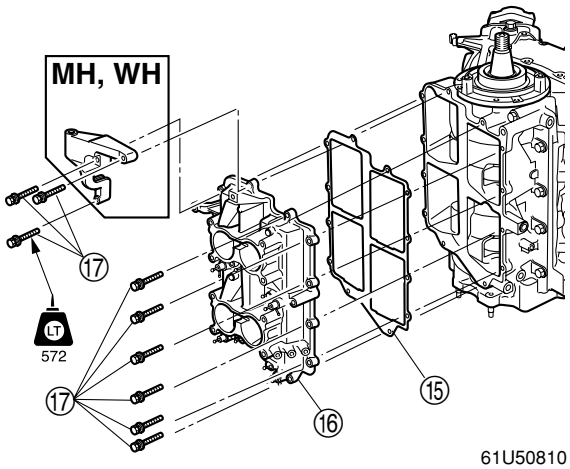
17. Install the spark plugs temporary tight ⓓ, and then to the specified torque ⓔ with a spark plug wrench.



S60V5C00

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

18. Install the new gasket ⑮ and the intake manifold assembly ⑯, and then tighten the intake manifold bolts ⑰ to the specified torques in 2 stages and in the sequence shown.

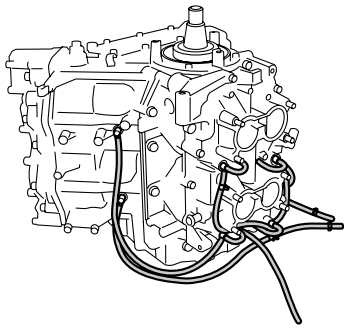


61U50810

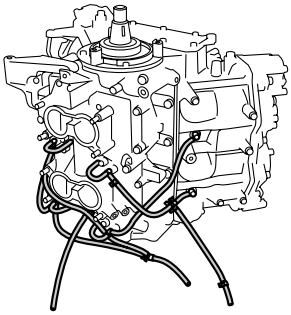
Intake manifold bolt ⑰:
1st: 4 N·m (0.4 kgf·m, 3.0 ft·lb)
2nd: 8 N·m (0.8 kgf·m, 5.9 ft·lb)

19. Connect the hoses as shown below.

A

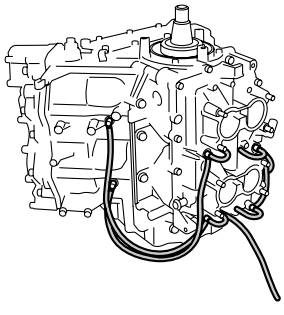


61U50820

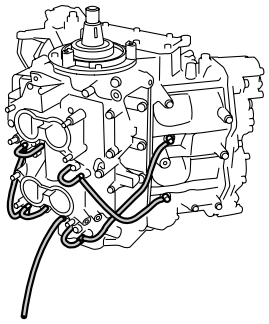


61U50830

B



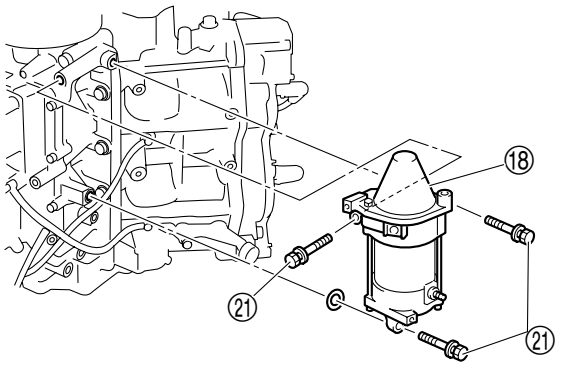
61U50825



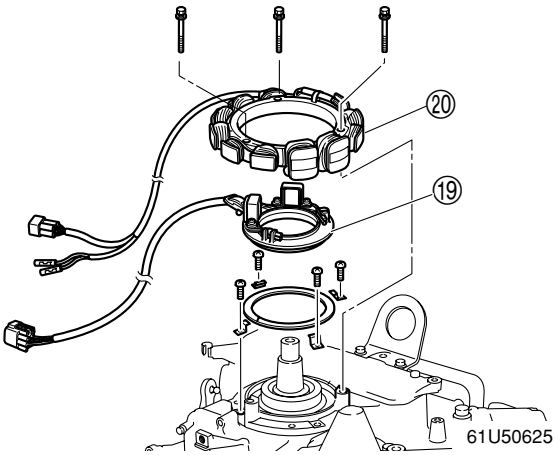
61U50835

A MH, WH
B E, ET

20. Install the starter motor ⑱, pulser coil assembly ⑲ and stator assembly ⑳ onto the power unit.



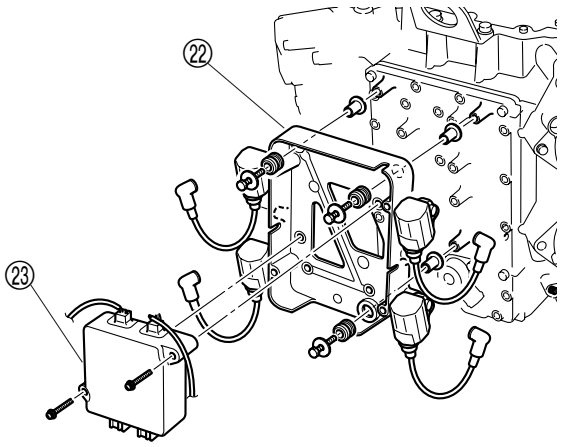
61U50645



61U50625

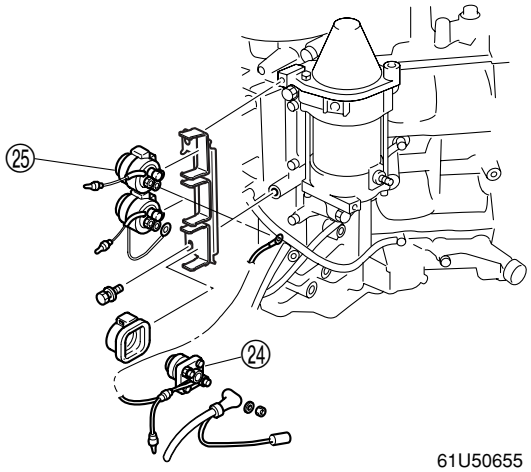
	Starter motor mount bolt ㉑ : 29 N·m (2.9 kgf·m, 21.4 ft·lb)

21. Install the case ㉒ and the CDI unit ㉓ onto the power unit.

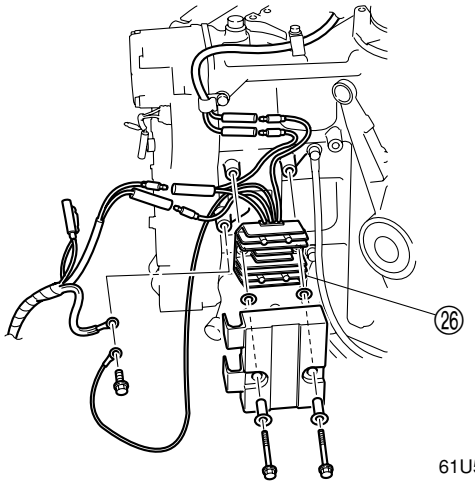


61U50605

22. Install the starter relay ㉔, the PTT relay assembly ㉕ and Rectifier Regulator ㉖ onto the power unit.



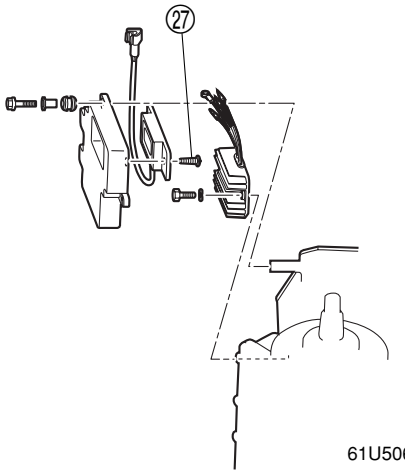
61U50655



61U50635

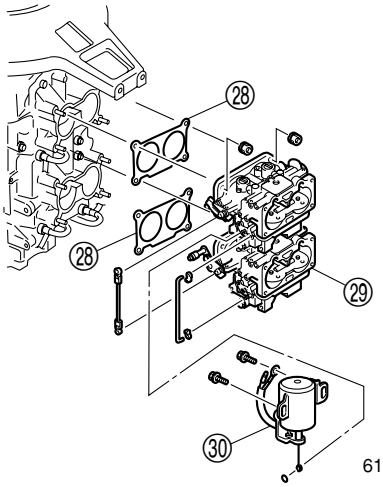
5

23. Install the hour meter into the case, and then onto the power unit.



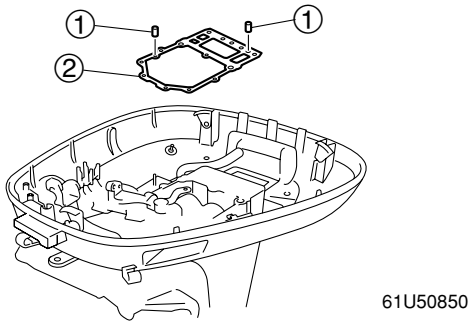
Hour meter screw ㉗:
3 N·m (0.3 kgf·m, 2.2 ft·lb)

24. Install the new gaskets ㉘, carburetor assemblies ㉙ and choke solenoid ㉚ onto the power unit.

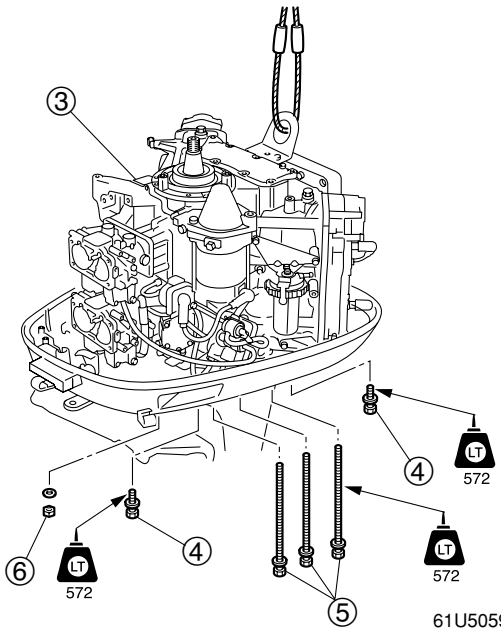


Installing the power unit

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

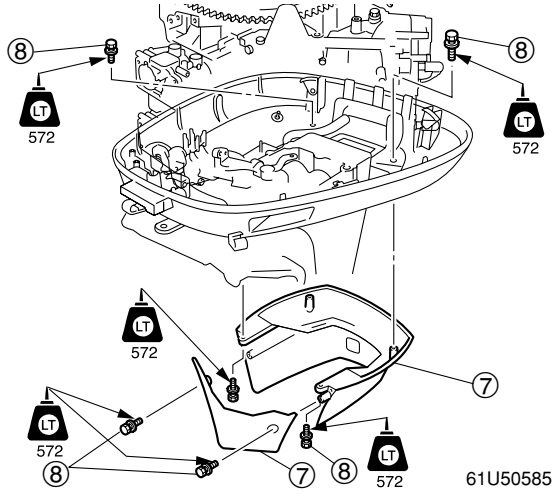


2. Install the power unit ③, and then tighten the power unit bolts ④, bolts ⑤ and nut ⑥ to the specified torque.



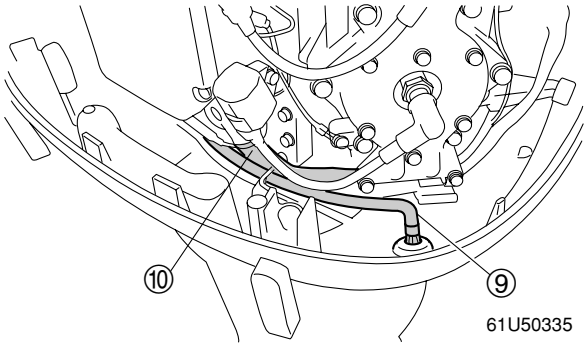
Power unit bolt ④,⑤, nut ⑥:
25 N·m (2.5 kgf·m, 18.4 ft·lb)

3. Install the apron ⑦, and then tighten the apron bolt ⑧ to specified torque.

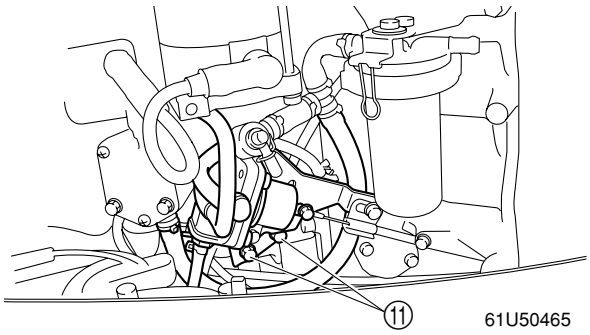


	Apron bolt ⑧: 8 N·m (0.8 kgf·m, 5.9 ft·lb)

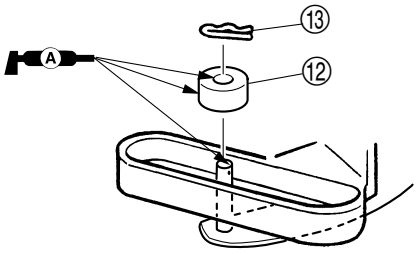
4. Connect the cooling water pilot hose ⑨ and PCV hose ⑩.



5. Install the manual injection pump cable end, and start-in-gear protection cable end, and then install the bracket bolt ⑪.

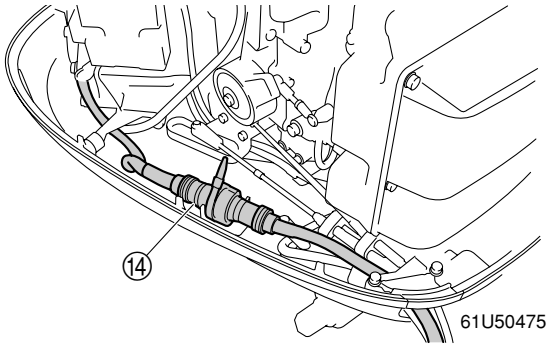


6. Install the bushing ⑫ and clip ⑬.

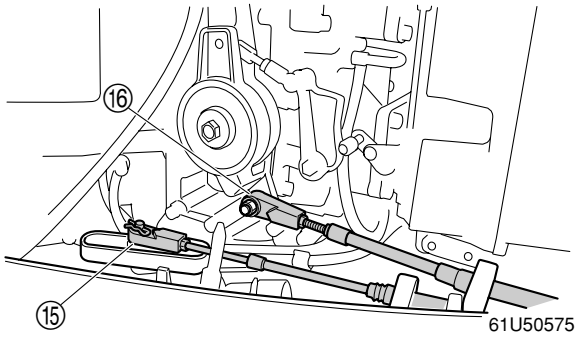


7. Connect the choke link rod.

8. Connect the 10-pin main harness coupler ⑭.



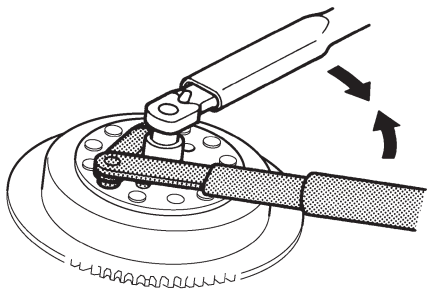
9. Connect the shift cable ⑮ and throttle cable ⑯, and then adjust their lengths. For adjustment procedures, see P3-6, “Adjusting the throttle cable,” and P3-7 “Checking the gear shift operation”.



5

10. Install the Woodruff key and flywheel magnet.

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



6F650700

CAUTION:

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

NOTE:

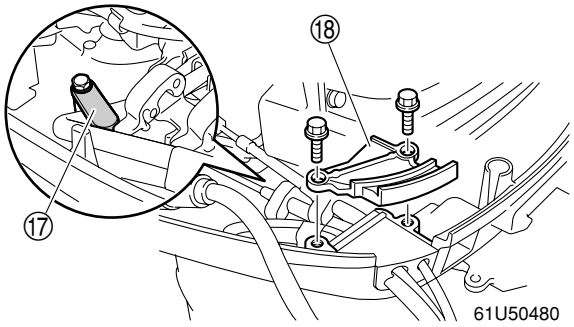
Apply engine oil to the flywheel magnet nut thread before installation.

	Flywheel holder: 90890-06522

	Flywheel magnet nut: 186 N·m (18.6 kgf·m, 137 ft·lb)

12. Install the starter pulley.

13. Tighten the cable holder plate ⑰ and retaining plate ⑱.

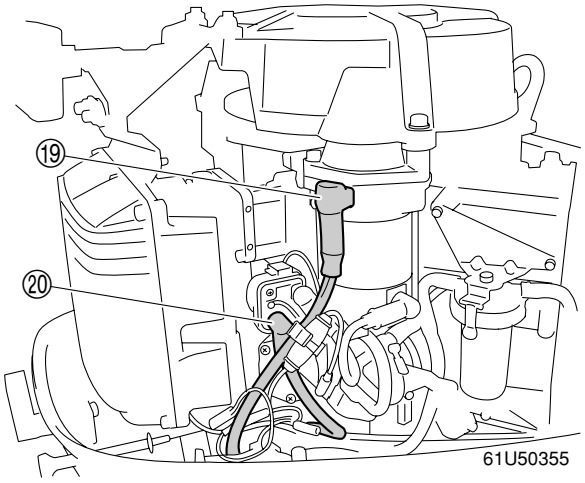


61U50480

14. Install the manual starter, start-in-gear protection cable, and then adjust it. For adjustment procedures, refer to "Adjusting the start-in-gear protection" P3-4.

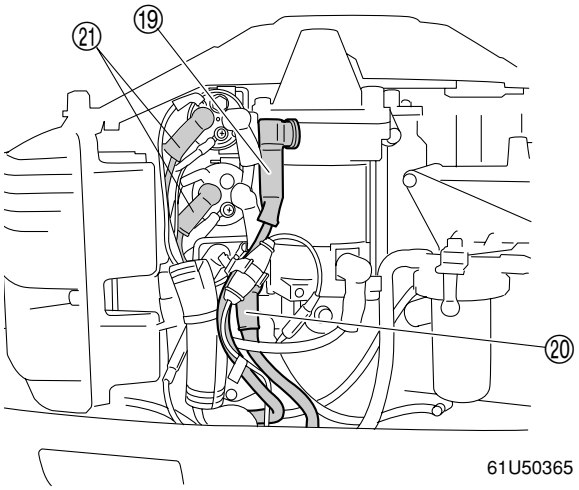
15. Connect the negative battery cable ⑲, positive battery cable ⑳, and PTT motor lead ㉑.

A



61U50355

B



61U50365

A WH
B E, ET

	Starter motor positive terminal nut: 9 N·m (0.9 kgf·m, 6.6 ft·lb)

16. Install the all removed parts.

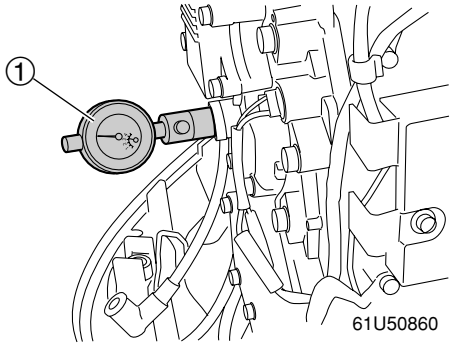
Adjusting the timing plate

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

1. Remove the manual starter or flywheel cover.

2. Slowly turn the flywheel magnet clockwise, align the piston of the #1 cylinder at the TDC.

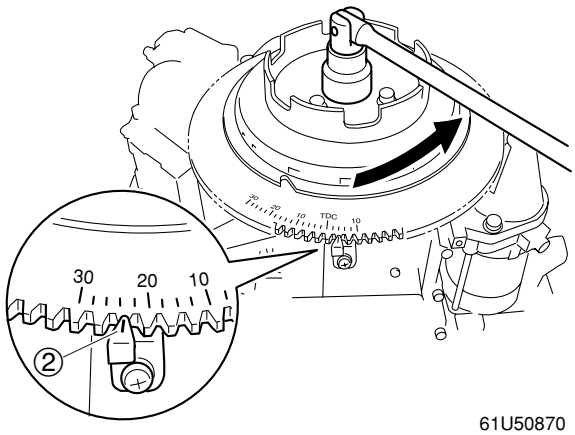
3. Install the dial gauge ① into the #1cylinder.



NOTE:
Set the dial gauge to “zero” position which is more than 4 mm from TDC.

Dial gauge set ① : 90890-01252

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



Cylinder #1 piston position (BTDC):
E115A, 115B:
3.33 mm (0.1311 in)
140B:
3.91 mm (0.1539 in)

5. Align the timing plate with the flywheel at specified position and install the timing plate ②.

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

Timing plate position:
E115A:
BTDC 23°
115B:
BTDC 25°
140B:
BTDC 22°

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

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

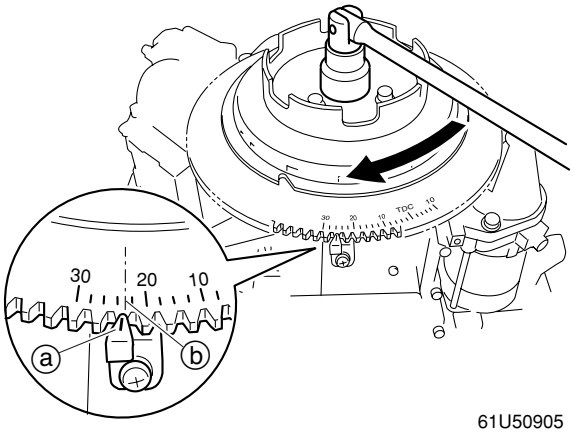
5

Adjusting the ignition timing stopper

NOTE:

For adjust the timing plate, refer to “Adjusting the timing plate”.

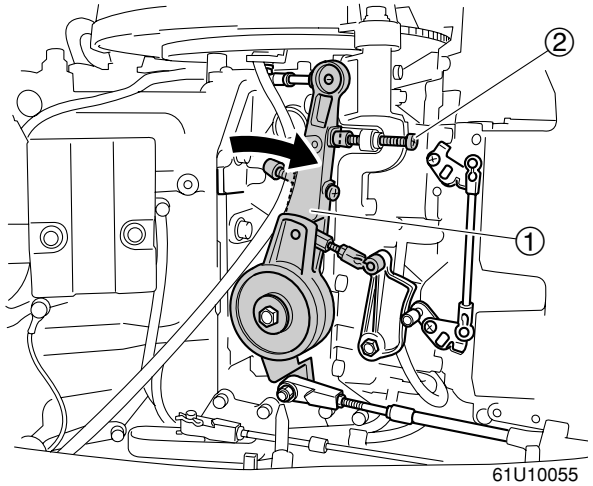
1. Slowly turn the flywheel magnet clockwise, and check that the timing plate ⓐ is aligned with the scale ⓑ on the flywheel magnet in the specified position.



61U50905

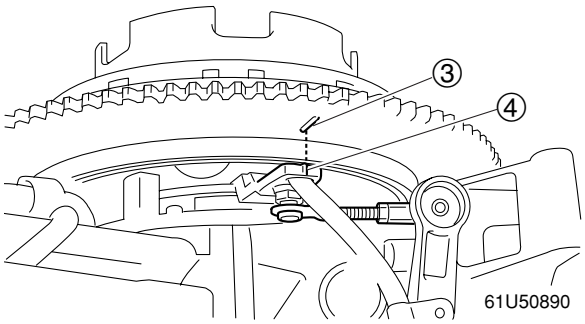
Timing plate position:
E115A:
BTDC 23°
115B:
BTDC 25°
140B:
BTDC 22°

2. Set the control lever ① to the full advanced position, and then check that the adjusting screw ② contact with the stopper.



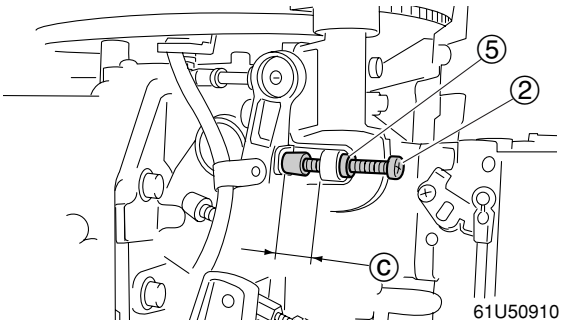
61U10055

3. Check that the mark ③ on the flywheel magnet aligned with the pointer ④ on the pulser coil assembly.



61U50890

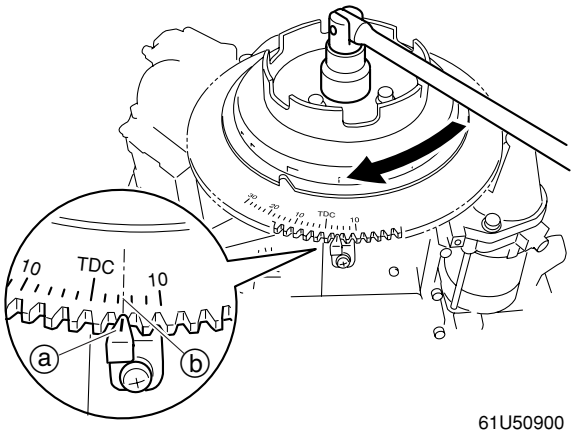
4. If not align them, loosen the lock nut ⑤ and adjust the length of the adjusting screw ②.



61U50910

Specified length ⓒ :
(Reference data)
E115A, 115B:
24.5 mm (0.96 in)
140B:
22.0 mm (0.87 in)

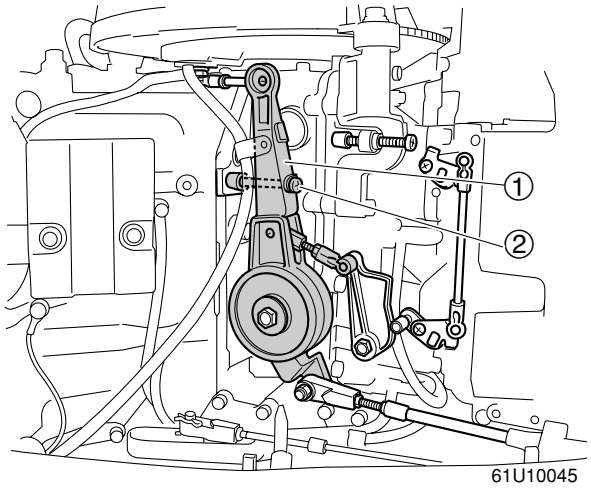
5. Slowly turn the flywheel magnet clockwise, and check that the timing plate ⓐ is aligned with the scale ⓑ on the flywheel magnet in the specified position.



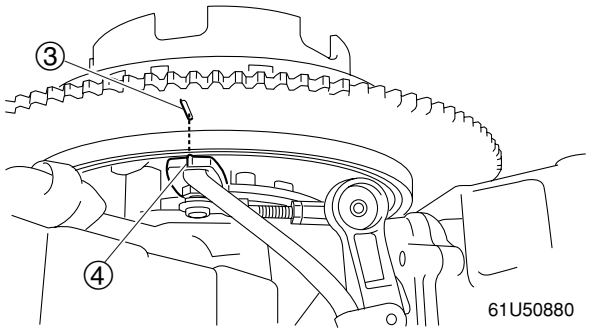
61U50900

Timing plate position:
ATDC 5°

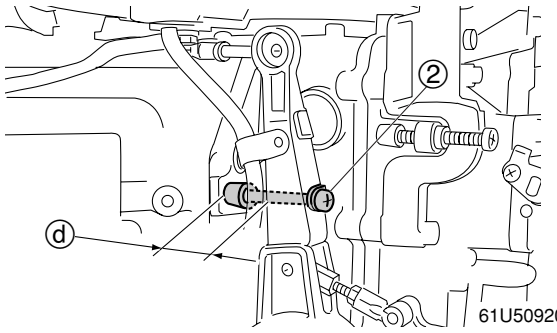
6. Set the control lever ① to the full retard position, and check that the adjusting screw ② contact with the stopper.



7. Check that the mark ③ on the flywheel magnet aligned with the pointer ④ on the pulser coil assembly.



8. If not align them, adjust the length of the adjusting screw ②.



Specified length ⓓ :
(Reference data)
23.5 mm (0.92 in)

— MEMO —

Lower unit

Lower unit 6-1
Removing the lower unit 6-4
Removing the water pump and shift rod 6-5
Checking the water pump and shift rod 6-5

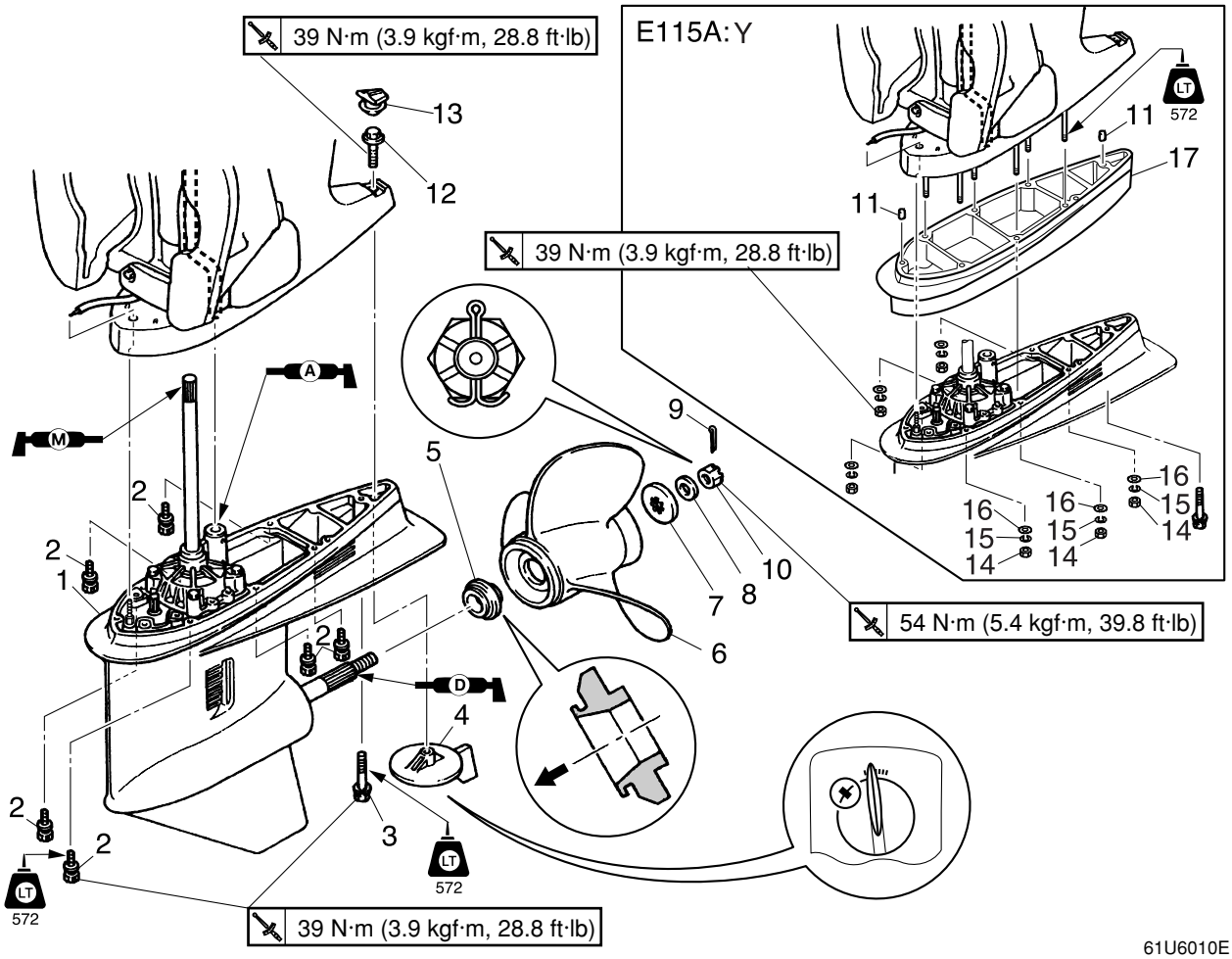
Propeller shaft housing 6-6
Removing the propeller shaft housing assembly 6-8
Disassembling the propeller shaft assembly 6-8
Disassembling the propeller shaft housing 6-8
Checking the propeller shaft housing 6-9
Checking the propeller shaft 6-9
Assembling the propeller shaft assembly 6-9
Assembling the propeller shaft housing 6-10

Drive shaft and lower case 6-12
Removing the drive shaft 6-13
Disassembling the drive shaft housing 6-13
Disassembling the forward gear 6-13
Disassembling the lower case 6-14
Checking the pinion and forward gear 6-14
Checking the bearing 6-14
Checking the drive shaft 6-14
Checking the lower case 6-15
Assembling the lower case 6-15
Assembling the forward gear 6-15
Assembling the drive shaft housing 6-16
Installing the drive shaft 6-16
Installing the propeller shaft housing 6-17
Installing the water pump and shift rod 6-18
Installing the lower unit 6-19

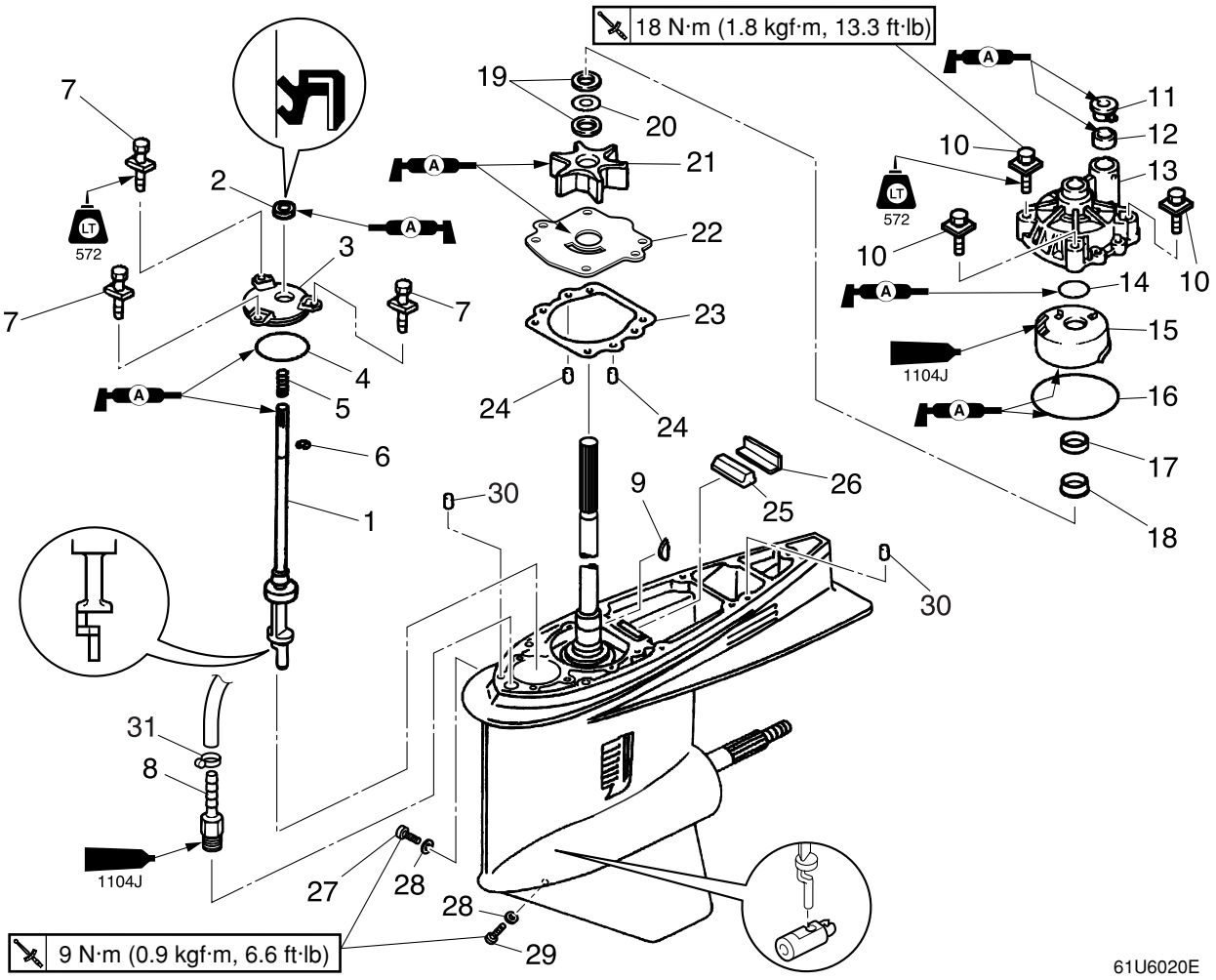
Shimming 6-22
Shimming 6-23
Selecting the pinion shim 6-23
Selecting the forward gear shim 6-24
Selecting the reverse gear shim 6-25

Backlash 6-26
Measuring the forward and reverse gear backlash 6-26

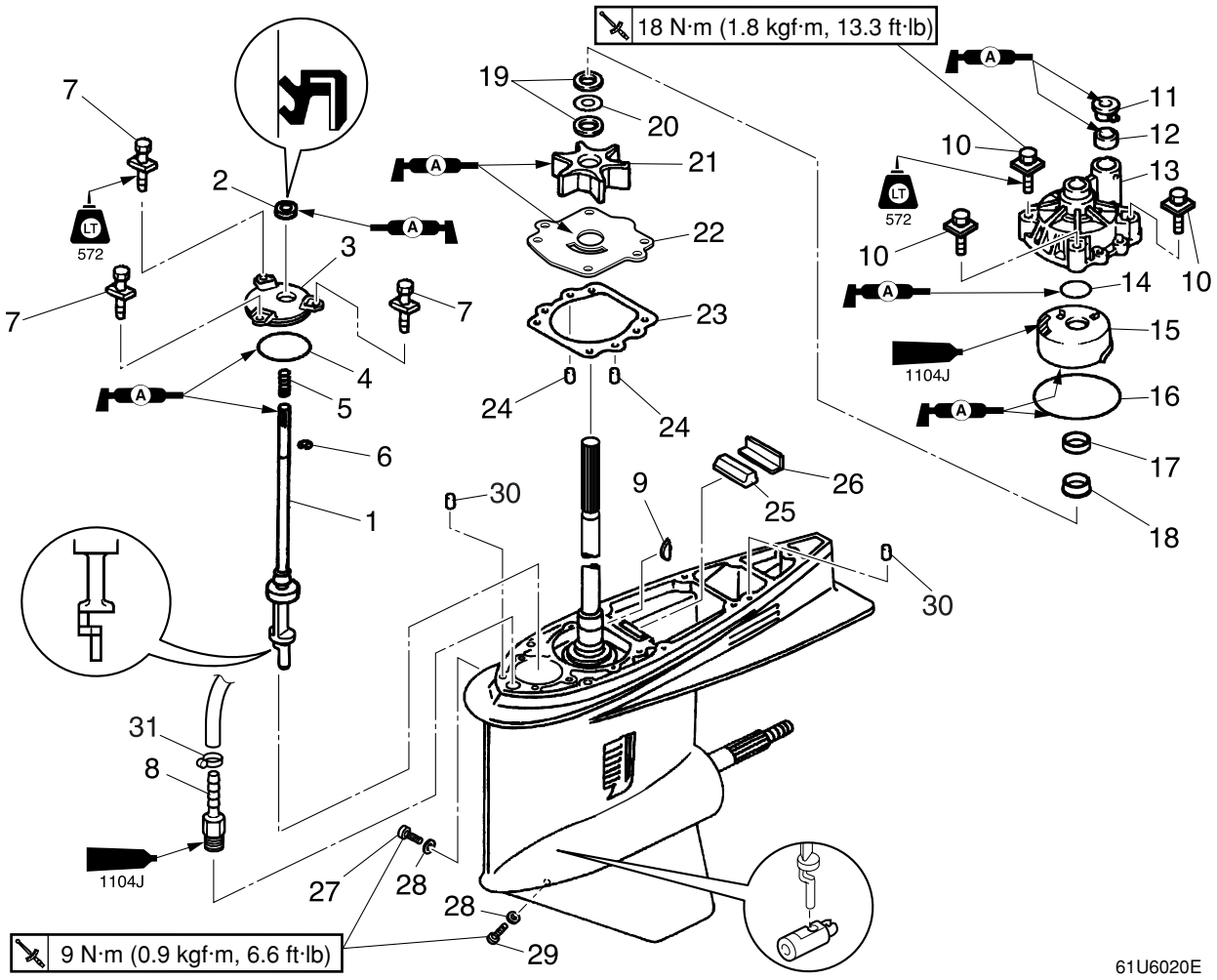
Lower unit



No.	Part name	Q'ty	Remarks
1	Lower unit	1	
2	Bolt	6	M10 × 45 mm
3	Bolt	1	M10 × 70 mm
4	Trim tab	1	
5	Spacer	1	
6	Propeller	1	
7	Washer	1	
8	Washer	1	
9	Cotter pin	1	Not reusable
10	Nut	1	
11	Dowel	2	E115A: Y-transom
12	Bolt	1	M10 × 45 mm
13	Grommet	1	
14	Nut	6	E115A: Y-transom
15	Spring washer	6	E115A: Y-transom
16	Washer	6	E115A: Y-transom
17	Extension	1	E115A: Y-transom



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

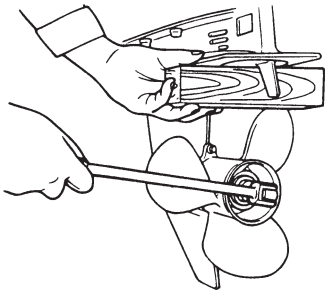


No.	Part name	Q'ty	Remarks
18	Spacer	1	
19	Washer	2	
20	Wave washer	1	
21	Impeller	1	
22	Outer plate cartridge	1	
23	Gasket	1	Not reusable
24	Dowel	2	
25	Rubber seal	1	
26	Plate	1	
27	Check screw	1	
28	Gasket	2	Not reusable
29	Drain screw	1	
30	Dowel	2	
31	Lock tie	1	Not reusable

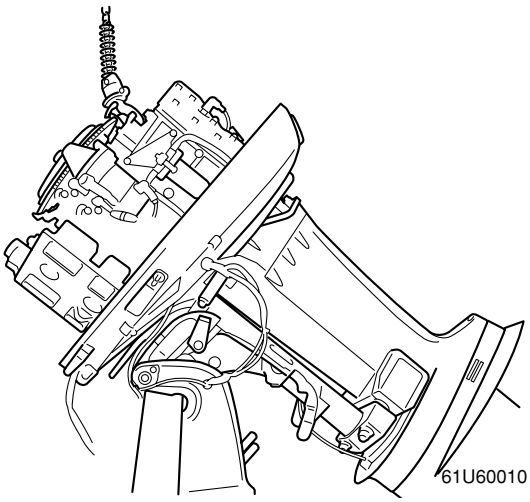
Removing the lower unit

1. Drain the gear oil. For draining procedures, see Chapter 3, “Changing the gear oil.”

2. Set the gear shift to the neutral position, and place a block of wood between the anti-cavitation plate and propeller to prevent the propeller from turning, and then remove the propeller nut and propeller.



6F660020



61U60010

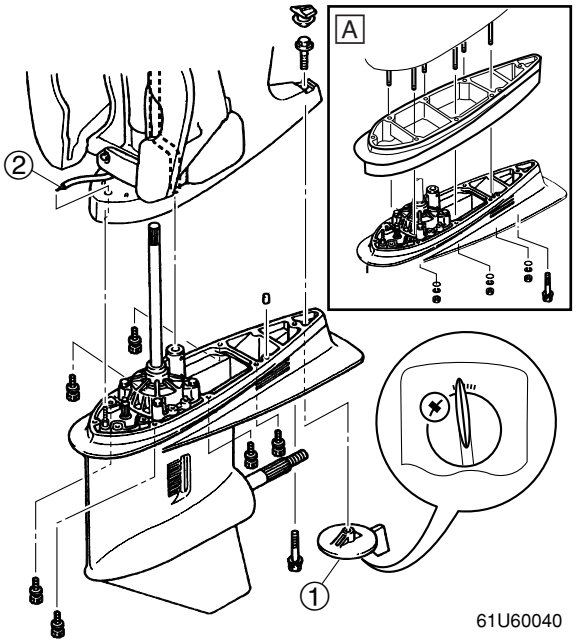
⚠WARNING

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

3. Mark the trim tab ① at the area shown, and then remove it.

4. Loosen the bolts (nuts) and then remove the lower unit from the upper case.

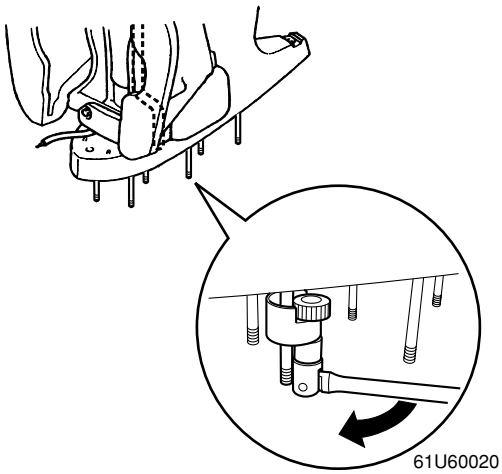
5. Disconnect the speedometer hose ②.



61U60040

A E115A: Y-transom

6. Remove the stud bolts.
(E115A: Y-transom)



61U60020

6

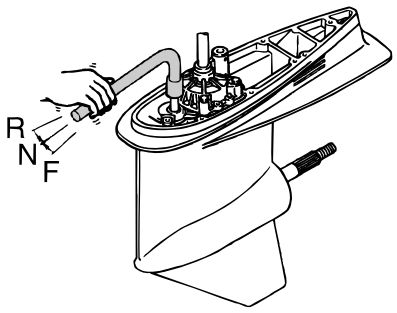
Removing the water pump and shift rod

1. Remove the water pump housing ①, collar ②, spacer ③, washer ④, wave washer ⑤, washer ⑥ and impeller ⑦.

2. Remove the Woodruff key ⑧.

3. Remove the outer plate cartridge ⑨, gasket ⑩ and dowels ⑪.

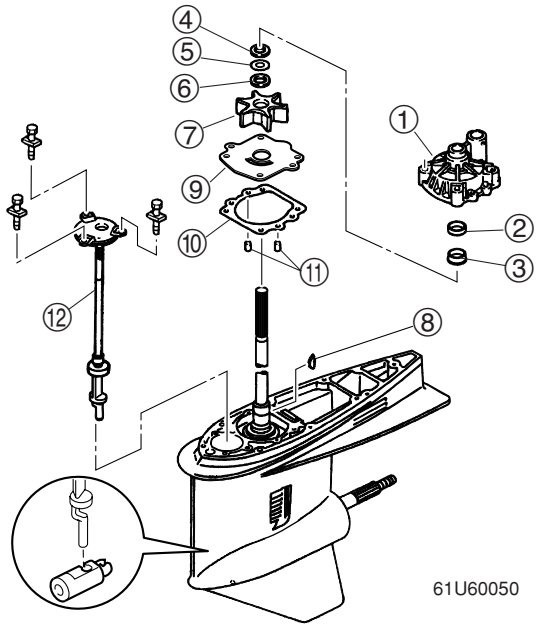
4. Set the gear shift to the neutral position at the lower unit. Make sure that the shift rod is in the neutral position using a special service tool.



69D60036

Shift rod push arm:
90890-06052

5. Remove the shift rod assembly ⑫.



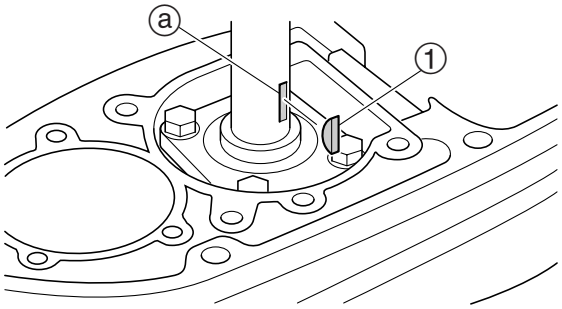
61U60050

Checking the water pump and shift rod

1. Check the water pump housing. Replace if there is deformation.

2. Check the impeller and insert cartridge. Replace if cracked or worn.

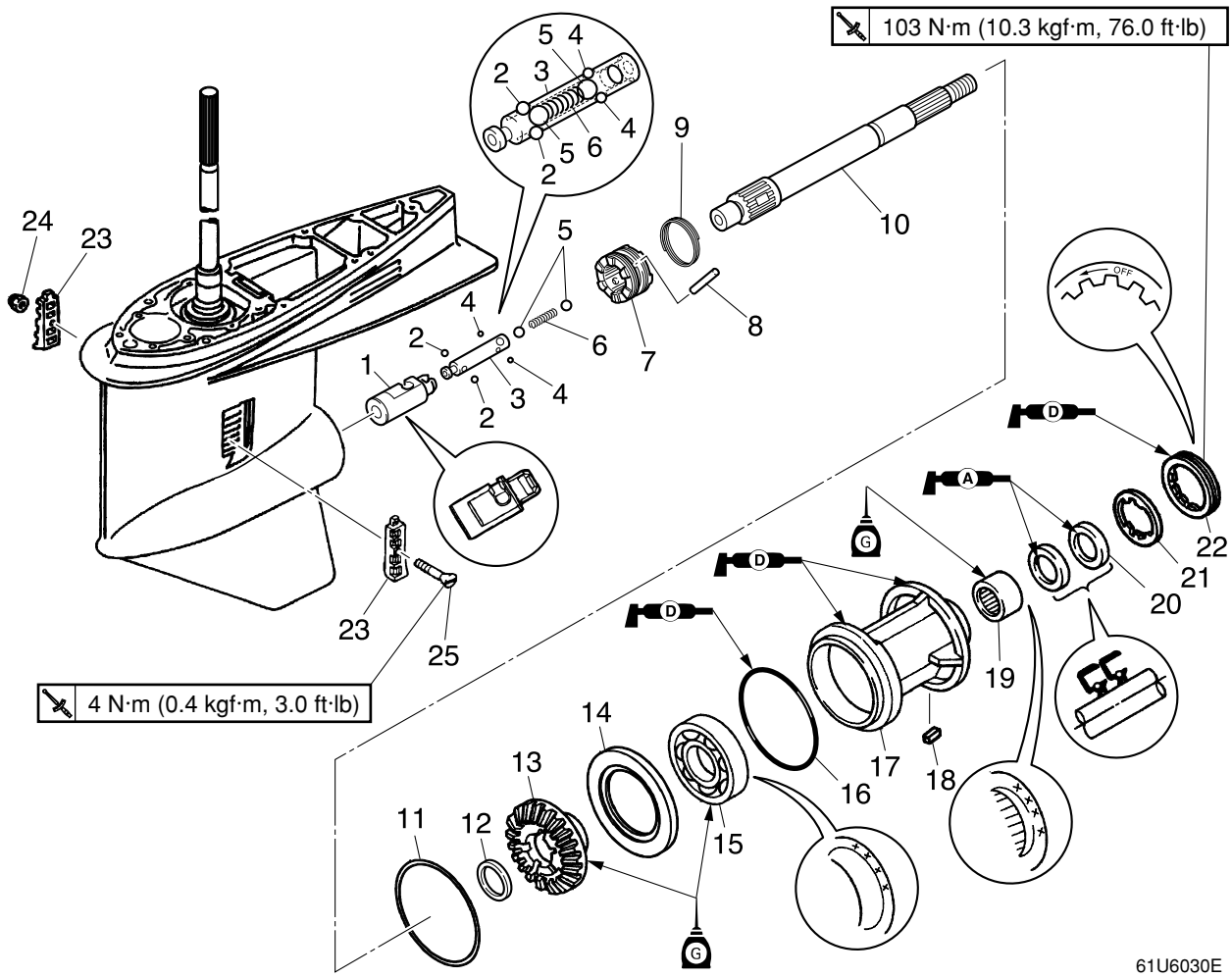
3. Check the Woodruff key ① and the groove ⓐ on the drive shaft. Replace if worn.



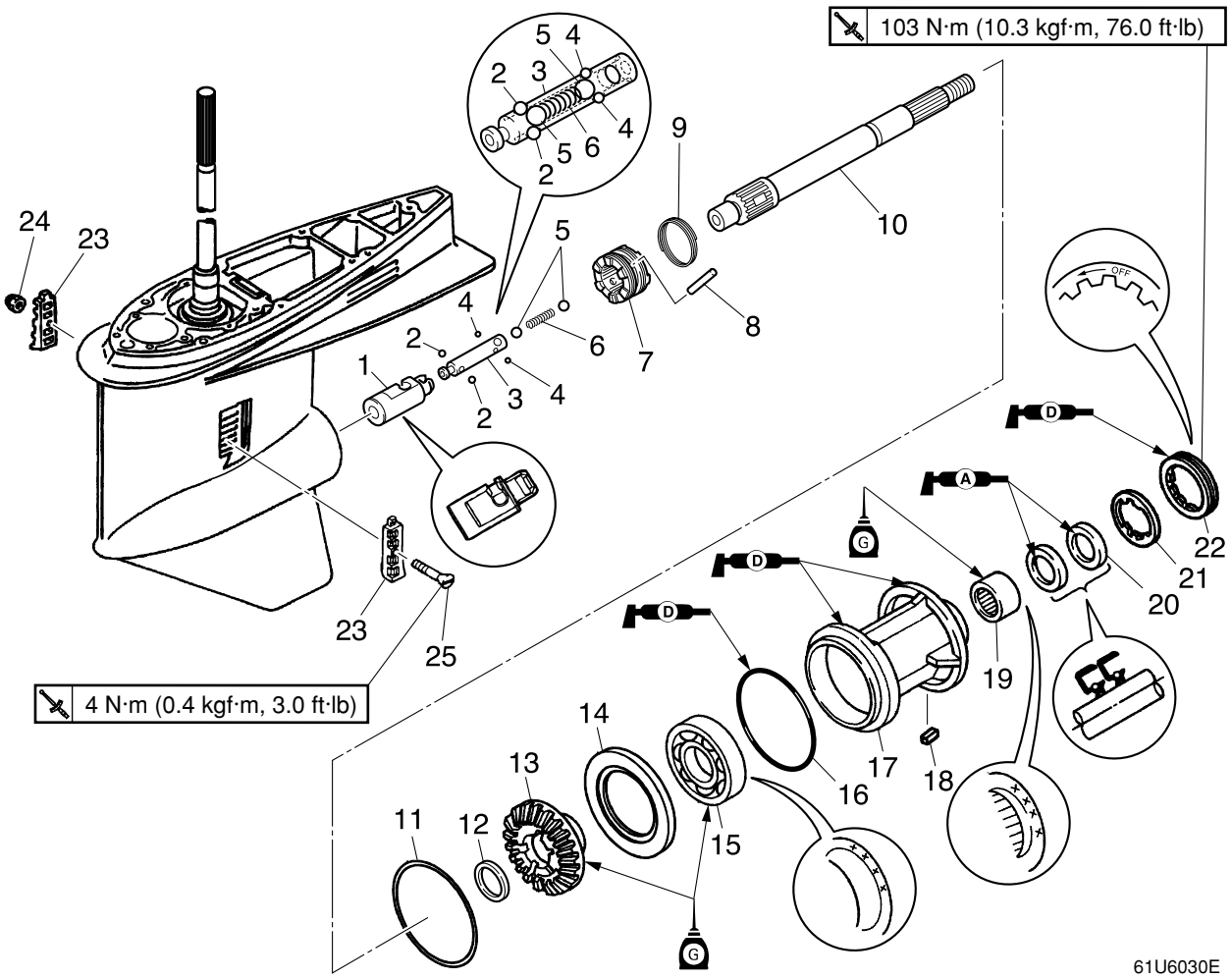
6S360027

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

Propeller shaft housing



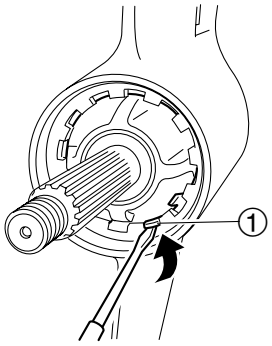
No.	Part name	Q'ty	Remarks
1	Shift rod joint	1	
2	Ball	2	
3	Shift slider	1	
4	Ball	2	
5	Ball	2	
6	Spring	1	
7	Dog clutch	1	
8	Crosspin	1	
9	Spring	1	
10	Propeller shaft	1	
11	Reverse gear shim	—	
12	Washer	1	
13	Reverse gear	1	
14	Thrust washer	1	
15	Ball bearing	1	
16	O-ring	1	Not reusable
17	Propeller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



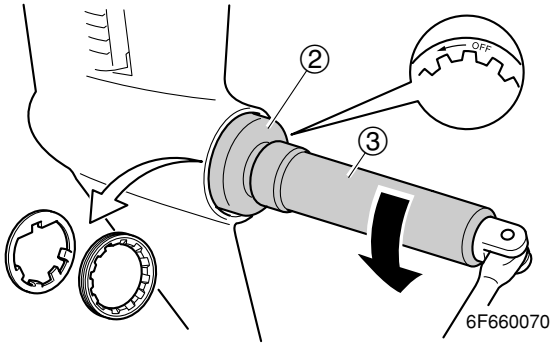
No.	Part name	Q'ty	Remarks
18	Straight key	1	
19	Needle bearing	1	
20	Oil seal	2	Not reusable
21	Claw washer	1	
22	Ring nut	1	
23	Cooling water inlet cover	2	
24	Nut	1	
25	Screw	1	ø5 × 45 mm

Removing the propeller shaft housing assembly

1. Remove the ring nut from the lower case, use the special service tools.



6F600060



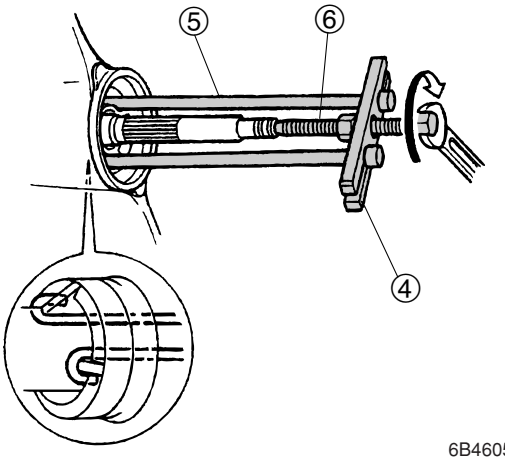
6F660070

NOTE:

- Before removing the propeller shaft from the lower case, remove the shift rod.
- Straighten the one tab ① of the claw washer, then turn the ring nut.
- Turn the ring nut toward to “OFF”.

Ring nut wrench 3 ②:
90890-06511
Ring nut wrench extension ③:
90890-06513

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

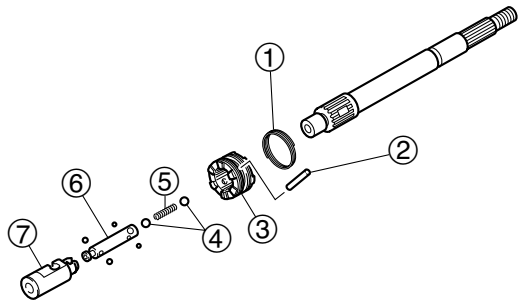


6B460580

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

Disassembling the propeller shaft assembly

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



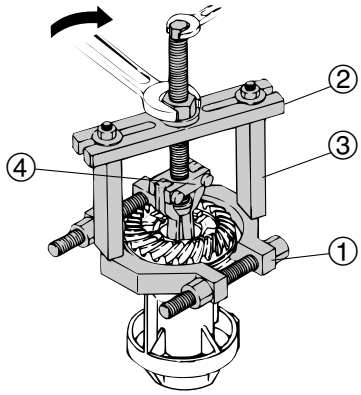
6G460030

NOTE:

Mark the front side of the dog clutch ③.

Disassembling the propeller shaft housing

1. Remove the reverse gear and ball bearing.

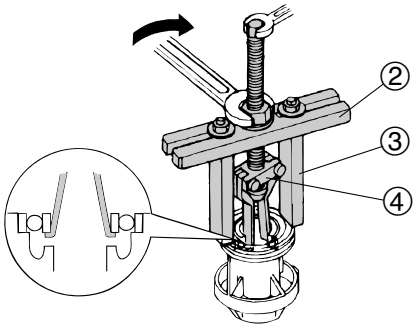


6F660100

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

6

2. Remove the ball bearing.



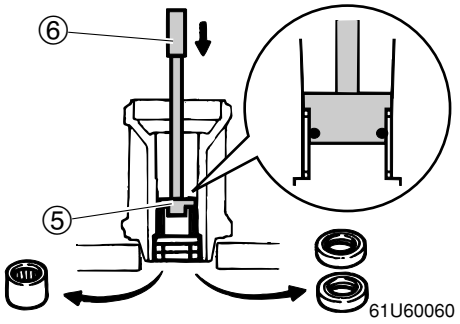
6F660110

CAUTION:

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

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

3. Remove the oil seals and needle bearing.



61U60060

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

Checking the propeller shaft housing

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

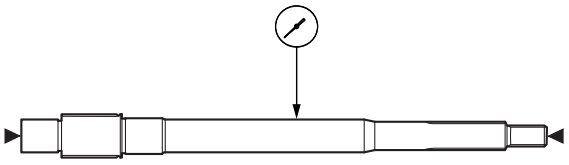
2. Check the teeth and dogs of the reverse gear. Replace if cracked or worn.

3. Check the bearings. Replace if pitted or if there is rumbling.

Checking the propeller shaft

1. Check the propeller shaft. Replace if bent or worn.

2. Measure the propeller shaft runout.

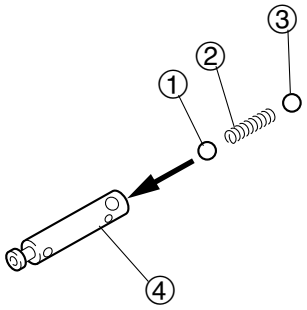

S6P26200

Runout limit: 0.02 mm (0.0008 in)

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

Assembling the propeller shaft assembly

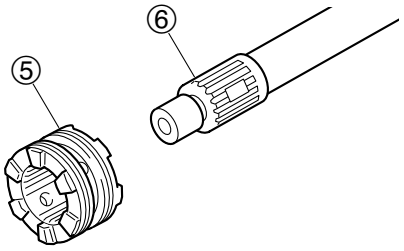
1. Insert the large ball ①, spring ②, and other large ball ③ into the shift slider ④.



61U60140

2. Install the dog clutch ⑤ onto the propeller shaft ⑥.

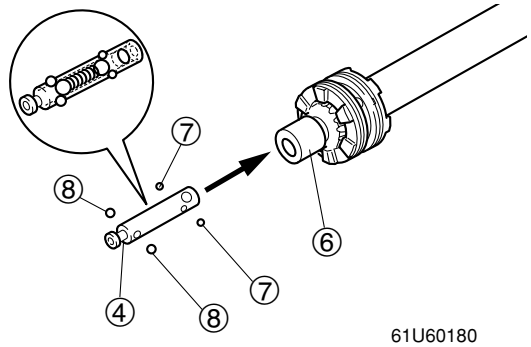
NOTE:
Face the marking side to original direction, and then install the dog clutch ⑤.



61U60170

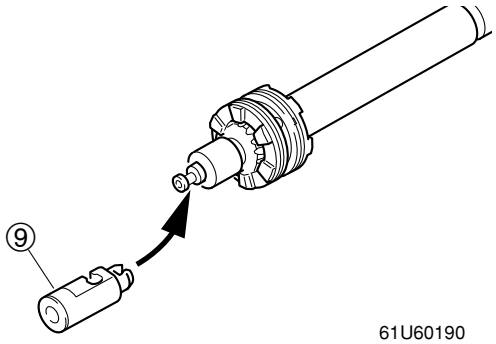
3. Insert the smallest balls ⑦ into the shift slider ④, and then insert the shift slider into the propeller shaft ⑥.

4. Insert the medium balls ⑧ into the shift slider, and then continue to insert the shift slider into the propeller shaft.



61U60180

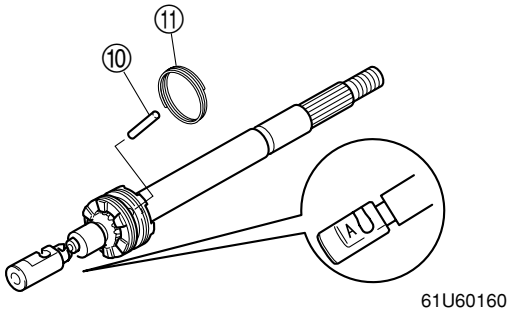
5. Hook the shift rod joint ⑨ onto the knob on the end of the shift slider.



61U60190

6. The hole in the dog clutch align with the 2 holes (propeller shaft and shift slider).

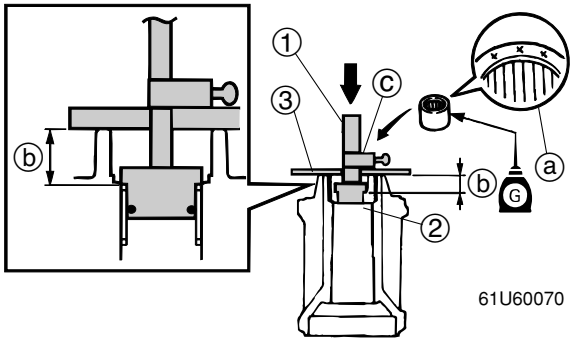
7. Install the cross pin ⑩ and spring ⑪.



61U60160

Assembling the propeller shaft housing

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



61U60070

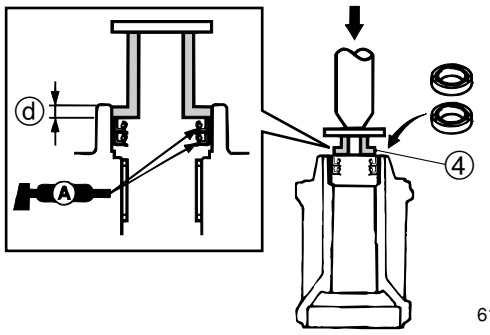
NOTE:
- Install the needle bearing with the manufacture identification mark ⓐ facing toward the propeller side.
- Be careful not to let the stopper ⓒ get out of position when using the driver rod SS ①.

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

Depth ⓑ:
24.75–25.25 mm (0.974–0.994 in)

6

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

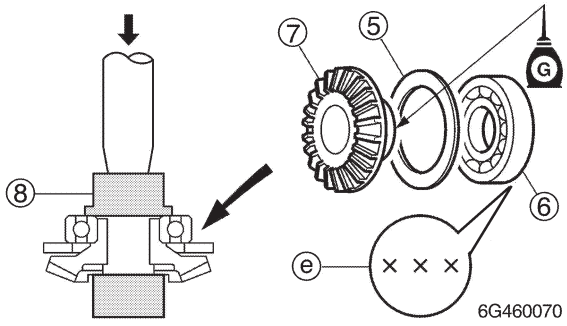


NOTE:
Install an oil seal halfway into the propeller shaft housing, then the other oil seal.

Bearing inner race attachment ④:
90890-06640

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

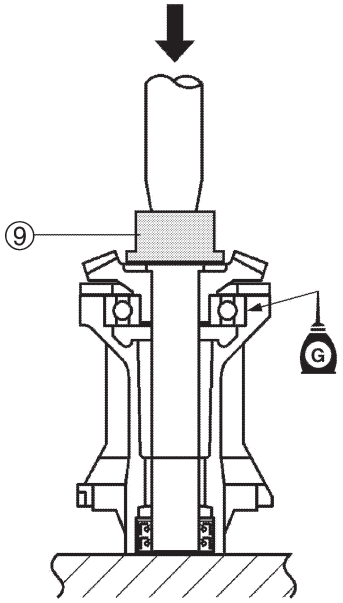
3. Install the thrust washer ⑤ and new ball bearing ⑥ onto the reverse gear ⑦ using a press.



NOTE:
Install the ball bearing with the manufacture identification mark ⓔ facing toward the propeller side.

Ball bearing attachment ⑧:
90890-06656

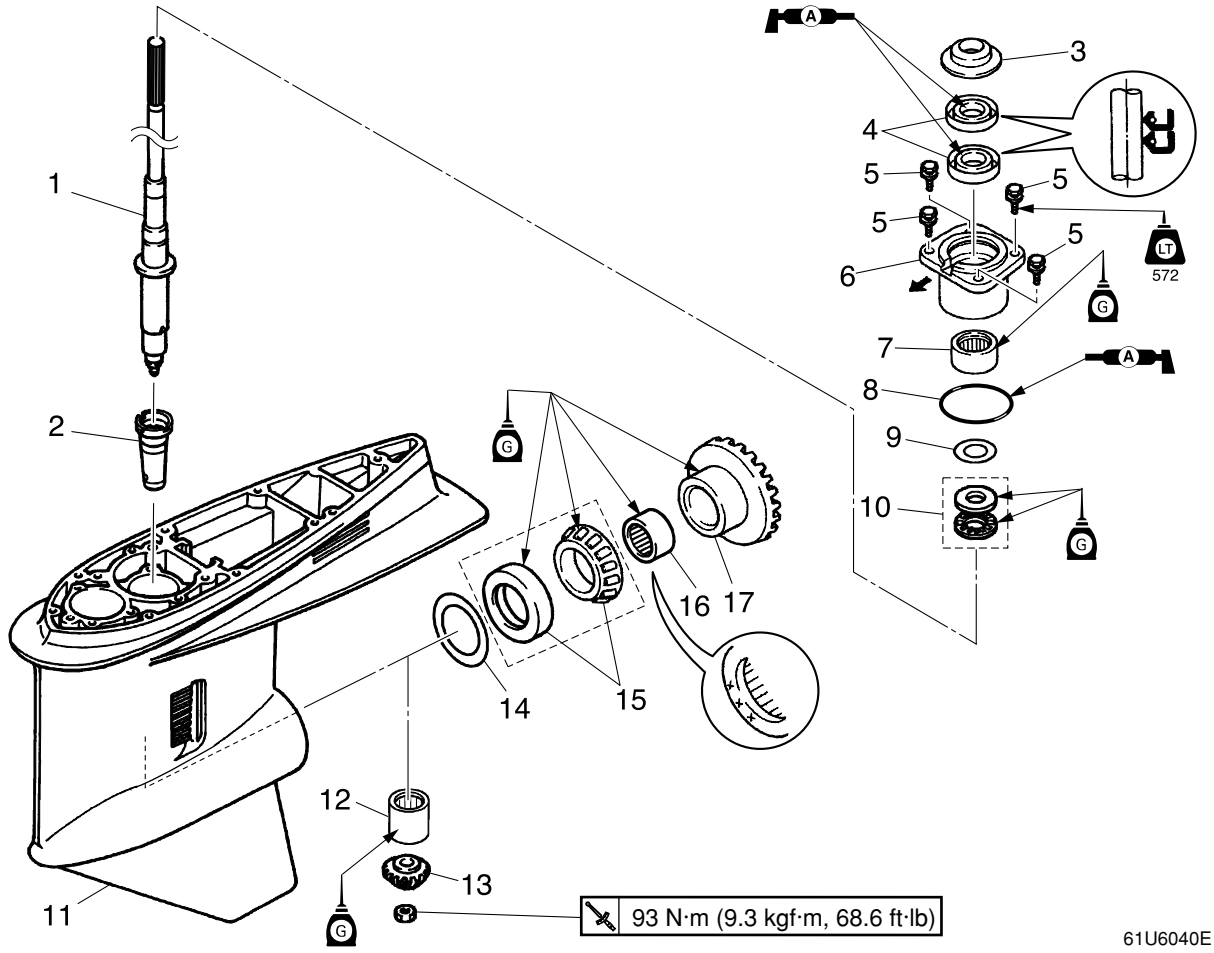
4. Install the reverse gear assembly into the propeller shaft housing using a press.



NOTE:
After installing the reverse gear, check that the reverse gear rotates smoothly.

Needle bearing attachment ⑨:
90890-06654

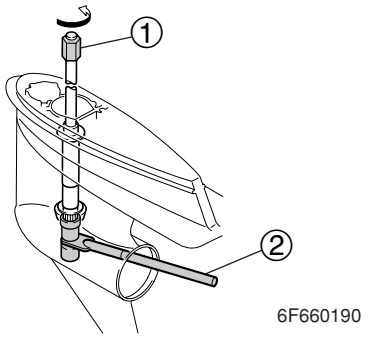
Drive shaft and lower case



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

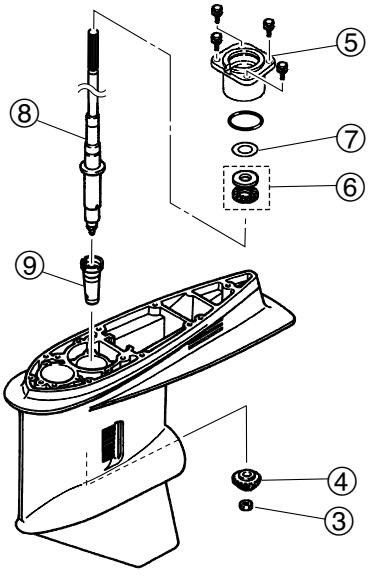
Removing the drive shaft

1. Loosen the pinion nut.



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

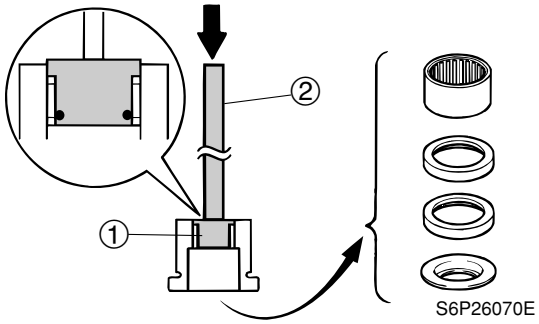
2. Remove the pinion nut ③, pinion ④, drive shaft housing ⑤, thrust bearing ⑥, pinion shim(s) ⑦, drive shaft ⑧, sleeve ⑨ from lower case.



3. Pull out the forward gear.

Disassembling the drive shaft housing

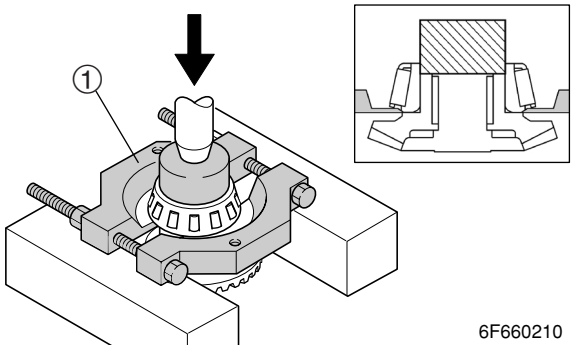
1. Remove the cover, oil seals, and needle bearing.



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

Disassembling the forward gear

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

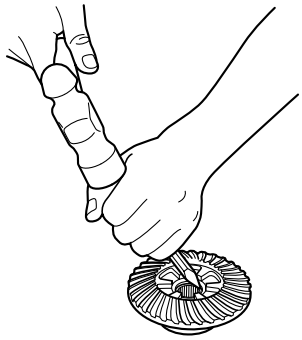


CAUTION:

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

Bearing separator ①:
90890-06534

2. Remove the needle bearing from the forward gear using a chisel.



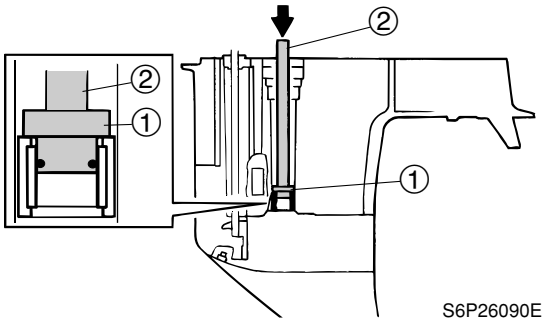
6G460100

CAUTION:

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

Disassembling the lower case

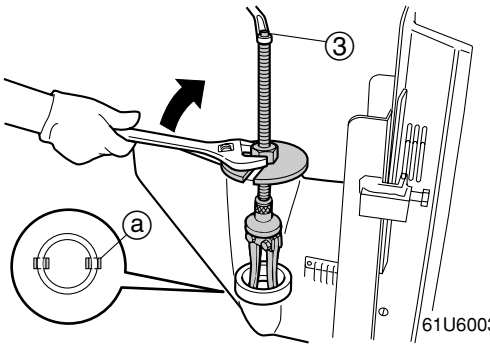
1. Remove the needle bearing.



S6P26090E

Ball bearing attachment ①: 90890-06636
Driver rod LL ②: 90890-06605

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



61U60030

Bearing outer race puller assembly ③: 90890-06523

NOTE:

Install the claws ⓐ as shown.

Checking the pinion and forward gear

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

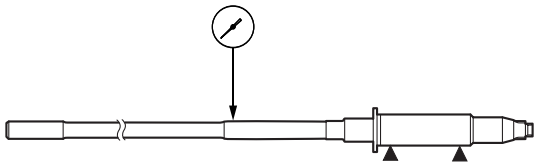
Checking the bearing

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

Checking the drive shaft

1. Check the drive shaft. Replace if bent or worn.

2. Measure the drive shaft runout.



S6P26210

Runout limit: 0.2 mm (0.008 in)

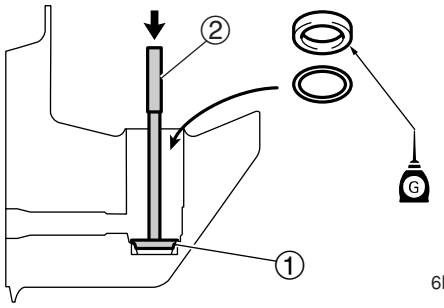
6

Checking the lower case

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

Assembling the lower case

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

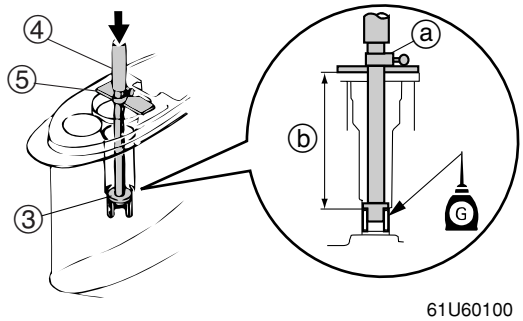


NOTE:

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

Bearing outer race attachment ①:
90890-06620
Driver rod LL ②: 90890-06605

2. Install the new needle bearing into the lower case.



NOTE:

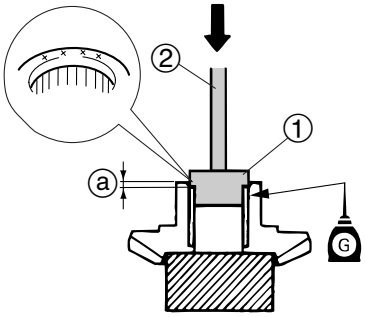
- Apply gear oil to the needle bearing before installation.
- Be careful not to let the stopper ⓐ get out of position when using the driver rod.

Needle bearing attachment ③:
90890-06609
Driver rod SL ④:
90890-06602
Bearing depth plate ⑤:
90890-06603

Depth ⓑ: 182 mm (7.16 in)

Assembling the forward gear

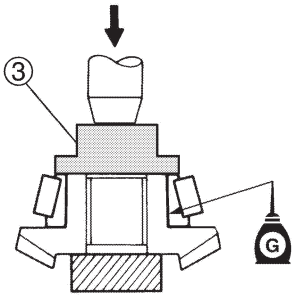
1. Install new needle bearing into the forward gear to the specified depth.



Needle bearing attachment ①:
90890-06612
Driver rod SS ②: 90890-06604

Depth ⓐ:
2.5–3.5 mm (0.098–0.137 in)

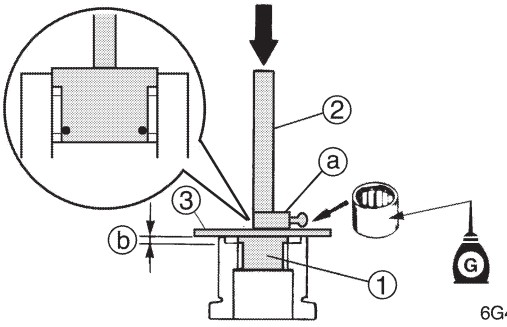
2. Install a new taper roller bearing into the forward gear using a press.



Needle bearing attachment ③:
90890-06654

Assembling the drive shaft housing

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

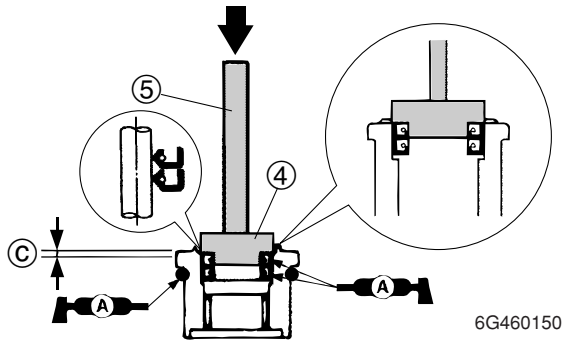


NOTE:
Be careful not to let the stopper ⓐ get out of position when using the driver rod.

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

Depth ⓑ:
5.75–6.25 mm (0.226–0.246 in)

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



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

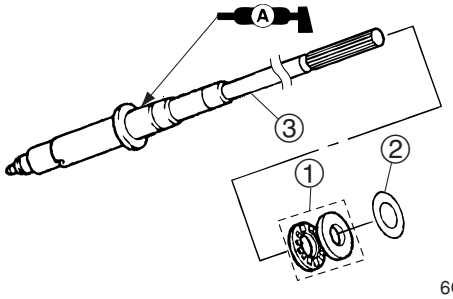
Ball bearing attachment ④:
90890-06633
Driver rod LS ⑤: 90890-06606

Depth ⓒ:
0.25–0.75 mm (0.01–0.03 in)

Installing the drive shaft

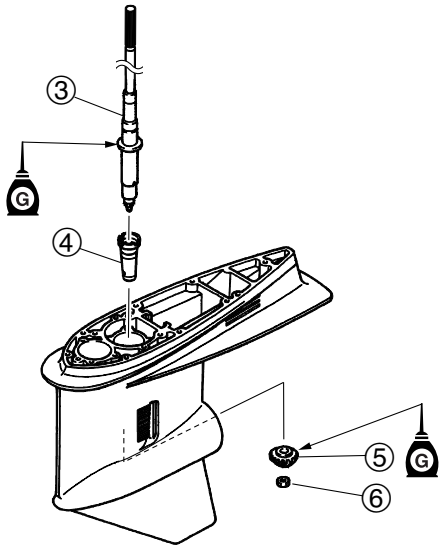
1. Install the forward gear into the lower case.

2. Install the thrust bearing ① and original shim(s) ② onto the drive shaft ③.



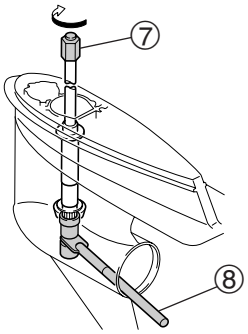
NOTE:
- Be sure to select the pinion shim(s) if replacing the thrust bearing, drive shaft housing, drive shaft or lower case.
- To select the shim(s), see “Shimming.”

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



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

6

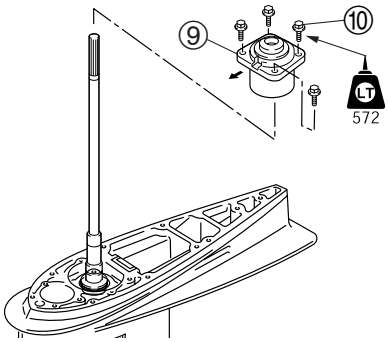


6F660310

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

	Pinion nut: 93 N·m (9.3 kgf·m, 68.6 ft·lb)

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

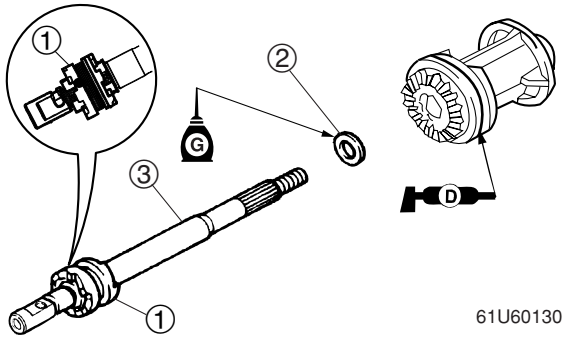


6S360106

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

Installing the propeller shaft housing

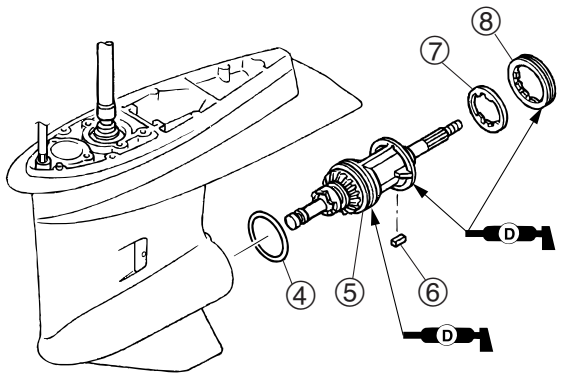
1. Set the shift rod joint and dog clutch ① to the neutral position as shown.
2. Apply grease to a new O-rings, and then install it onto the propeller shaft housing.
3. Install the washer ② and propeller shaft assembly ③ into the propeller shaft housing assembly.



61U60130

NOTE:
Face the shift rod joint connect part to upward.

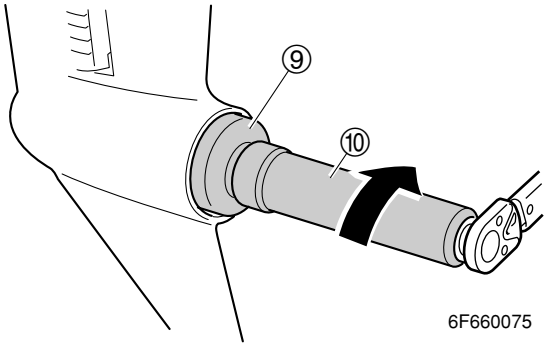
4. Install the original shim(s) ④ and propeller shaft housing assembly ⑤ into the lower case, and then install the straight key ⑥, claw washer ⑦, and ring nut ⑧.



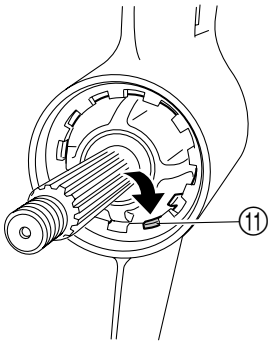
6G460190

NOTE:
- Be sure to select the reverse gear shim(s) if replacing the propeller shaft housing, lower case, or ball bearing.
- To select the shim(s), see “Shimming”.

5. Tighten the ring nut to the specified torque.



6F660075



6F600065

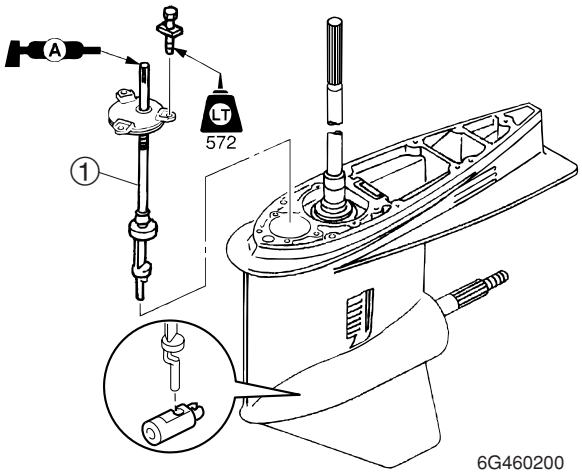
NOTE:
- To secure the ring nut, bend one tab ⑪ of the claw washer into a slot in the ring nut.
- Bend all other tabs toward the propeller shaft housing assembly.

	Ring nut wrench 3 ⑨: 90890-06511 Ring nut wrench extension ⑩: 90890-06513

	Ring nut ⑧: 103 N·m (10.3 kgf·m, 76.0 ft·lb)

Installing the water pump and shift rod

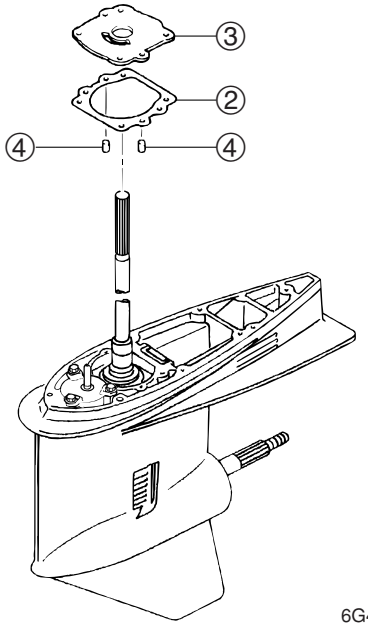
1. Install the shift rod assembly ①.



6G460200

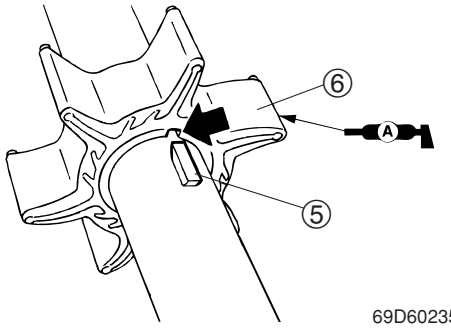
NOTE:
- Check the gear shift to the neutral position, when installing the shift rod.
- After assembling the lower unit, check that the shift rod operates smoothly, and check that the drive shaft and propeller shaft rotates smoothly.

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



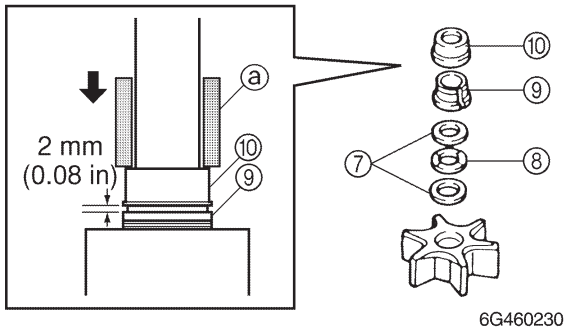
6G460210

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



69D60235

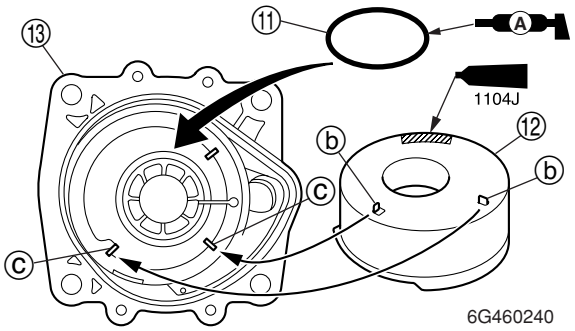
5. Install the washers ⑦, wave washer ⑧, spacer ⑨, and collar ⑩ onto the drive shaft.



6G460230

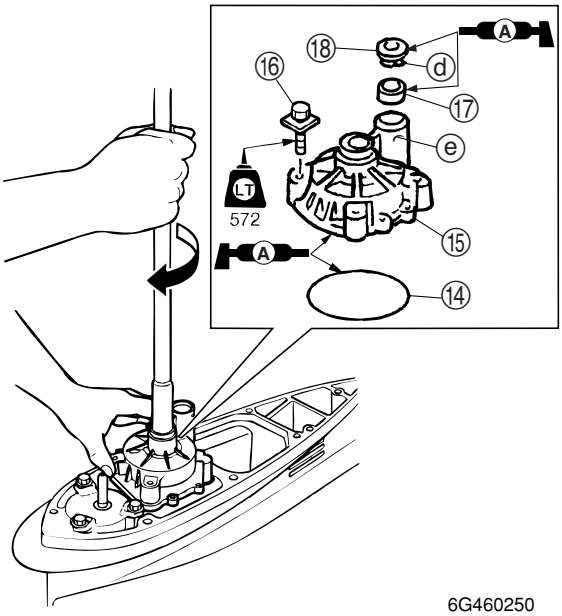
NOTE:
- The collar and spacer should fit together firmly.
- While pulling the drive shaft up, install the collar with an appropriate tool ⓐ that fits over the drive shaft as shown.

6. Install the new O-ring ⑪ and insert cartridge ⑫ into the pump housing ⑬.



NOTE:
Align the insert cartridge projections ⓑ with the holes ⓒ in the pump housing.

7. Install the new O-ring ⑭ and pump housing assembly ⑮ into the lower case, tighten the bolts ⑯, and then install the seal ⑰ and cover ⑱.



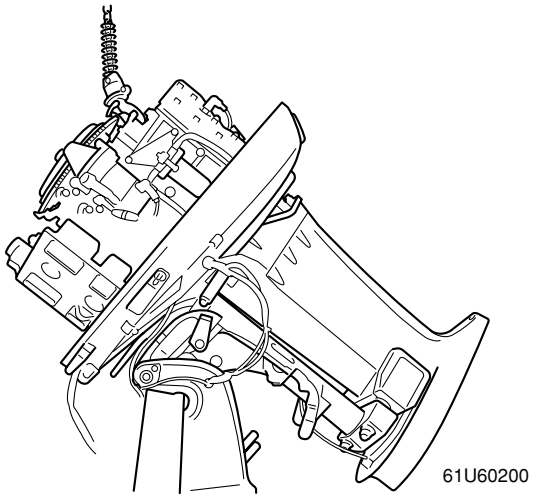
Water pump housing bolt ⑯:
18 N·m (1.8 kgf·m, 13.3 ft·lb)

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

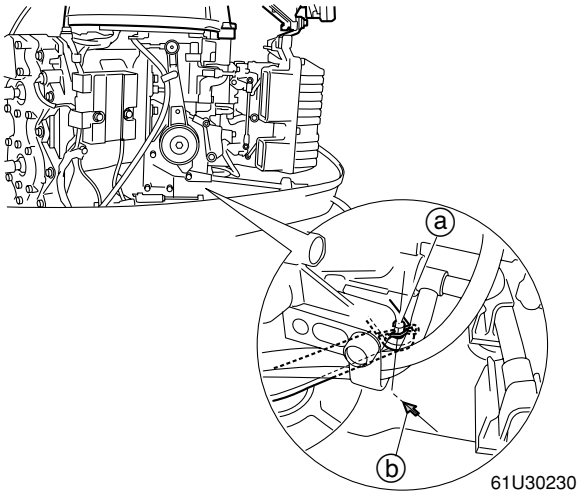
NOTE:
- When installing the pump housing, apply grease to the inside of the housing, and then turn the drive shaft clockwise while pushing down the pump housing.
- Align the cover projection ⓓ with the hole ⓔ in the pump housing.

Installing the lower unit

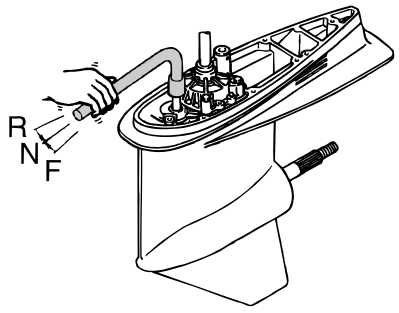
WARNING
When installing the lower unit without removing the power unit, be sure to suspend the outboard motor. Otherwise, the outboard motor could suddenly fall and result in injury.



1. Align the center of the set pin ⓐ with the alignment mark ⓑ on the bottom cowling.



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



69D60036

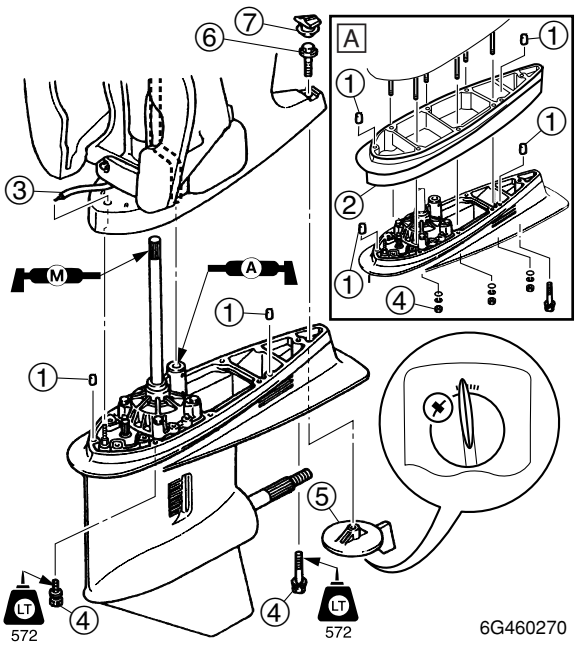
Shift rod push arm:
90890-06052

3. Install the 2 dowels ① into the lower unit and extension ② (E115A: Y-transom).

4. Connect the speedometer hose ③.

5. Install the lower unit into the upper case, and then tighten the lower case mount bolts ④ or nuts to the specified torque.

6. Install the trim tab ⑤ to its original position, and then tighten the trim tab bolt ⑥ to the specified torque.



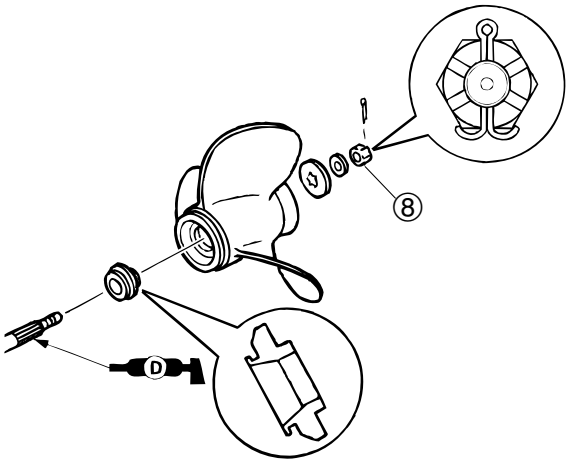
6G460270

A E115A: Y-transom

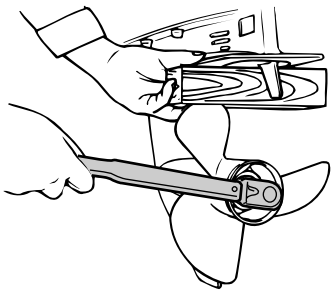
Lower case mount bolt (nut) ④:
39 N·m (3.9 kgf·m, 28.8 ft·lb)
Trim tab bolt ⑥:
39 N·m (3.9 kgf·m, 28.8 ft·lb)

7. Install the grommet ⑦.

8. Install the propeller and propeller nut ⑧, and then temporarily tighten the nut. Place a block of wood between the anti-cavitation plate and propeller to prevent the propeller from turning, and then tighten the nut to the specified torque.



6G460280



6F660420

⚠WARNING

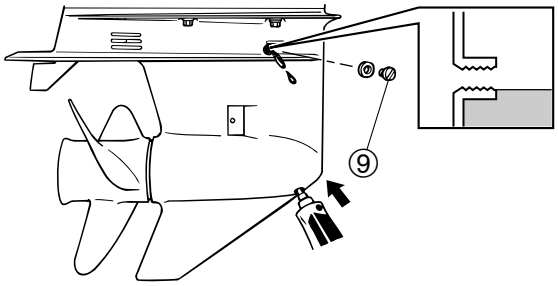
- **Do not hold the propeller with your hands when loosening or tightening it.**
- **Be sure to disconnect the battery cables from the battery and remove the lock plate from the engine stop lanyard switch.**
- **Put a block of wood between the anti-cavitation plate and propeller to prevent the propeller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

NOTE:

If the grooves in the propeller nut ⑧ do not align with the propeller shaft hole, tighten the nut until they are aligned.

Propeller nut ⑧:
54 N·m (5.4 kgf·m, 39.8 ft·lb)

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



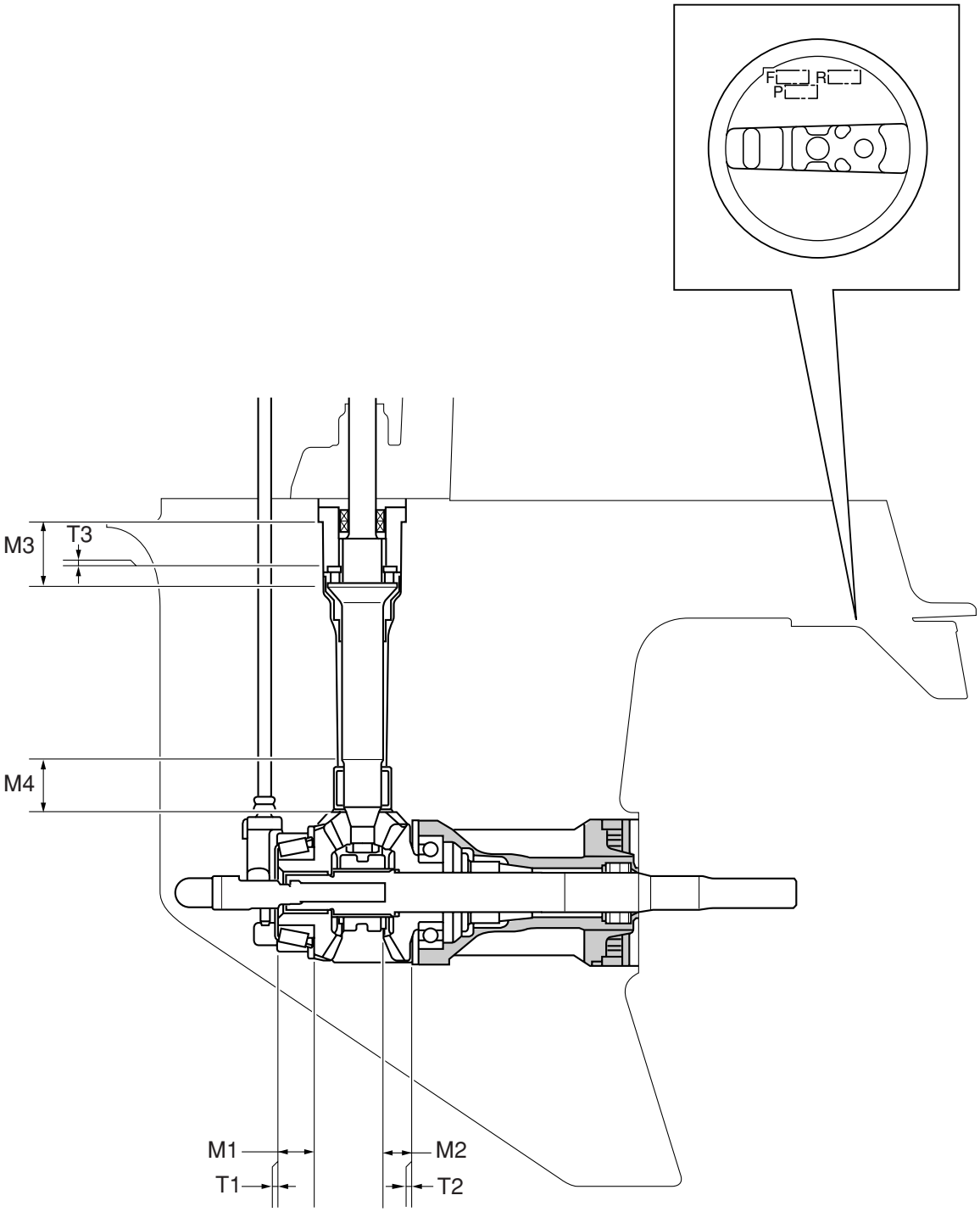
69D10050

Recommended gear oil:
Hypoid gear oil
API: GL-4
SAE: 90
Gear oil quantity:
760 cm^3
(25.70 US oz, 26.81 Imp oz)

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

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

Shimming



6G46090E

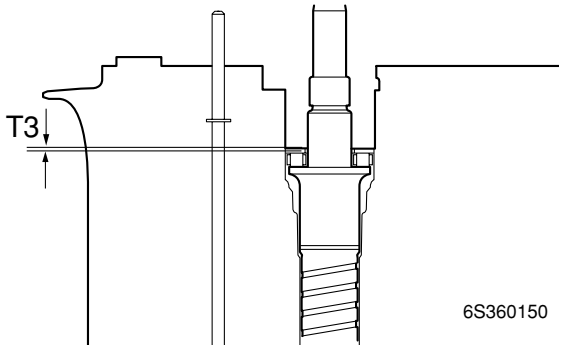
6

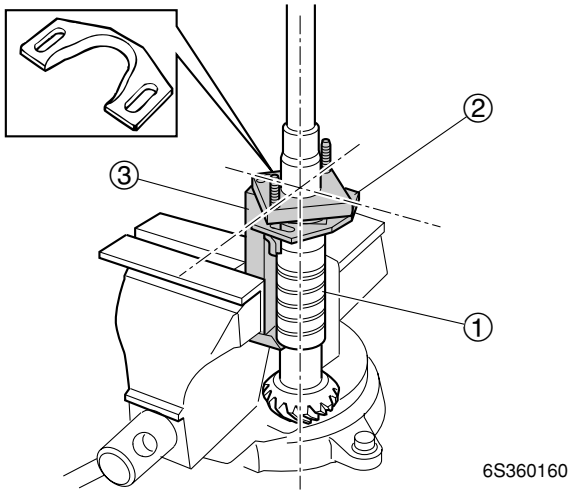
Shimming

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

Selecting the pinion shim

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





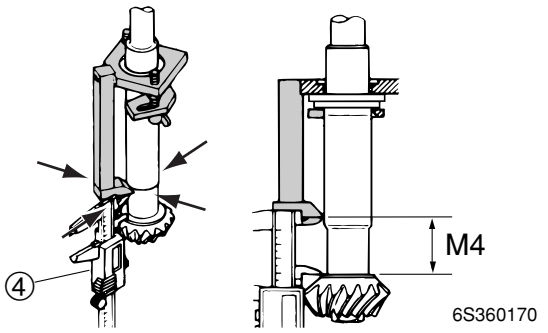
NOTE:
- Select the shim thickness (T3) by using the specified measurement(s) and the calculation formula.
- Install the special service tools onto the drive shaft so that the shaft is at the center of the hole.
- Tighten the wing nuts another 1/4 of a turn after they contact the fixing plate ②.

Pinion height gauge ③: 90890-06710

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

Pinion nut: 93 N·m (9.3 kgf·m, 68.6 ft·lb)

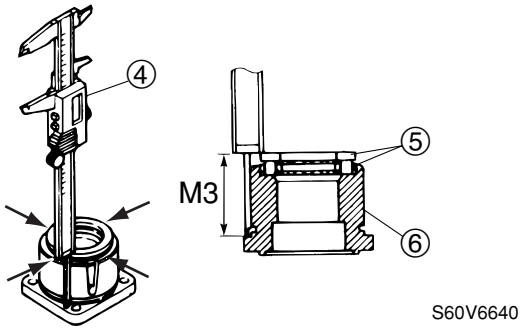
3. Measure the distance (M4) between the special service tool and the pinion as shown.



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

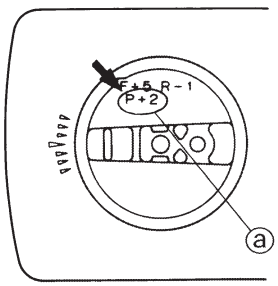
Digital caliper ④: 90890-06704

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



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

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



6G460340

NOTE:

"P" is the deviation of the lower case dimension from standard. The "P" mark ⓐ 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:
Pinion shim thickness (T3) =
62.5 + P/100 – M3 – M4

Example:
If "M3" is 46.65 mm and "M4" is 15.15 mm and "P" is (+ 2), then
T3 = 62.5 + (+ 2)/100 – 46.65 – 15.15 mm
= 62.5 + 0.02 – 46.65 – 15.15 mm
= 0.72 mm

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

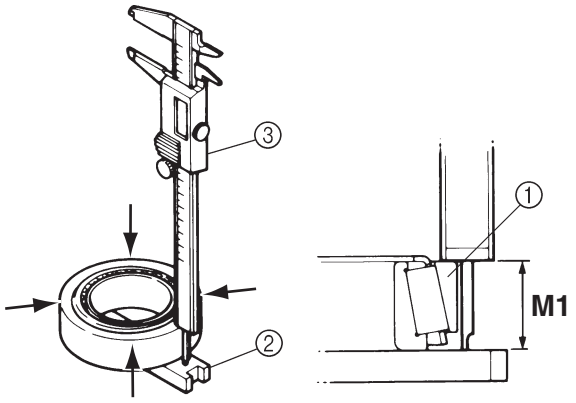
Calculated numeral at 1/100th place	Rounded numeral
1, 2	0
3, 4, 5	2
6, 7, 8	5
9, 10	8

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

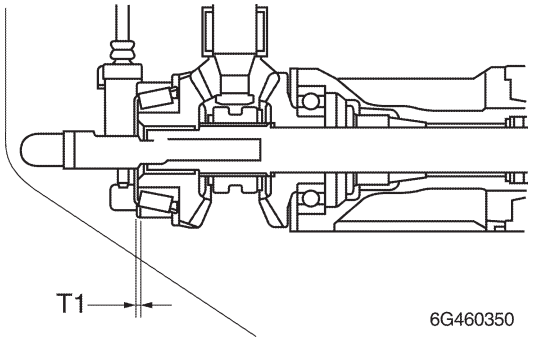
Example:
If "T3" is 0.70 mm, then the pinion shim is 0.68 mm.
If "T3" is 0.74 mm, then the pinion shim is 0.72 mm.

Selecting the forward gear shim

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



6B460550



6G460350

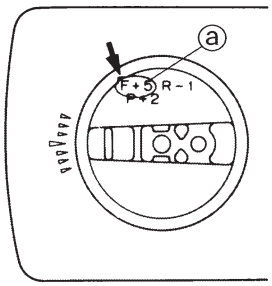
NOTE:

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

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

6

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



6G460360

NOTE:
"F" is the deviation of the lower case dimension from standard. The "F" mark ⓐ 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:
Forward gear shim thickness (T1) = 24.6 + F/100 – M1

Example:
If "M1" is 23.80 mm and "F" is (+5), then
T1 = 24.6 + (+5)/100 – 23.80 mm
= 24.6 + 0.05 – 23.80 mm
= 0.85 mm

If "M1" is 23.80 mm and "F" is (0), then
T1 = 24.6 + (0)/100 – 23.80 mm
= 24.6 + 0 – 23.80 mm
= 0.80 mm

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

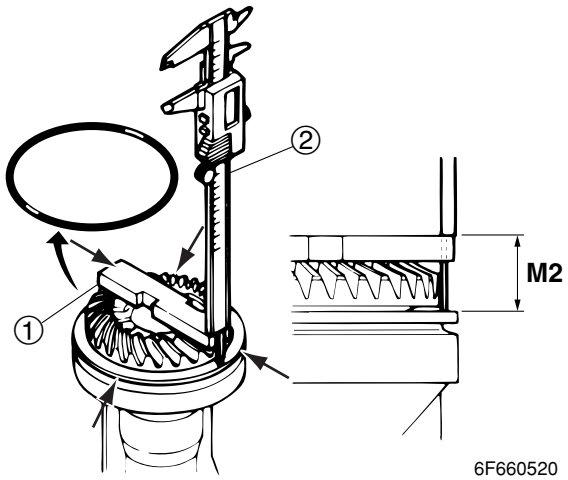
Calculated numeral at 1/100th place	Rounded numeral
1, 2	0
3, 4, 5	2
6, 7, 8	5
9, 10	8

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

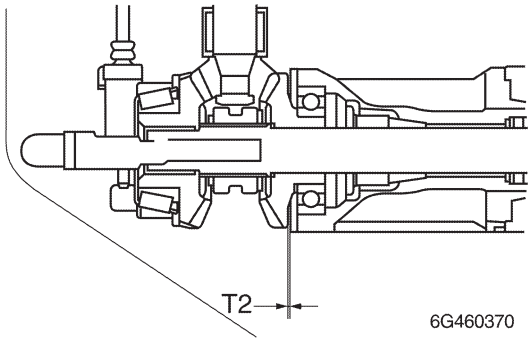
Example:
If "T1" is 0.85 mm, then the forward gear shim is 0.82 mm.
If "T1" is 0.80 mm, then the forward gear shim is 0.78 mm.

Selecting the reverse gear shim

1. Install the ball bearing, thrust washer, and reverse gear onto the propeller shaft housing.
2. Measure the gear height (M2) from the thrust washer on the propeller shaft housing.



6F660520

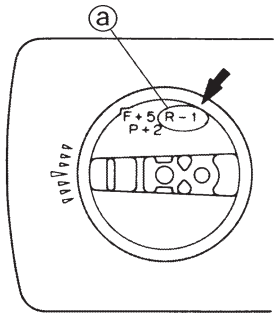


6G460370

NOTE:
- Without the O-ring, when measuring the reverse gear height.
- Select the shim thickness (T2) by using the specified measurement(s) and the calculation formula.
- Measure the reverse gear at 4 points to find the height average.
- Make of note the each measurement numerical.

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

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



6G460380

NOTE:
"R" is the deviation of the lower case dimension from standard. The "R" mark ⓐ 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 – 27.4 – R/100

Example:
If "M2" is 28.25 mm and "R" is (– 1), then
T2 = 28.25 – 27.4 – (– 1)/100 mm
= 28.25 – 27.4 + 0.01 mm
= 1.36 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:
0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm

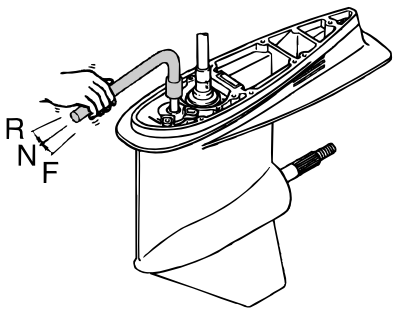
Example:
If "T2" is 1.30 mm, then the reverse gear shim is 1.30 mm.
If "T2" is 1.36 mm, then the reverse gear shim is 1.38 mm.

Backlash

Measuring the forward and reverse gear backlash

1. Remove the water pump assembly.

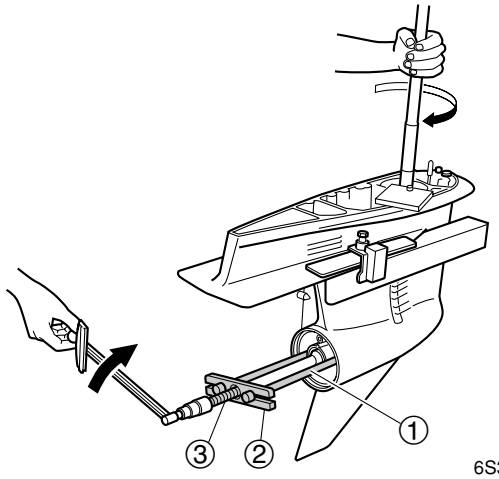
2. Set the gear shift to the neutral position at the lower unit.



69D60035

Shift rod push arm:
90890-06052

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



6S360190

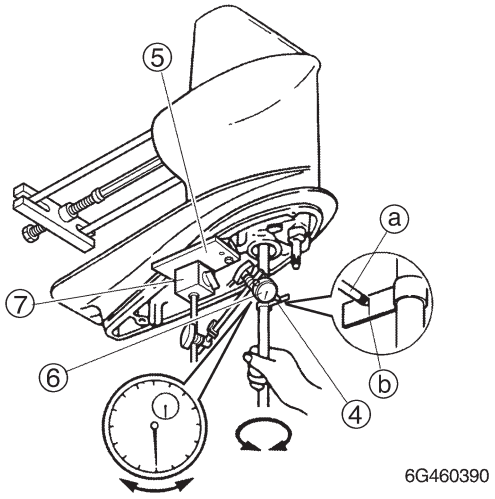
NOTE:
While turning the drive shaft clockwise 5–6 times to contact the gear evenly it tightens center bolt ③ to specified torque.

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

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

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

5. Set the lower unit upside down.



6G460390

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

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

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

Forward gear backlash:
0.32–0.50 mm
(0.0126–0.0197 in)

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

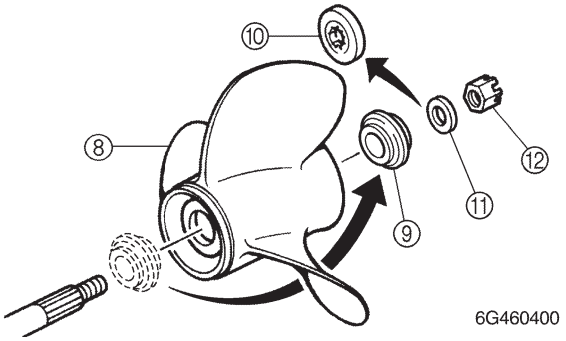
Forward gear backlash	Shim thickness
Less than 0.32 mm (0.0126 in)	To be decreased by (0.41 – M) × 0.63
More than 0.50 mm (0.0197 in)	To be increased by (M – 0.41) × 0.63

M: Measurement

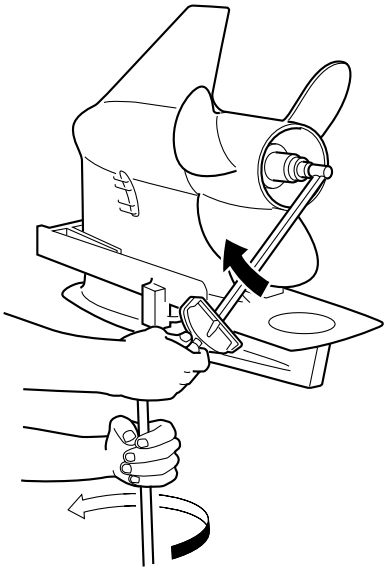
Available shim thicknesses:
0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm

8. Remove the special service tools from the propeller shaft.

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



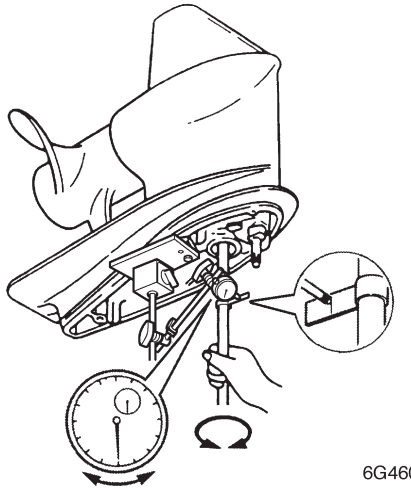
6G460400


6S360200

NOTE:
While turning the drive shaft clockwise 5–6 times to contact the gear evenly it tightens propeller nut ⑫ to specified torque.

Propeller nut ⑫:
5 N·m (0.5 kgf·m, 3.7 ft·lb)

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


6G460410

Reverse gear backlash:
0.80–1.17 mm
(0.0315–0.0461 in)

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

Reverse gear backlash	Shim thickness
Less than 0.80 mm (0.0315 in)	To be increased by (0.98 – M) × 0.63
More than 1.17 mm (0.0461 in)	To be decreased by (M – 0.98) × 0.63

M: Measurement

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

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

Bracket unit

Tiller handle 7-1
Checking the throttle cable and shift cable 7-4
Assembling the tiller handle.....7-4
Lubricating the throttle gear.....7-4

Bottom cowling 7-5

Upper case, steering arm 7-8
Disassembling the upper case 7-12
Checking the upper case.....7-13
Assembling the upper case 7-13
Removing the steering arm 7-17
Removing the oil seal of swivel bracket (MH, WH, E).....7-17
Installing the oil seal of swivel bracket (MH, WH, E).....7-17
Installing the steering arm 7-18
Installing the upper case.....7-19

Clamp bracket and swivel bracket 7-20
Removing the clamp bracket (MH, WH, E) 7-24
Disassembling the swivel bracket (MH, WH, E).....7-25
Assembling the swivel bracket (MH, WH, E).....7-25
Assembling the clamp bracket (MH, WH, E).....7-26
Removing the PTT unit (ET).....7-30
Removing the clamp bracket (ET).....7-30
Installing the clamp bracket (ET).....7-31
Installing the PTT unit (ET).....7-32
Adjusting the trim sensor cam (ET).....7-33

PTT unit.....7-34
Checking the hydraulic pressure 7-35

PTT motor 7-38
Disassembling the PTT motor 7-39
Checking the PTT motor.....7-40
Checking the filter.....7-41
Assembling the PTT motor 7-41

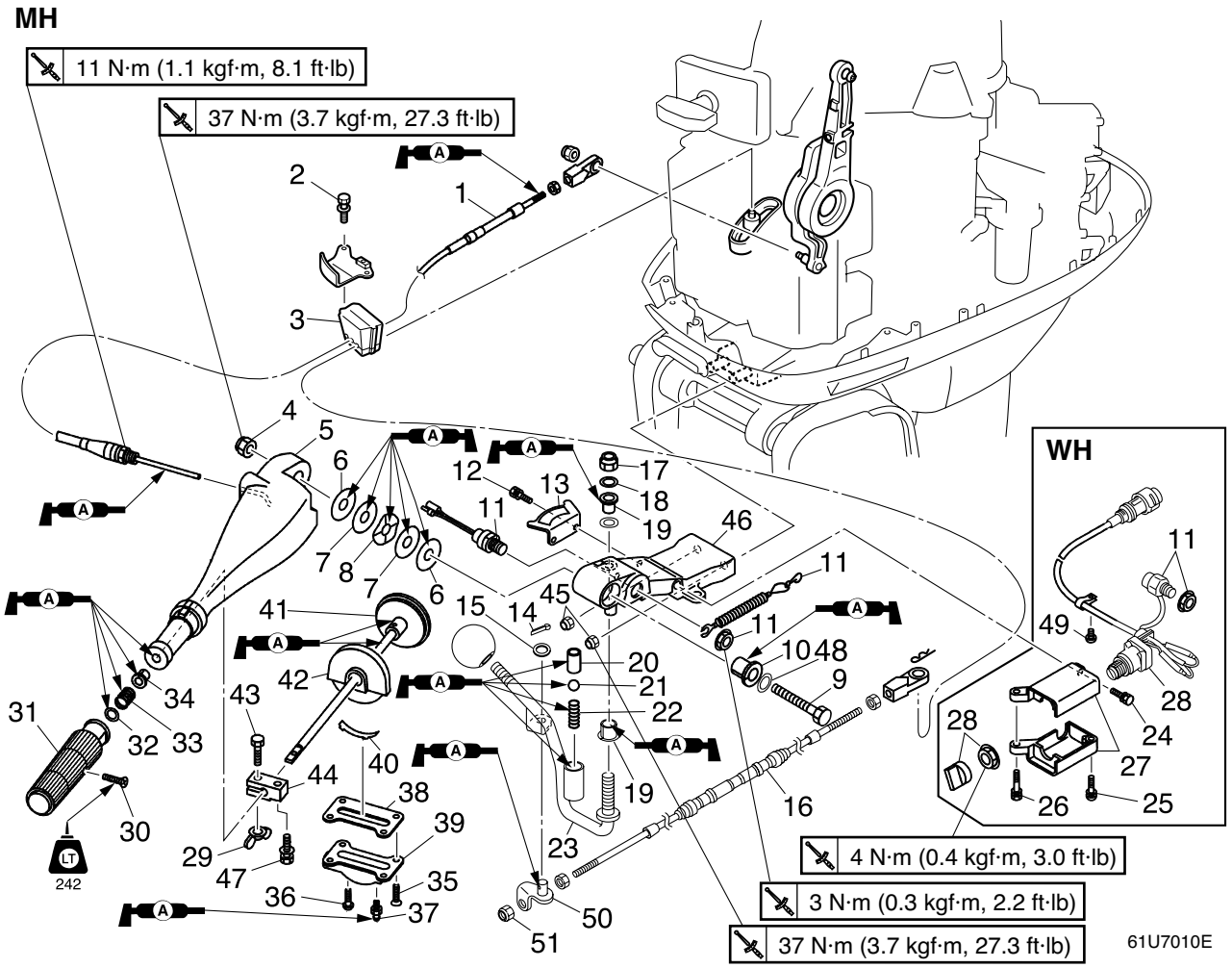
Gear pump 7-42
Disassembling the gear pump housing 7-44
Checking the main valve 7-45
Checking the gear pump 7-45
Checking the gear pump housing.....7-45
Checking the reservoir.....7-45
Checking the relief valve 7-45
Assembling the gear pump housing 7-46

Tilt cylinder and trim cylinder 7-48
Disassembling the tilt cylinder and trim cylinder 7-50
Checking the tilt cylinder and trim cylinder 7-51
Assembling the tilt piston and trim piston 7-51
Assembling the PTT unit 7-52
Bleeding the PTT unit 7-55
Bleeding the PTT unit (built-in) 7-56

PTT electrical system 7-57
Checking the fuse 7-57
Checking the PTT relay 7-57
Checking the trim sensor 7-57

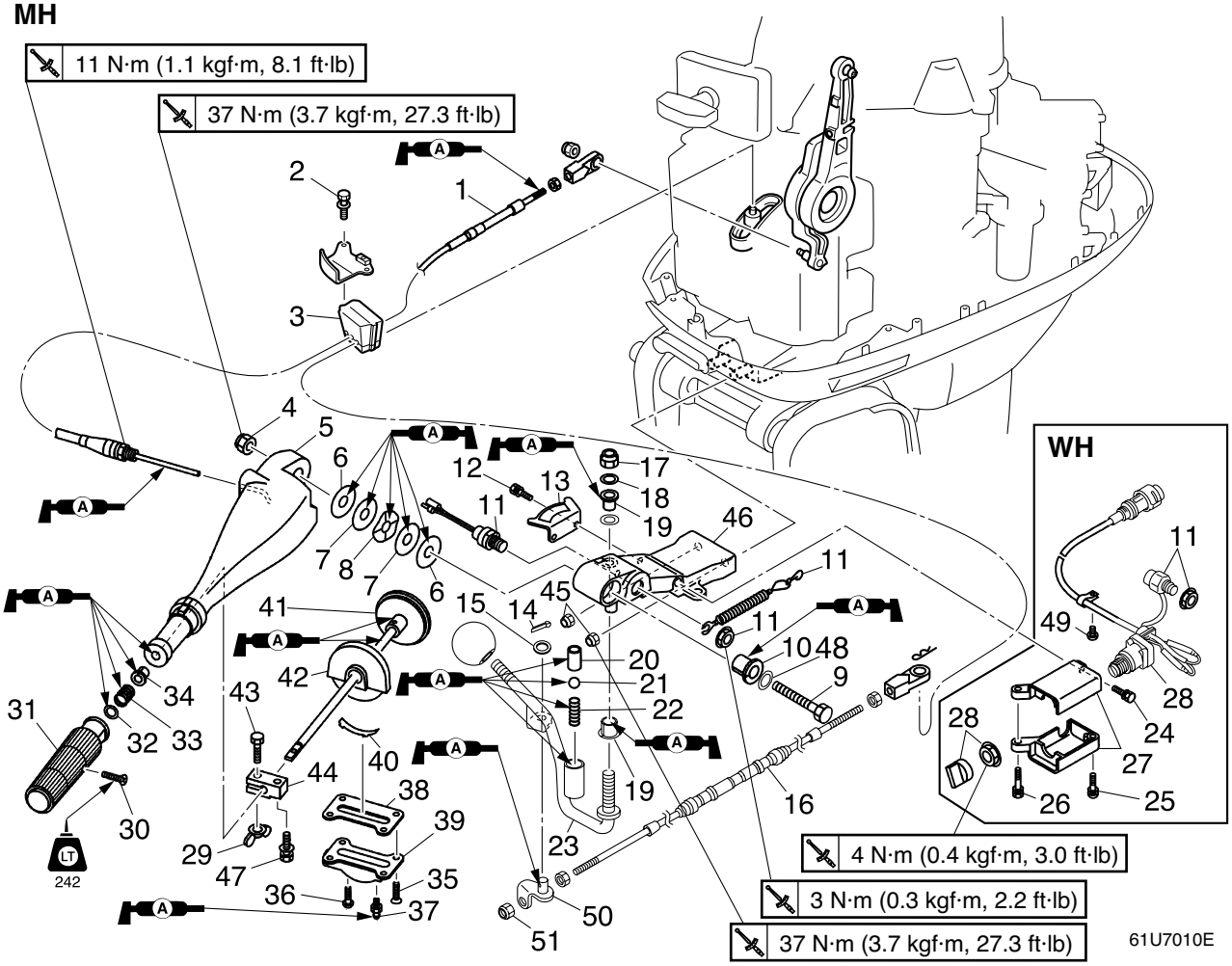
7

Tiller handle



No.	Part name	Q'ty	Remarks
1	Throttle cable	1	
2	Bolt	2	M6 × 16 mm
3	Grommet	1	
4	Nut	1	
5	Tiller handle	1	
6	Plastic washer	2	
7	Metal washer	2	
8	Wave washer	1	
9	Bolt	1	M8 × 70 mm
10	Bushing	1	
11	Engine stop lanyard switch	1	
12	Bolt	2	M6 × 16 mm
13	Bracket	1	
14	Cotter pin	1	
15	Washer	1	
16	Shift cable	1	
17	Nut	1	

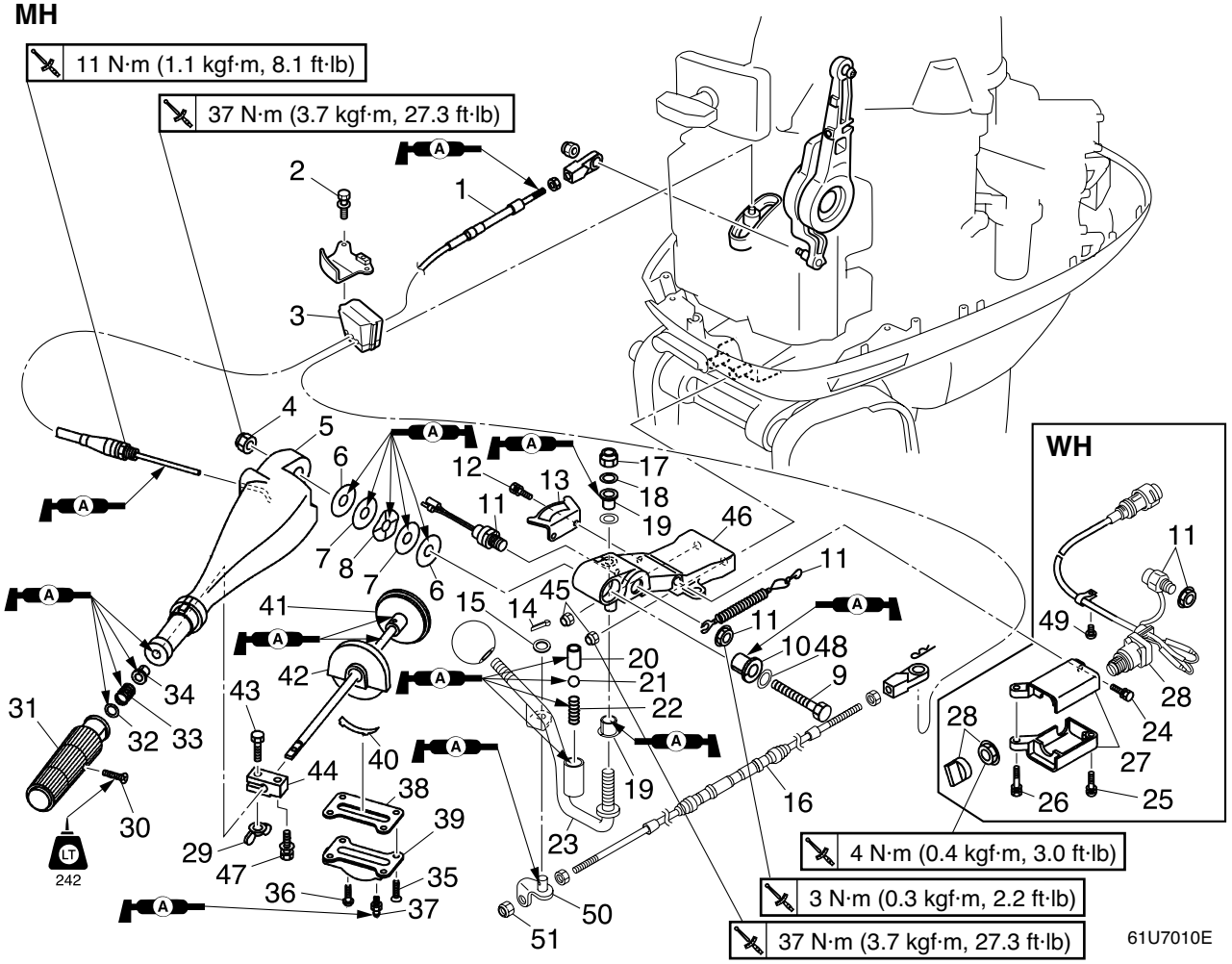
MH



No.	Part name	Q'ty	Remarks
18	Washer	1	
19	Bushing	2	
20	Collar	1	
21	Ball	1	
22	Spring	1	
23	Shift lever	1	
24	Bolt	1	M6 × 20 mm
25	Screw	1	ø6 × 26 mm
26	Bolt	1	M6 × 30 mm
27	Switch holder	2	
28	Engine start switch	1	
29	Nut	1	
30	Screw	1	
31	Throttle grip	1	
32	Washer	1	
33	Spring	1	
34	Bushing	1	

7

MH



No.	Part name	Q'ty	Remarks
35	Screw	4	ø6 × 8 mm
36	Screw	1	ø5 × 12 mm
37	Grease nipple	1	
38	Gasket	1	Not reusable
39	Cover	1	
40	Plate	1	
41	Throttle shaft	1	
42	Housing	1	
43	Bolt	1	M6 × 25 mm
44	Friction piece	1	
45	Nut	2	
46	Bracket	1	
47	Bolt	1	M6 × 25 mm
48	Washer	1	
49	Screw	1	
50	Shift link rod	1	
51	Nut	1	

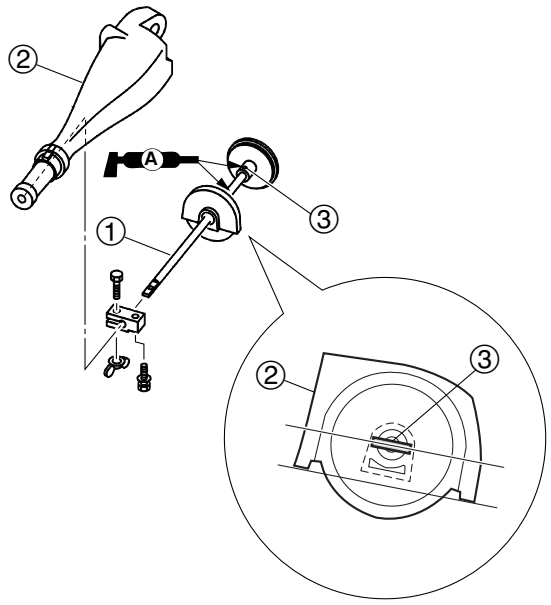
Checking the throttle cable and shift cable

1. Check that the operation of the throttle cable and shift cable.

2. Check the inner wire, outer wire of the throttle cable and shift cable. Replace if the outer wire is bent or damaged and the rubber seals are damaged.

Assembling the tiller handle

1. Install the throttle shaft ① into the tiller handle ② so that the pin ③ of the throttle shaft ① aligned with the mating surface of the tiller handle ② in horizontal position.

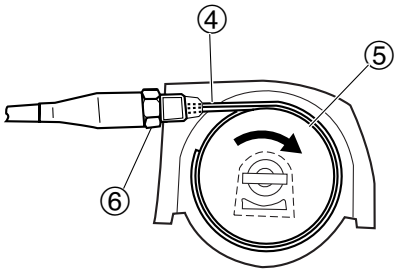


61U70470

2. Insert the throttle cable ④ into the gear ⑤ until the inner cable is engaged with the gear.

3. Turn the throttle shaft ① clockwise to wind the inner cable around the gear ⑤.

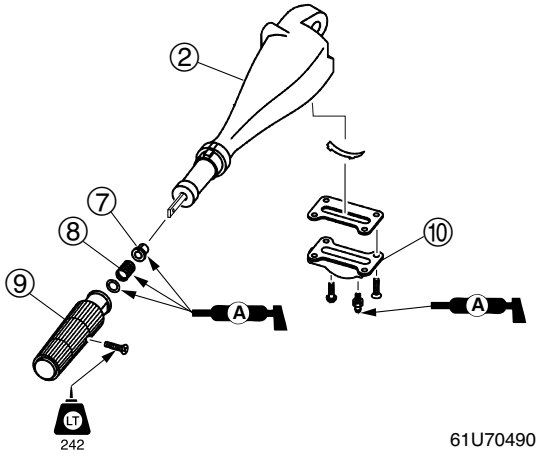
4. Tighten the nut ⑥.



61U70480

Lock nut ⑥:
11 N·m (1.1 kgf·m, 8.1 ft·lb)

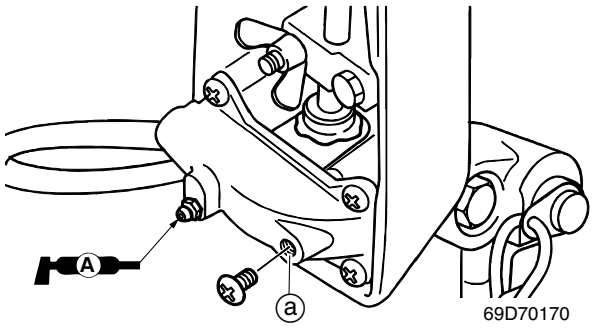
5. Install the bushing ⑦, spring ⑧, throttle grip ⑨ and cover ⑩ into the tiller handle ②.



61U70490

Lubricating the throttle gear

1. Inject grease into the grease nipple until grease comes out from the screw hole ⓐ.



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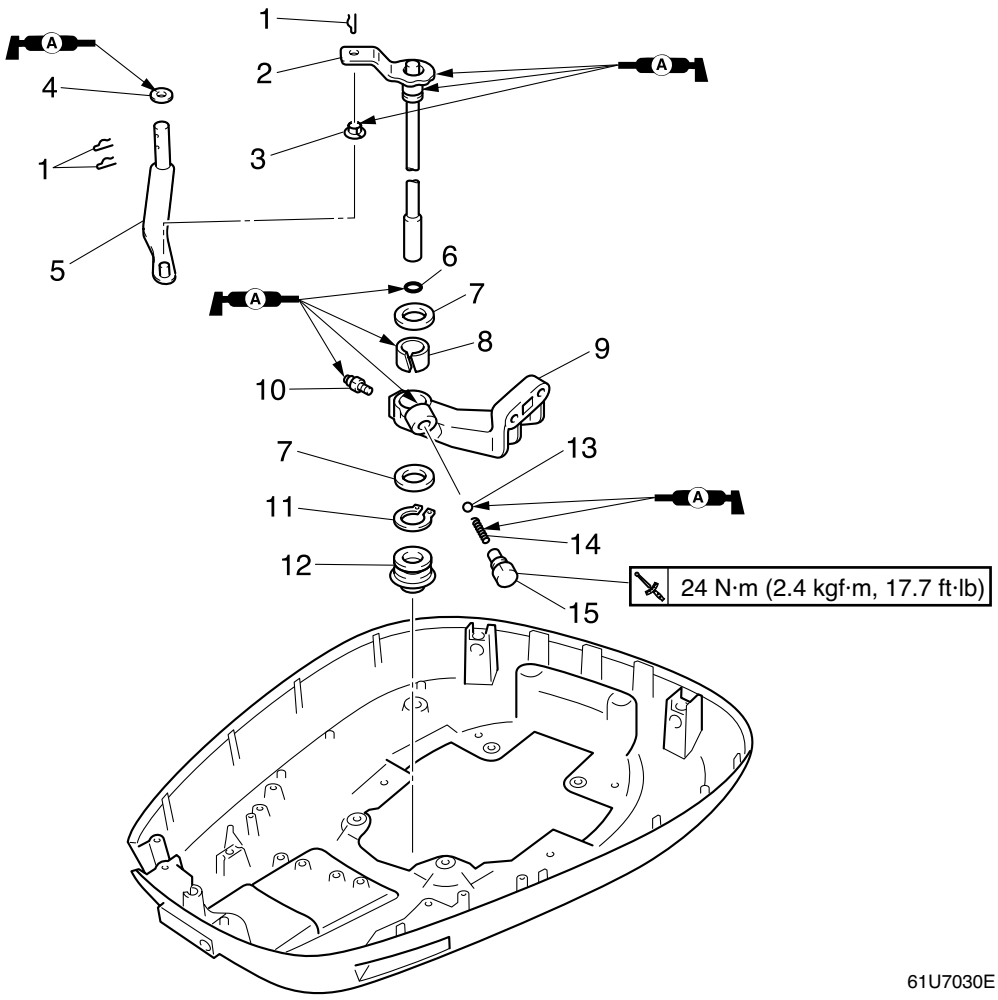
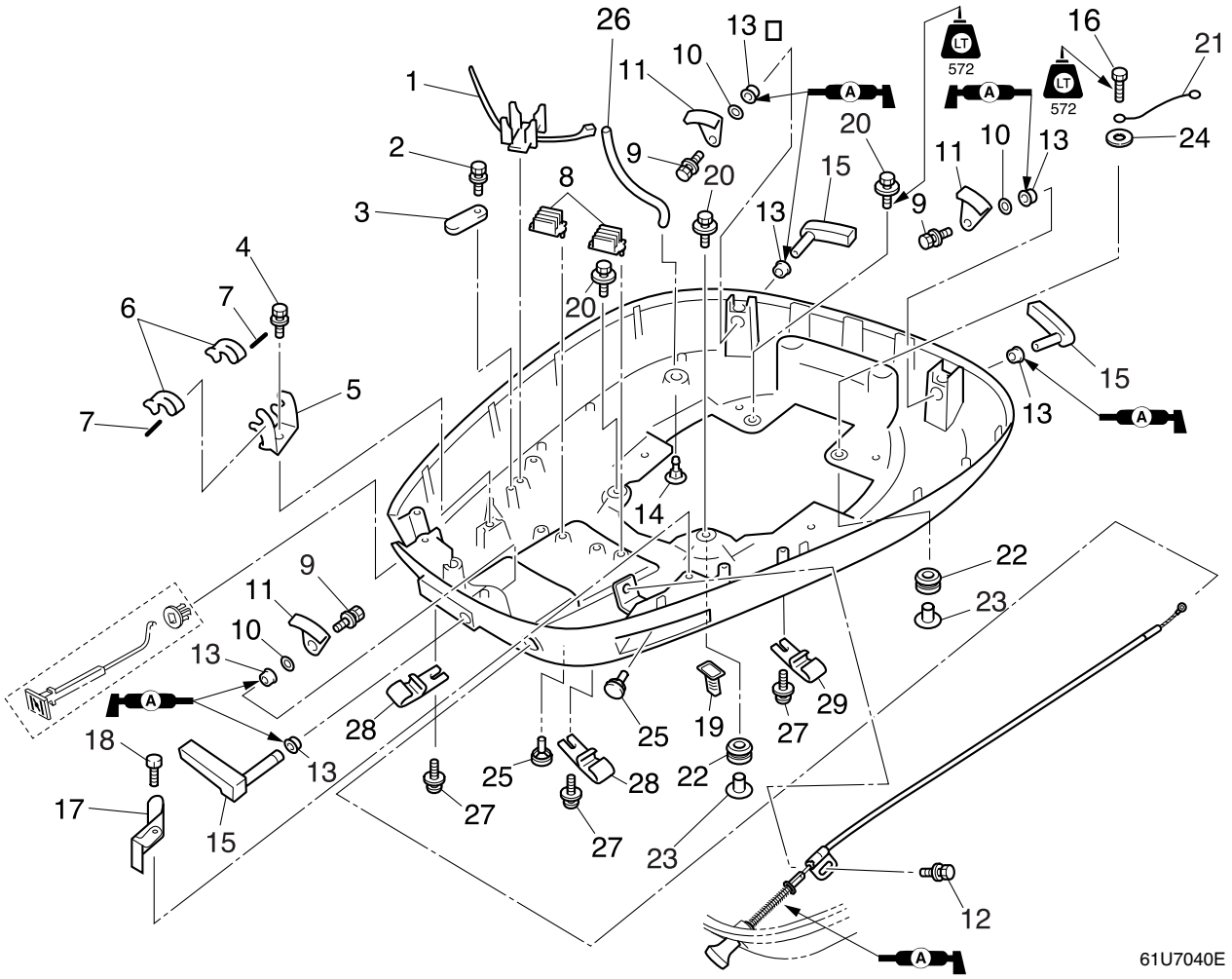
7

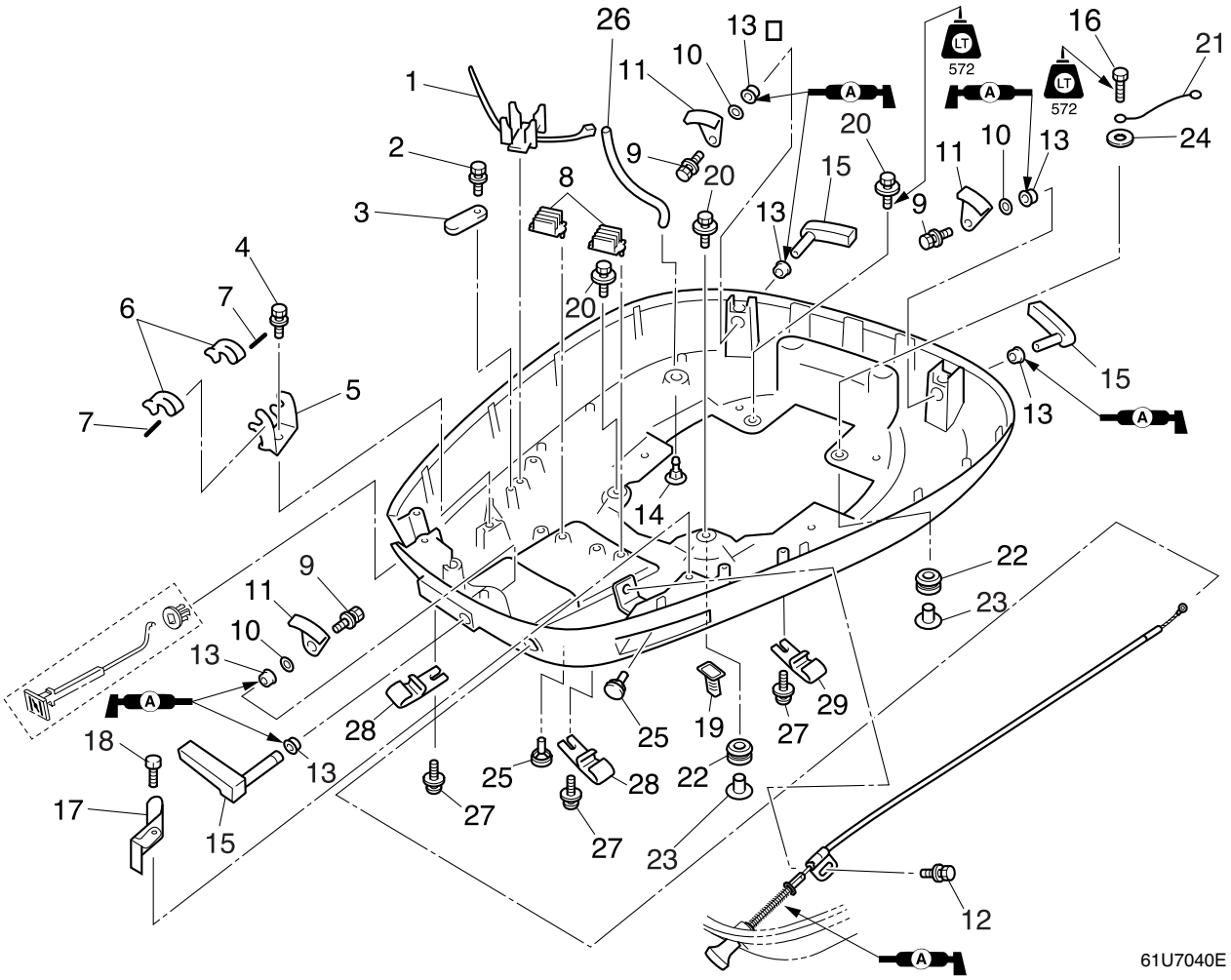
Bottom cowling



No.	Part name	Q'ty	Remarks
1	Clip	3	
2	Shift rod	1	
3	Bushing	1	
4	Washer	1	
5	Shift lever	1	
6	O-ring	1	Not reusable
7	Washer	1	
8	Bushing	1	
9	Bracket	1	
10	Grease nipple	1	
11	Circlip	1	Not reusable
12	Grommet	1	
13	Ball	1	
14	Spring	1	
15	Bolt	1	

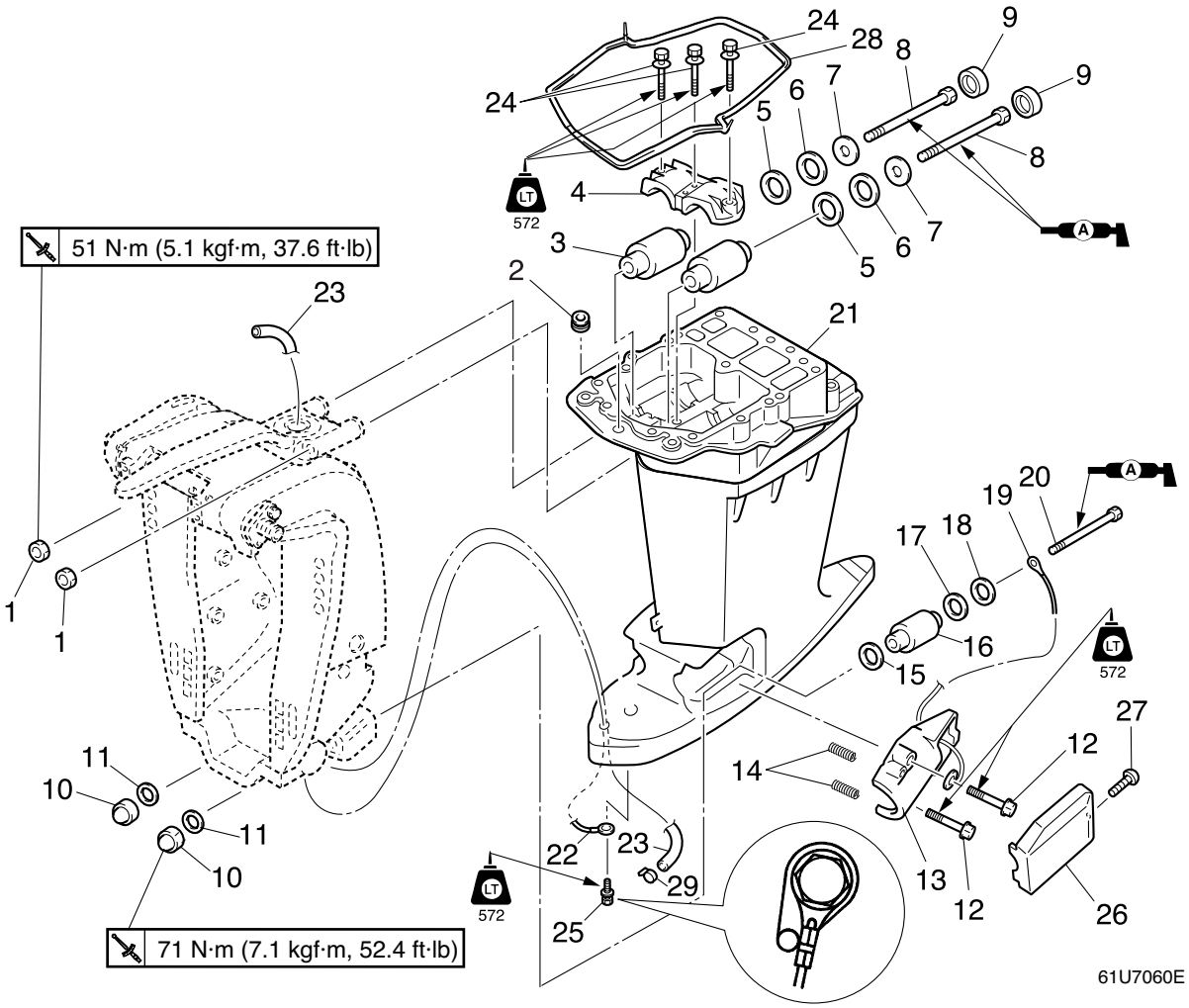


No.	Part name	Q'ty	Remarks
1	Clamp	1	
2	Bolt	1	M6 × 20 mm
3	Plate	1	
4	Bolt	1	M8 × 20 mm
5	Bracket	1	
6	Holder	2	
7	Pin	2	
8	Holder	2	
9	Bolt	3	M6 × 12 mm
10	Wave washer	3	
11	Clamp lever	3	
12	Bolt	1	M6 × 12 mm
13	Collar	6	
14	Pilot hole	1	
15	Lock lever	3	
16	Bolt	1	M8 × 35 mm
17	Clamp	1	

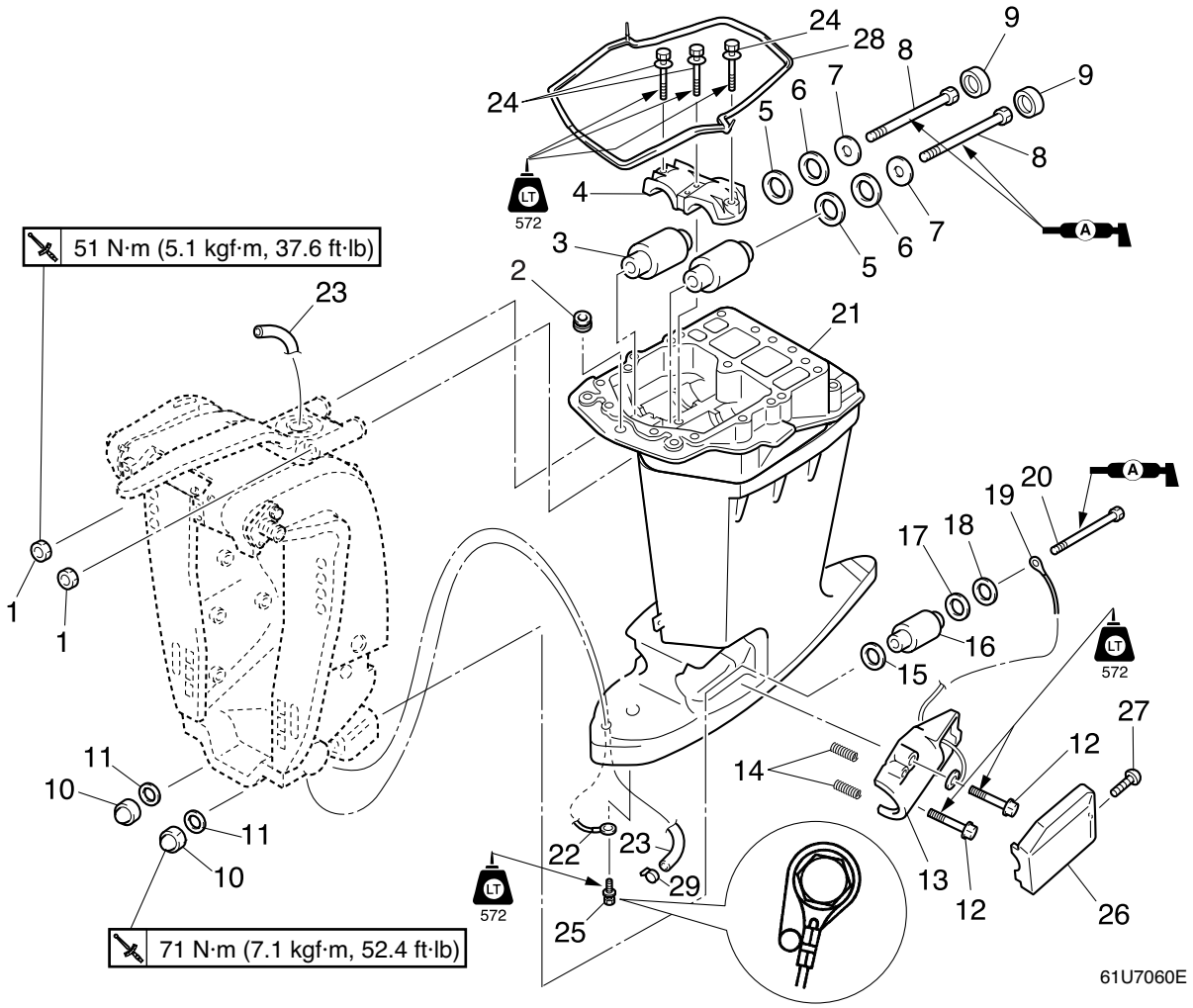


No.	Part name	Q'ty	Remarks
18	Bolt	1	M6 × 28 mm
19	Grommet	1	
20	Bolt	3	M8 × 35 mm
21	Ground lead	1	
22	Grommet	4	
23	Collar	4	
24	Washer	1	
25	Grommet	2	
26	Hose	1	
27	Screw	3	E, ET
28	Bracket	2	E, ET
29	Bracket	1	E, ET

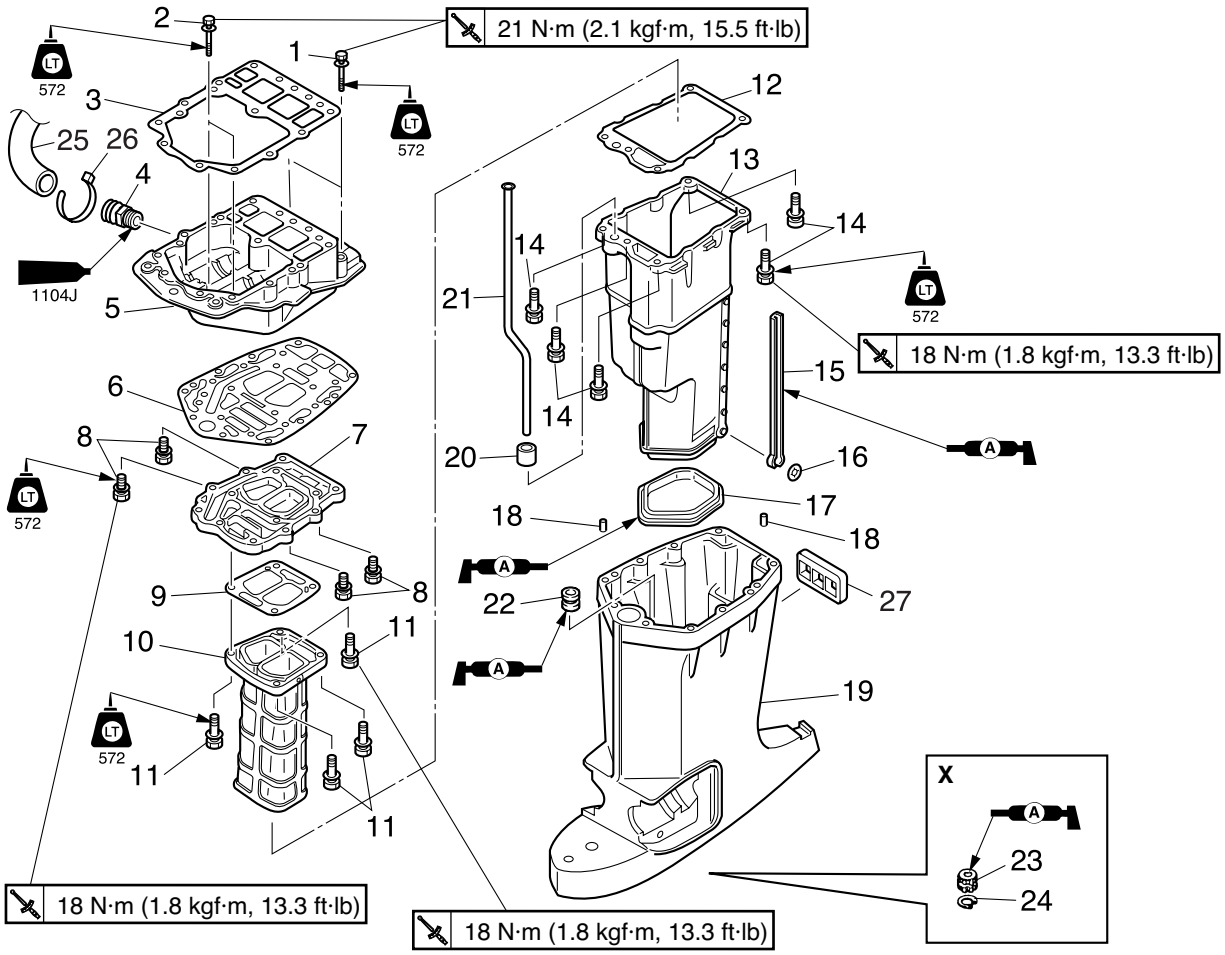
Upper case, steering arm



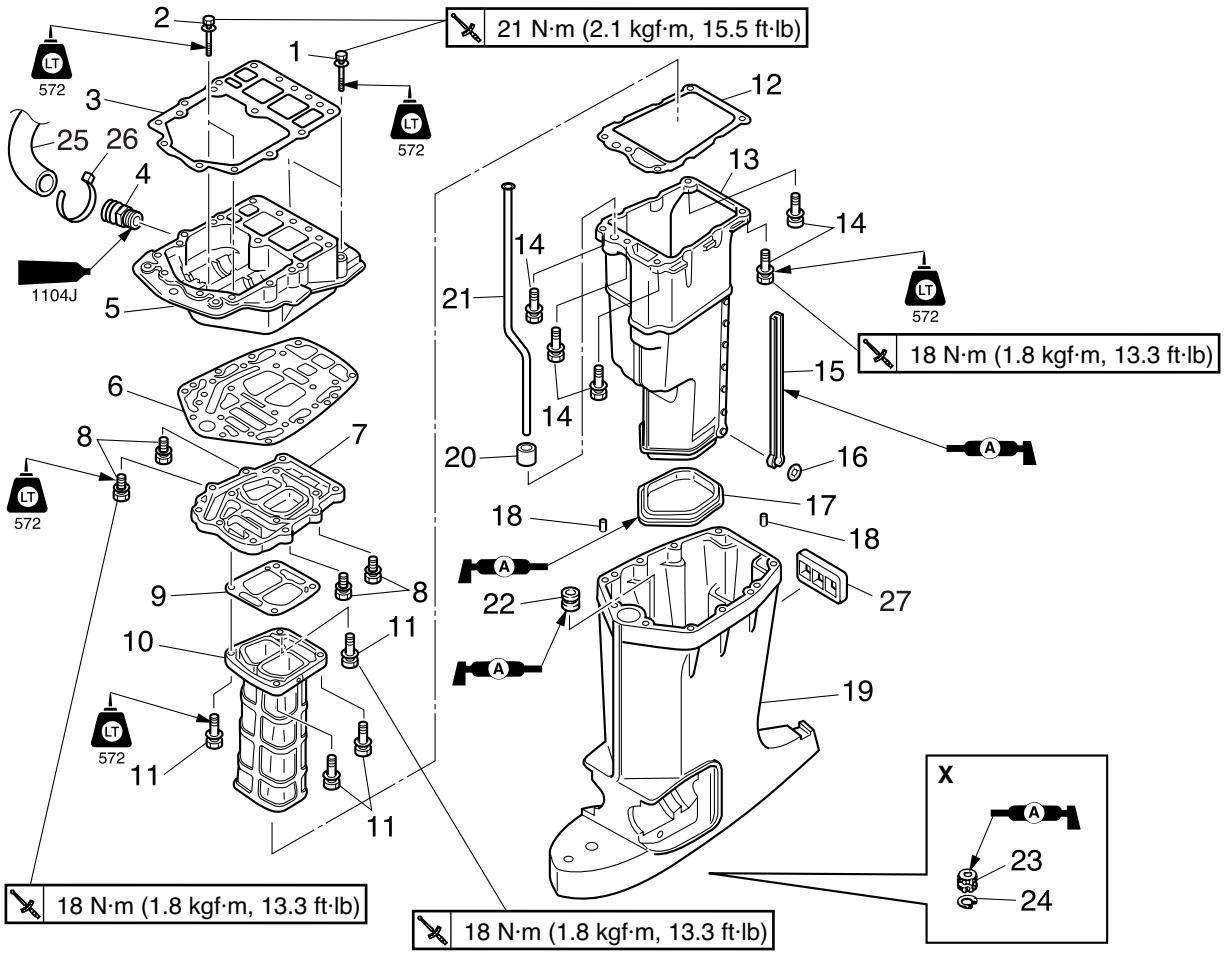
No.	Part name	Q'ty	Remarks
1	Nut	2	
2	Grommet	1	
3	Upper mount	2	
4	Bracket	1	
5	Washer	2	
6	Rubber washer	2	
7	Washer	2	
8	Bolt	2	
9	Damper	2	
10	Nut	2	
11	Washer	2	
12	Bolt	4	M10 × 45 mm
13	Mount housing	2	
14	Spring	4	
15	Washer	2	
16	Lower mount	2	
17	Rubber washer	2	



No.	Part name	Q'ty	Remarks
18	Washer	2	
19	Ground lead	1	
20	Bolt	2	M14 × 180 mm
21	Upper case assembly	1	
22	Ground lead	1	
23	Hose	1	
24	Bolt	3	M10 × 45 mm
25	Bolt	1	M6 × 10 mm
26	Cover	2	
27	Screw	2	
28	Rubber seal	1	
29	Lock tie	1	Not reusable



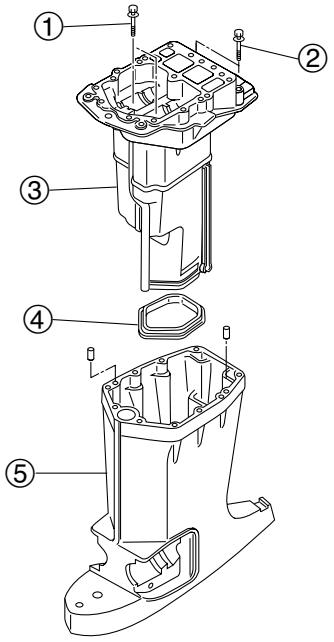
No.	Part name	Q'ty	Remarks
1	Bolt	2	M8 × 45 mm
2	Bolt	2	M8 × 30 mm
3	Gasket	1	Not reusable
4	Joint	1	
5	Upper exhaust guide	1	
6	Gasket	1	Not reusable
7	Lower exhaust guide	1	
8	Bolt	4	M8 × 30 mm
9	Gasket	1	Not reusable
10	Exhaust manifold	1	
11	Bolt	4	M8 × 45 mm
12	Gasket	1	Not reusable
13	Muffler	1	
14	Bolt	5	M8 × 45 mm
15	Rubber damper	2	
16	Clip	2	
17	Rubber seal	1	Not reusable



No.	Part name	Q'ty	Remarks
18	Dowel	2	
19	Upper case	1	
20	Rubber seal	1	
21	Pipe	1	
22	Rubber seal	1	
23	Bushing	1	
24	Circlip	1	
25	Hose	1	
26	Lock tie	1	Not reusable
27	Grommet	1	

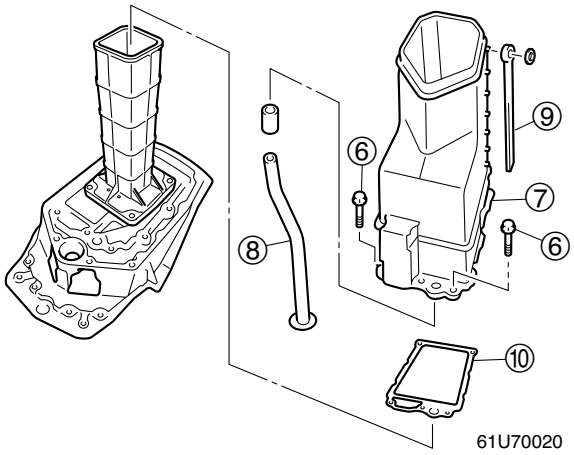
Disassembling the upper case

1. Remove the bolts ①, ②, muffler assembly ③ and rubber seal ④ from the upper case ⑤.

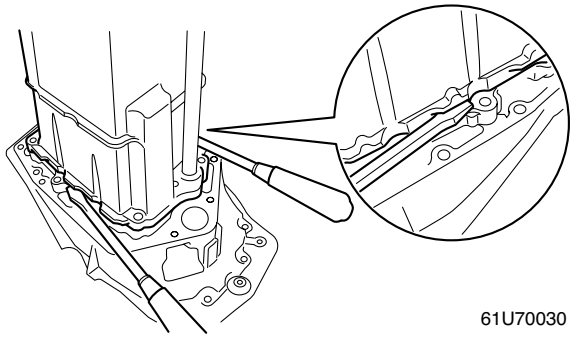


61U70010

2. Remove the bolts ⑥, muffler ⑦, cooling water pipe ⑧, rubber dampers ⑨ and gasket ⑩.

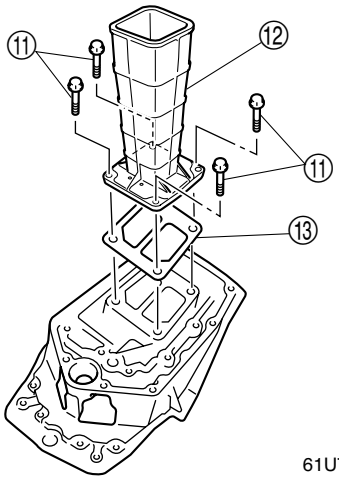


61U70020


61U70030

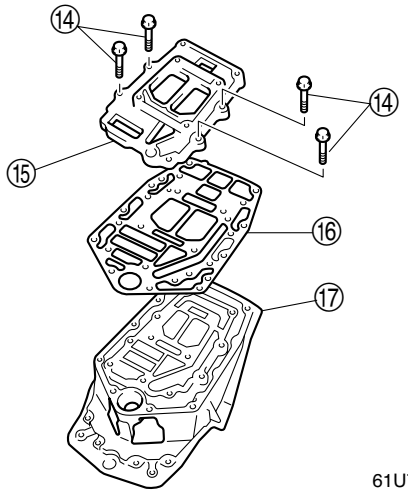
NOTE:
Insert a flat-head screw driver between the pry tabs to pry off the muffler.

3. Remove the bolts ⑪, exhaust manifold ⑫ and gasket ⑬.

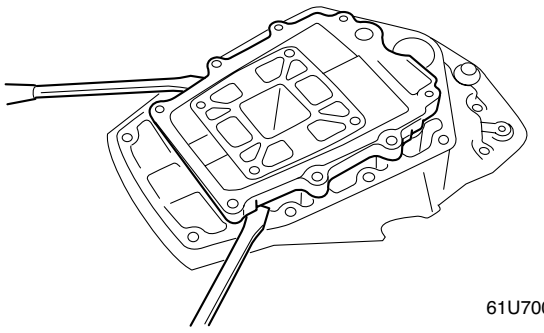


61U70040

4. Remove the bolts ⑭, lower exhaust guide ⑮ and gasket ⑯ from the upper exhaust guide ⑰.

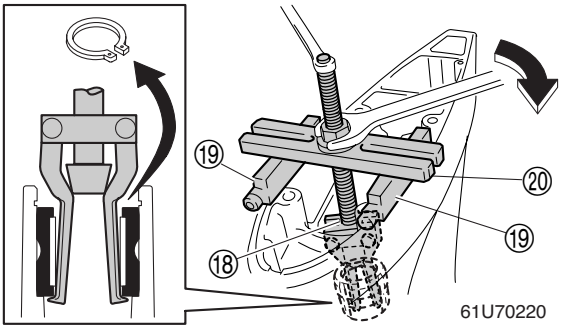


61U70050


61U70060

NOTE:
Insert a flat-head screw driver between the pry tabs to pry off the exhaust guide.

5. Remove the circlip, and then remove drive shaft bushing.



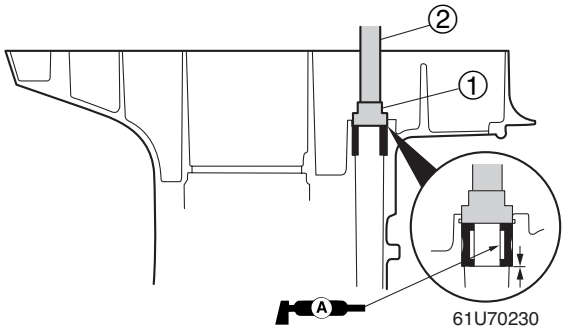
Bearing puller assembly ⑱:
90890-06535
Stopper guide stand ⑲:
90890-06538
Stopper guide plate ⑳:
90890-06501

Checking the upper case

1. Check the rubber dampers. Replace if deteriorated or cracked.
2. Check the cooling water pipe. Replace if deformated or corrosion.
3. Check the exhaust guide, exhaust manifold, and muffler. Replace if deformated or corrosion.

Assembling the upper case

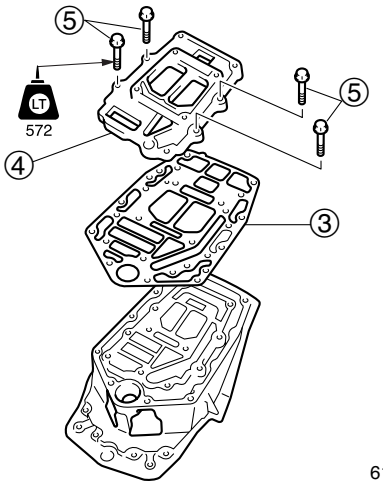
1. Install the drive shaft bushing into the upper case, and then install the circlip.



NOTE:
After installing the drive shaft bushing, apply grease to the inside of the bushing.

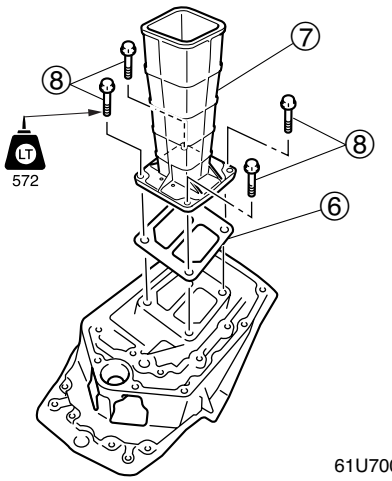
Needle bearing attachment ①:
90890-06653
Driver rod L3 ②: 90890-06652

2. Install a new gasket ③, the lower exhaust guide ④, and bolts ⑤, and then tighten the bolts to the specified torque.



Exhaust guide bolt ⑤:
18 N·m (1.8 kgf·m, 13.3 ft·lb)

3. Install a new gasket ⑥, the exhaust manifold ⑦, and bolts ⑧, and then tighten the bolts to the specified torque.

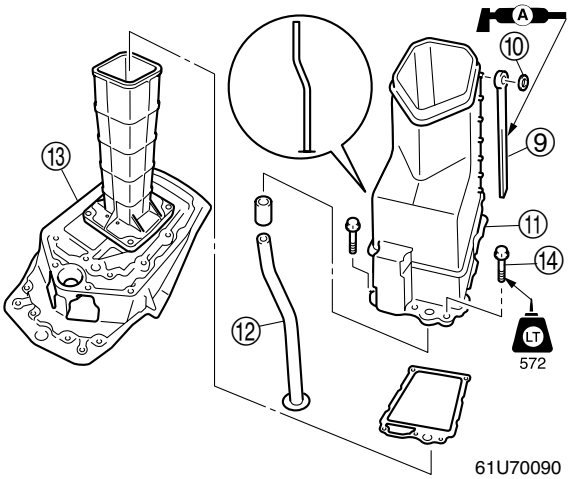


Exhaust manifold bolt ⑧:
18 N·m (1.8 kgf·m, 13.3 ft·lb)

4. Install the rubber damper ⑨ and clip ⑩ onto the muffler ⑪.

5. Install the cooling water pipe ⑫ onto the muffler ⑪.

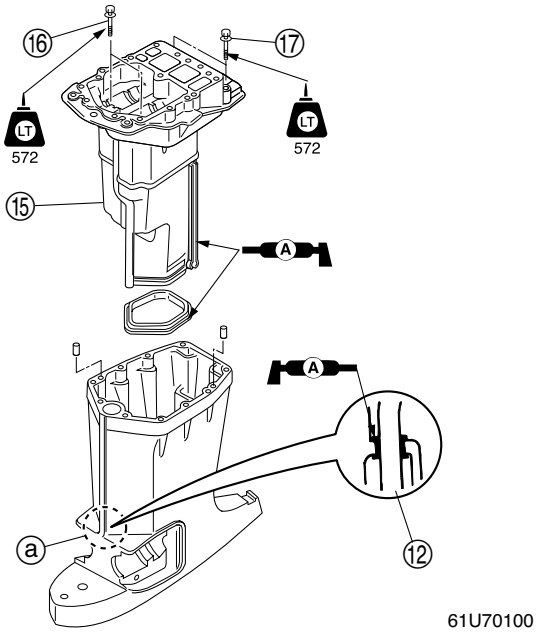
6. Install the new gasket, muffler ⑪ onto the exhaust guide assembly ⑬, and then tighten the bolts ⑭ to the specified torque.



Muffler bolt ⑭:
18 N·m (1.8 kgf·m, 13.3 ft·lb)

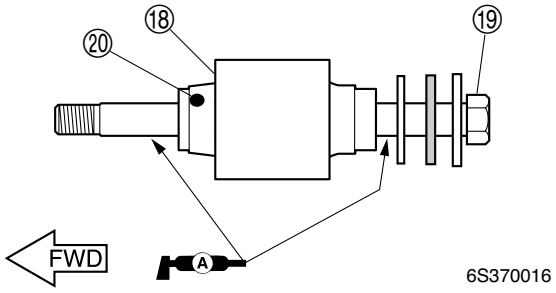
7. Install the muffler assembly ⑮ during inserting the tip of the cooling water pipe ⑫ into the joint hole ⓐ of the upper case.

8. Tighten the muffler assembly bolts ⑯ and ⑰ to the specified torque.



Upper case mount bolt ⑯ and ⑰:
21 N·m (2.1 kgf·m, 15.5 ft·lb)

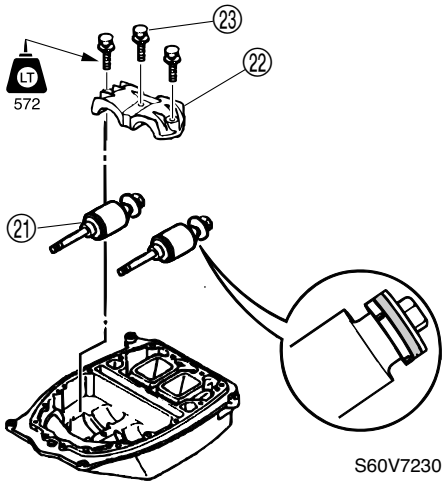
9. Install the upper mounts ⑱ and bolts ⑲ as below shown.



NOTE:
Install the upper mounts ⑱ so that the mark ⑳ of the upper mounts toward the forward side.

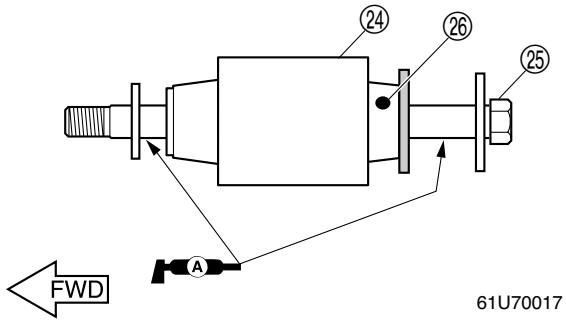
7

10. Install the upper mounts ㉑ and bracket ㉒ into the upper case assembly, and then tighten it with the bolts ㉓.



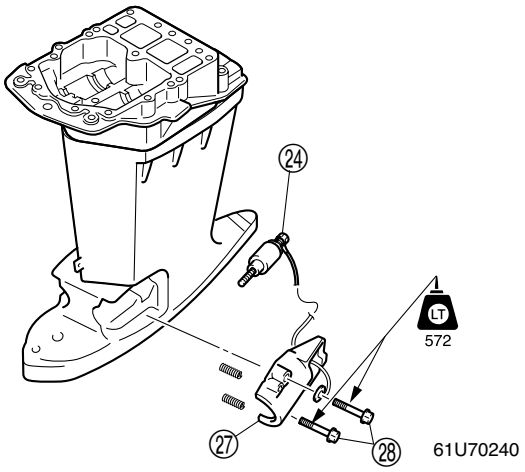
NOTE:
First tighten the center located, when tighten the bolts ㉓.

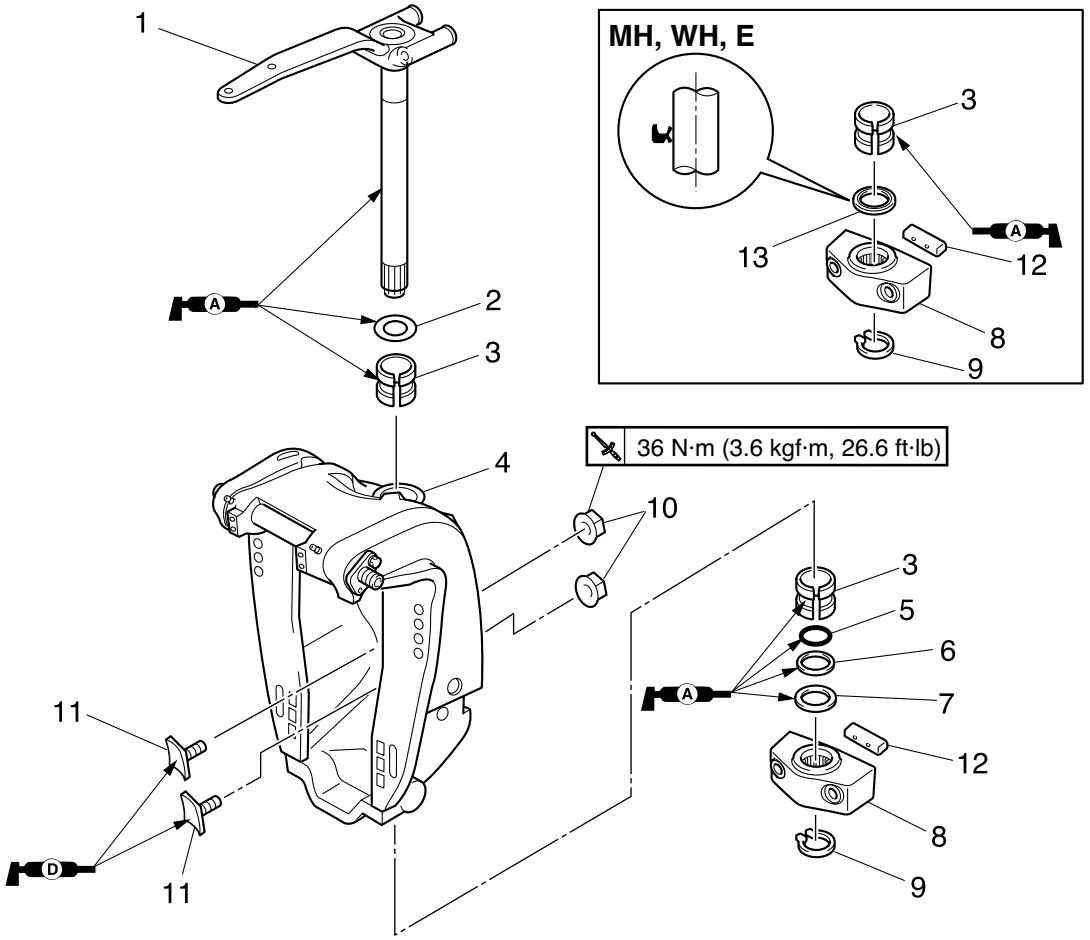
11. Install the lower mounts ㉔ and bolts ㉕ as below shown.



NOTE:
Install the lower mounts ㉔ so that the mark ㉖ of the lower mounts toward the reverse side.

12. Install the lower mounts ㉔ and mount housings ㉗ and tighten the bolts ㉘.



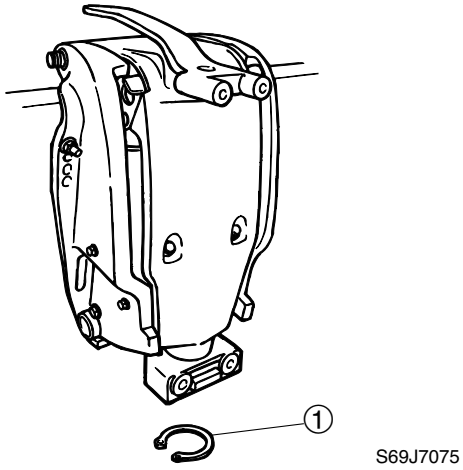


61U7080E

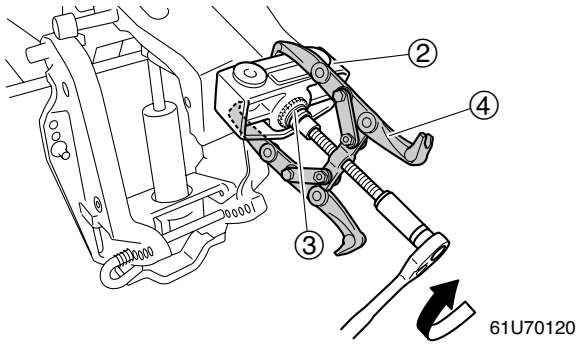
No.	Part name	Q'ty	Remarks
1	Steering arm	1	
2	Washer	1	
3	Bushing	2	
4	Bracket assembly	1	
5	O-ring	1	Not reusable
6	Bushing	1	
7	Washer	1	
8	Steering yoke	1	
9	Circlip	1	
10	Nut	2	
11	Trim stopper	2	
12	Damper	1	
13	Oil seal	1	Not reusable

Removing the steering arm

1. Remove the circlip ①.



2. Remove the steering yoke ② as shown.

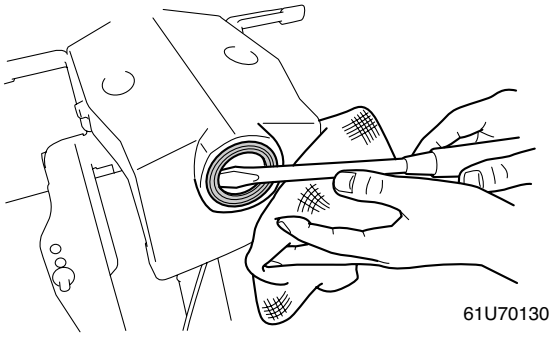


Needle bearing attachment ③: 90890-06611
Gear puller ④: 90890-06540

3. Remove the steering arm from the swivel bracket by pulling the arm off the bracket.

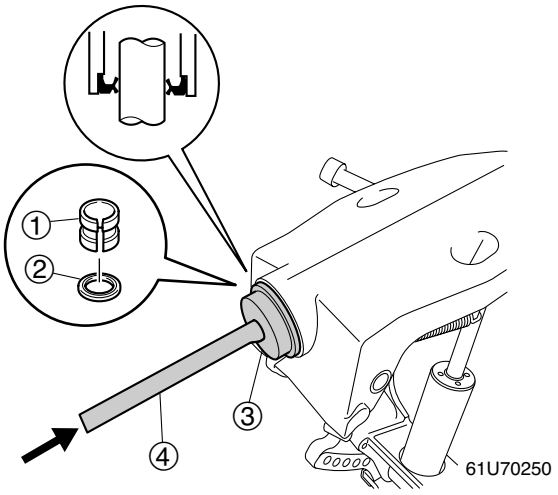
Removing the oil seal of swivel bracket (MH, WH, E)

1. Remove the oil seal by using the flat head driver.



Installing the oil seal of swivel bracket (MH, WH, E)

1. Install the bushing ① and oil seal ②.

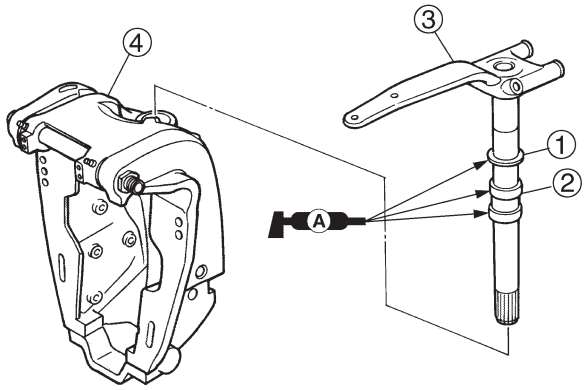


Needle bearing attachment ③: 90890-06654
Driver rod L3 ④: 90890-06652

Installing the steering arm

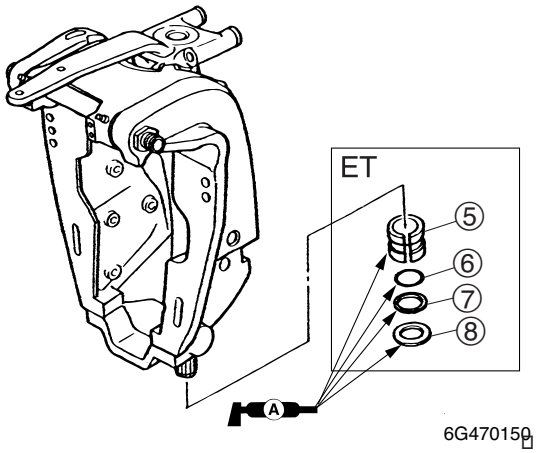
1. Install the washer ① and bushing ② onto the steering arm ③.

2. Place the swivel bracket ④ in an upright position, and then install the steering arm ③ onto the bracket assembly.



6G470140

3. Install the bushing ⑤, new O-ring ⑥, bushing ⑦, and washer ⑧ onto the bracket assembly.



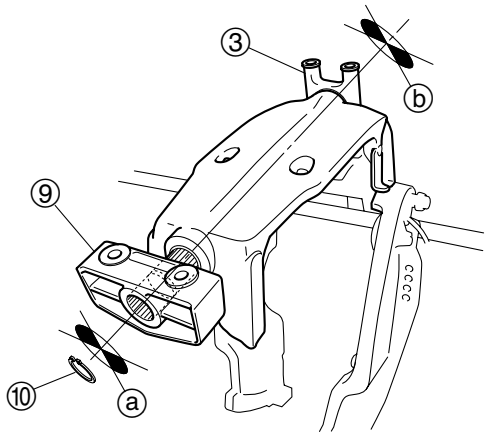
6G470150

4. Install the steering yoke ⑨ to the steering arm ③ by aligning the center ⓐ of the yoke with the center ⓑ of the steering arm.

NOTE:

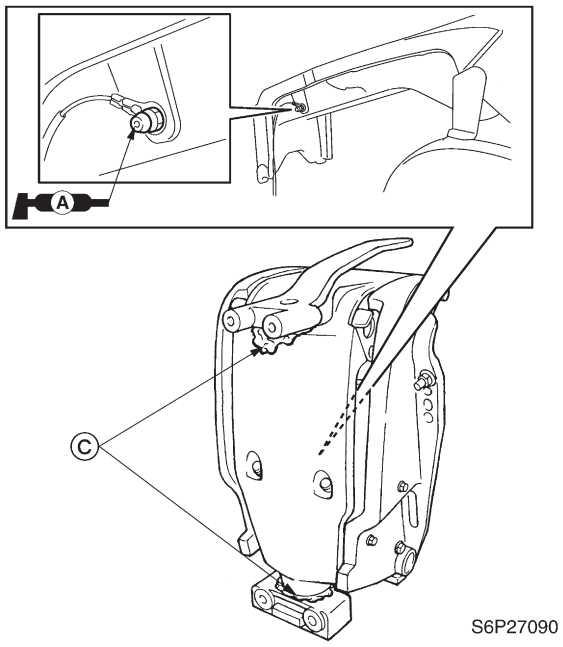
Hold the steering arm after tilt up the swivel bracket, and then strike the steering yoke until the circlip installing groove visible.

5. Install the circlip ⑩.



6S370020

6. Inject grease into the grease nipple until grease comes out from both the upper and lower bushings ⓒ.



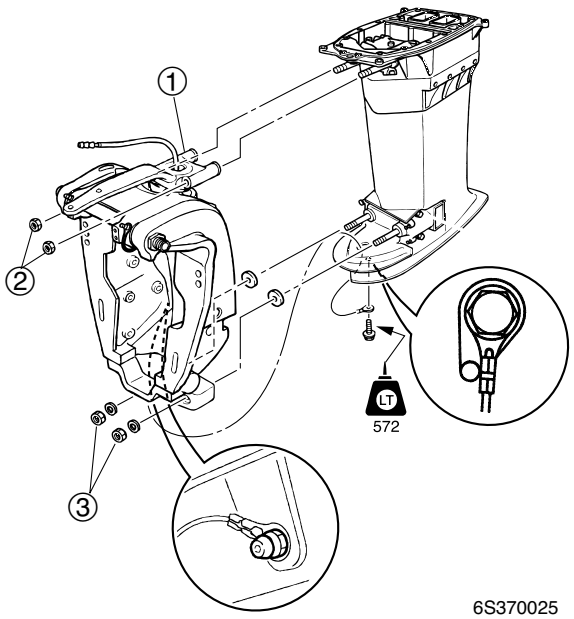
S6P27090

7

Installing the upper case

1. Install the upper and lower mount assembly into the bracket assembly ① simultaneously.

2. Install the upper mount nuts ② and lower mount nuts ③, and then tighten them to the specified torques.

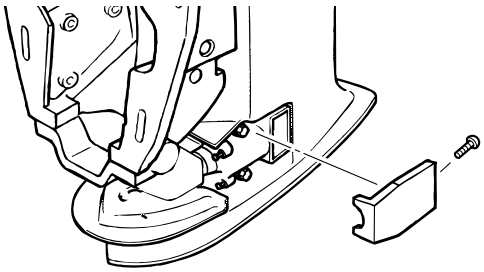


6S370025

NOTE:
Before tighten the uppercase, wiring the ground lead.

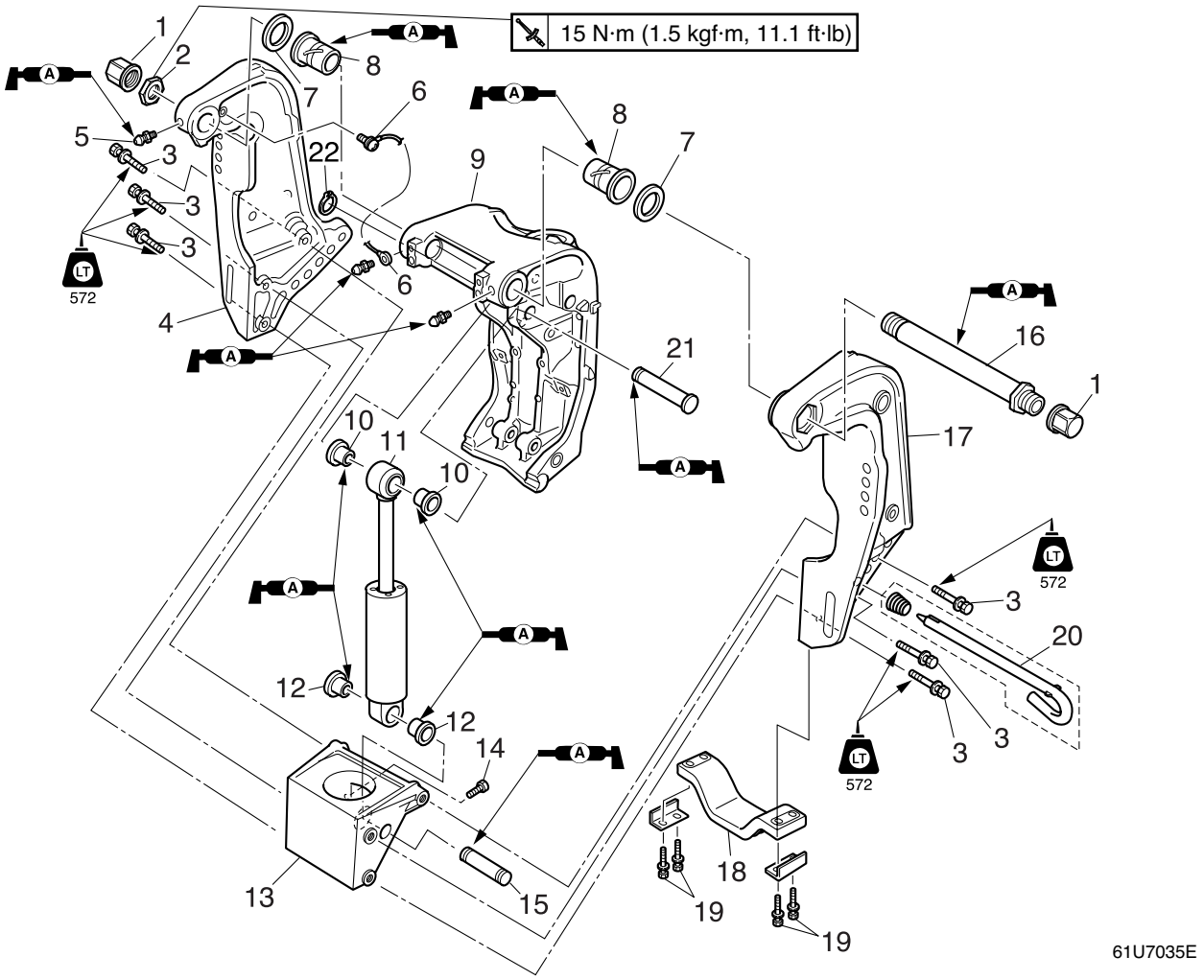
Upper mount nut ②:
51 N·m (5.1 kgf·m, 37.6 ft·lb)
Lower mount nut ③:
71 N·m (7.1 kgf·m, 52.4 ft·lb)

3. Install the covers.

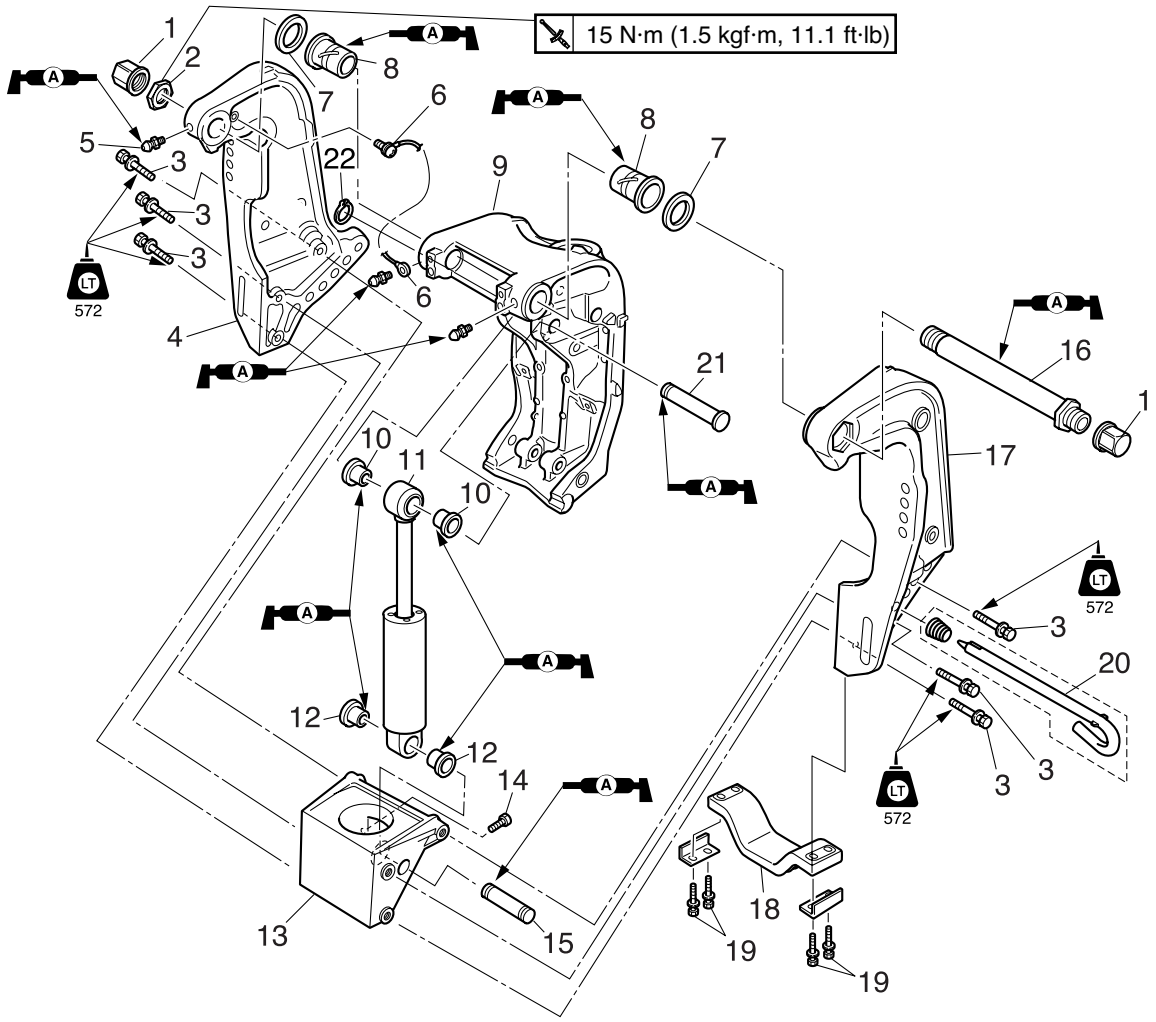


6S370026

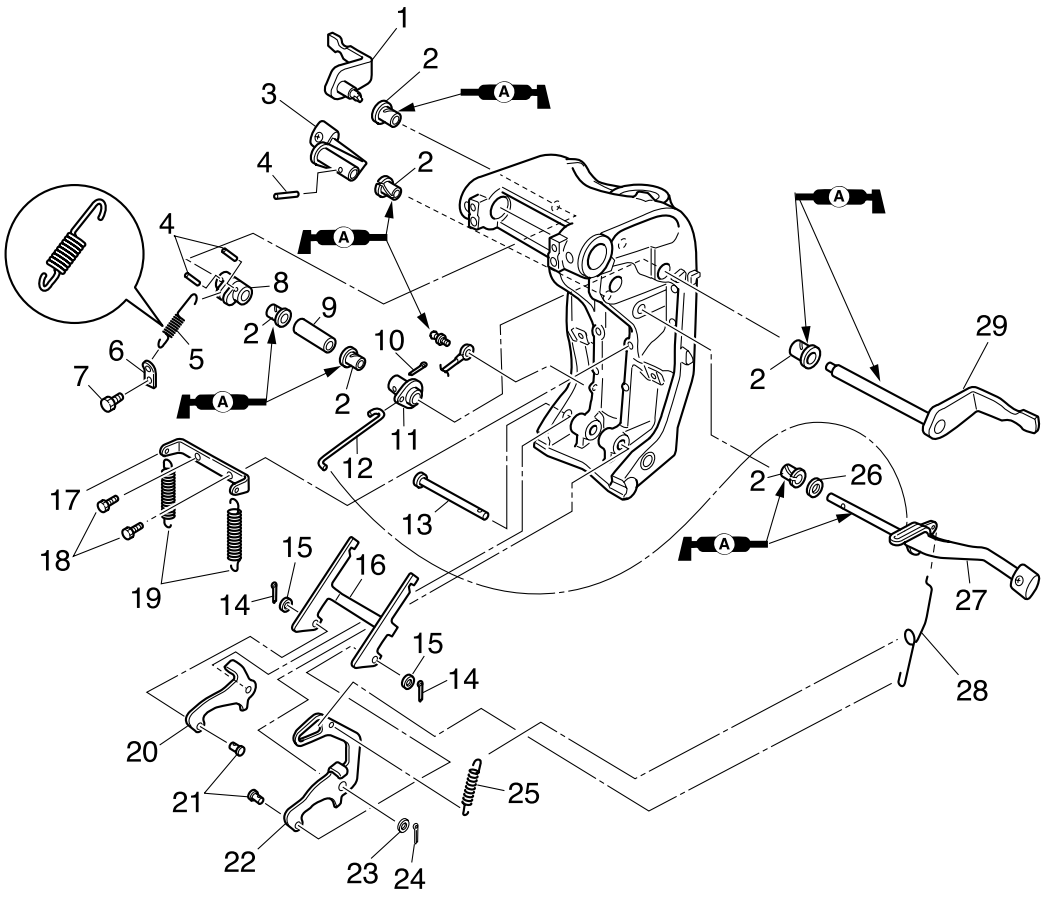
Clamp bracket and swivel bracket



No.	Part name	Q'ty	Remarks
1	Cap	2	
2	Self-locking nut	1	
3	Bolt	6	M10 × 45 mm
4	Clamp bracket	1	
5	Grease nipple	3	
6	Ground lead	1	
7	Washer	2	
8	Bushing	2	
9	Swivel bracket	1	
10	Bushing	2	
11	Shock absorber	1	
12	Bushing	2	
13	Bracket	1	
14	Bolt	1	M6 × 14 mm
15	Pin	1	
16	Through tube	1	
17	Clamp bracket	1	



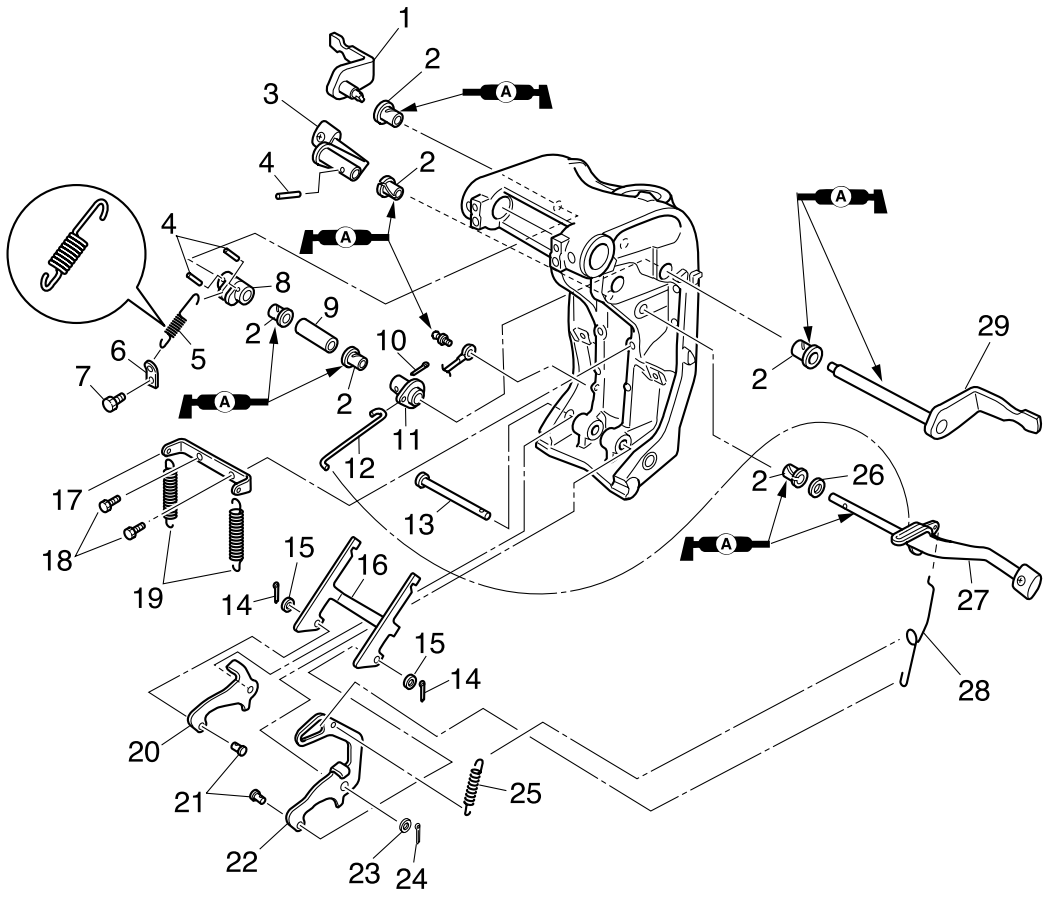
No.	Part name	Q'ty	Remarks
18	Anode	1	
19	Bolt	4	M6 × 30 mm
20	Tilt pin	1	
21	Pin	1	
22	Circlip	1	



61U7140E

No.	Part name	Q'ty	Remarks
1	Tilt stop lever	1	
2	Bushing	6	
3	Tilt lock lever	1	
4	Pin	3	
5	Spring	1	
6	Plate	1	
7	Bolt	1	M6 × 10 mm
8	Distance collar	1	
9	Collar	1	
10	Cotter pin	1	
11	Lever	1	
12	Rod	1	
13	Pin	1	
14	Cotter pin	2	
15	Washer	2	
16	Arm	1	
17	Bracket	1	

7



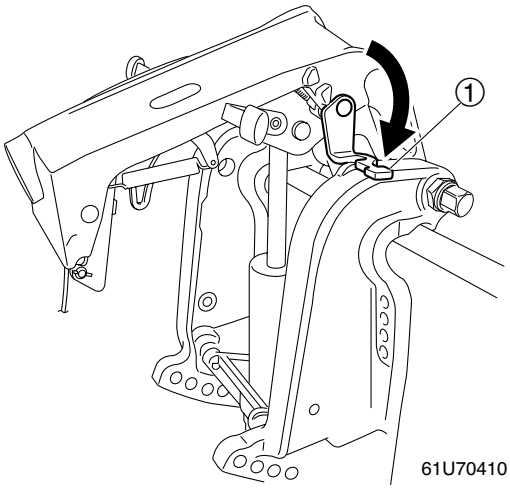
No.	Part name	Q'ty	Remarks
18	Bolt	2	M6 × 16 mm
19	Spring	2	
20	Lever	1	
21	Pin	2	
22	Lever	1	
23	Washer	1	
24	Cotter pin	1	
25	Spring	1	
26	Washer	1	
27	Tilt lock lever	1	
28	Rod	1	
29	Tilt stop lever	1	

Removing the clamp bracket (MH, WH, E)

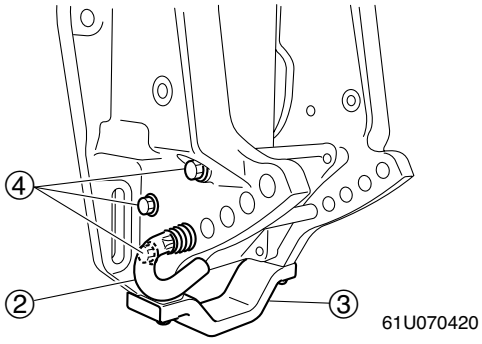
⚠WARNING

- **Do not tamper or attempt to open the shock absorber.**
- **Do not subject the shock absorber to an open flame or any other source of high heat. High heat can cause an explosion due to excessive gas pressure.**
- **Do not deform or damage the shock absorber. If the shock absorber is damaged, damping performance will suffer.**

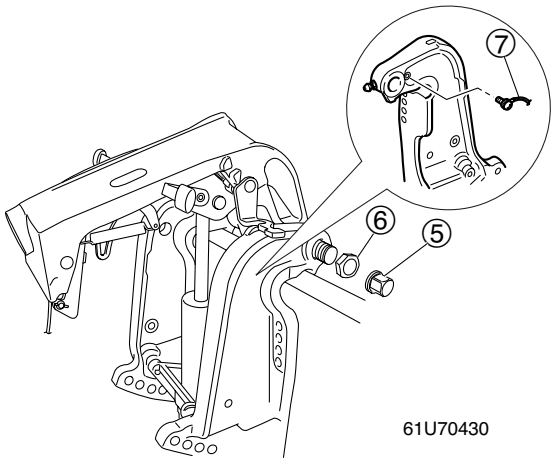
1. Fully tilt the outboard motor up, and then support it with the tilt stop lever ①.



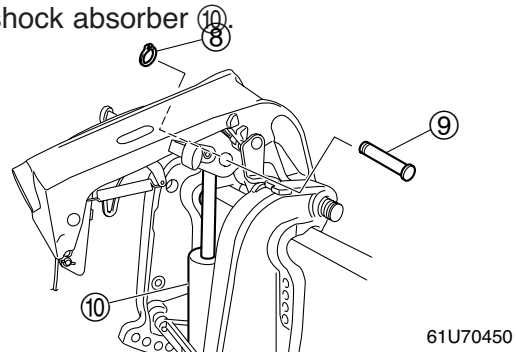
2. Remove the tilt pin ②, anode ③, and clamp bracket bolt ④.



3. Remove the caps ⑤, self-locking nut ⑥ and then ground lead ⑦.



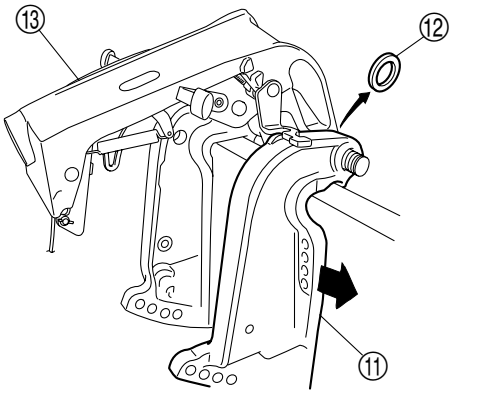
4. Remove the circlip ⑧, pin ⑨, and then shock absorber ⑩.



5. Remove the starboard clamp bracket ⑪ in the direction arrow.

6. Remove the washer ⑫.

7. Remove the swivel bracket ⑬.

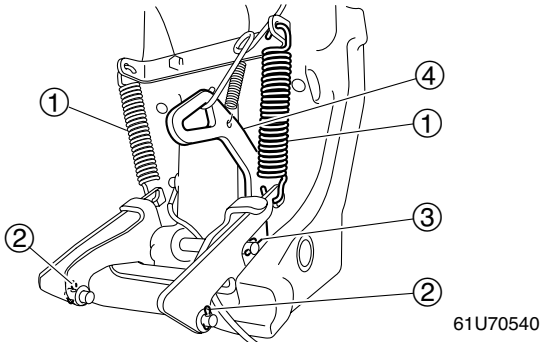


7

Disassembling the swivel bracket (MH, WH, E)

1. Remove the 2 large springs ① and 2 cotter pins ②.

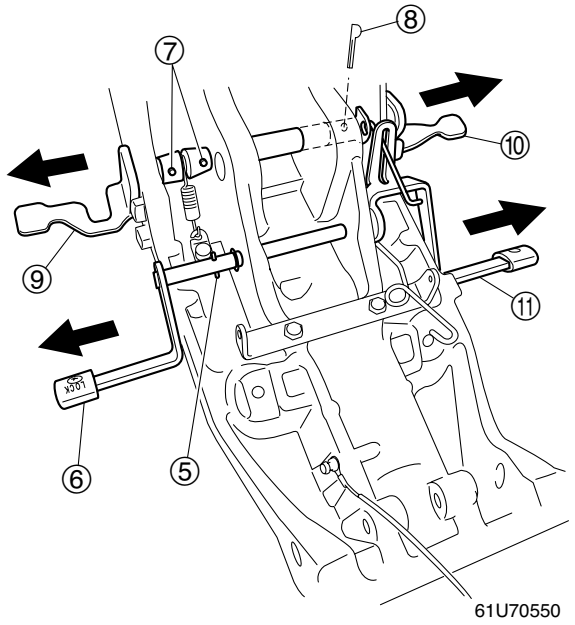
2. Remove the cotter pin ③ and lever ④.



3. Remove the pin ⑤ and tilt lock lever ⑥.

4. Remove the 2 pins ⑦ and cotter pin ⑧ and then remove the both tilt stopper ⑨, ⑩.

5. Remove the tilt lock lever ⑪.



Assembling the swivel bracket (MH, WH, E)

1. Install the rod ① and rod ② into the tilt lock lever ③, and then install the tilt lock lever to the swivel bracket ④.

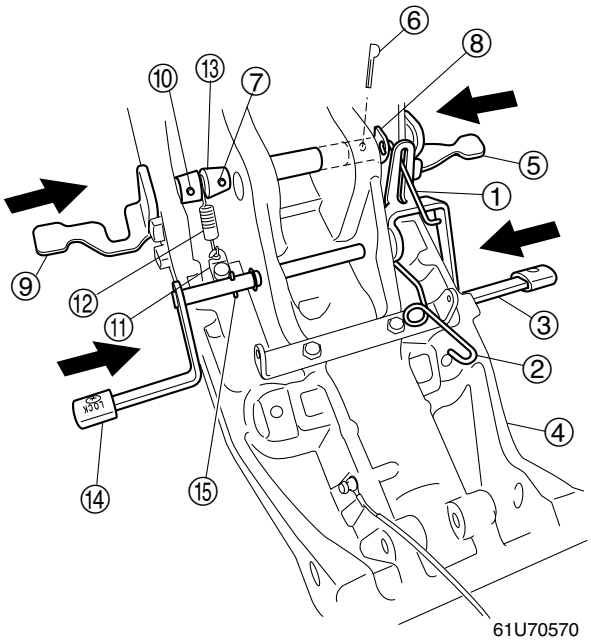
2. Install the tilt stopper ⑤ into the swivel bracket ④ with the cotter pin ⑥ and pin ⑦.

NOTE:
Pass the tilt stopper ⑤ into the bushing ⑧.

3. Install the tilt stopper ⑨ with the pin ⑩.

4. Install the plate ⑪ and spring ⑫ and then hook the spring ⑫ to the distance collar ⑬.

5. Install the tilt lock lever ⑭ with pin ⑮.

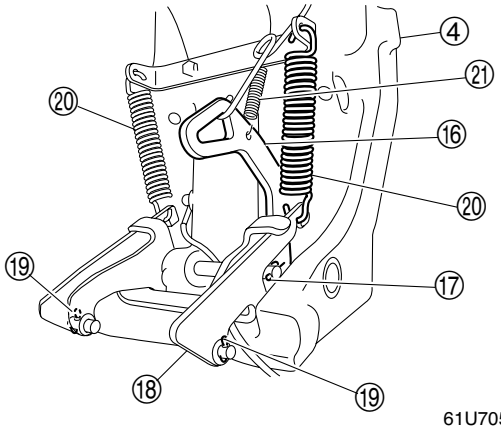


6. Install the lever ⑯ to the swivel bracket ④ with the cotter pin ⑰.

7. Install the lever ⑱ to the lever ⑯ with the 2 cotter pins ⑲.

8. Install the 2 large springs ⑳.

9. Install the small spring ㉑.

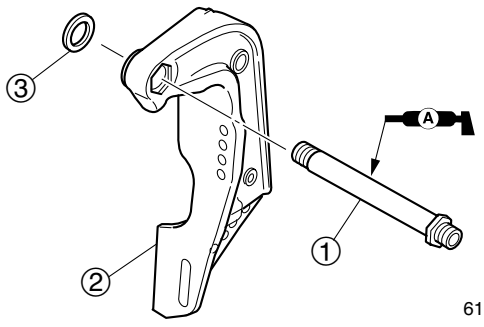


61U70560

NOTE:
After assembling the swivel bracket, check the tilt stop lever for proper operation.

Assembling the clamp bracket (MH, WH, E)

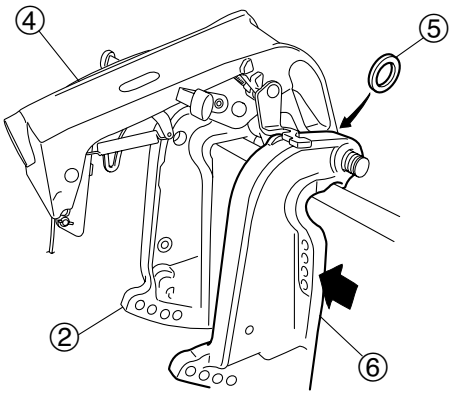
1. Pass the through tube ① into the clamp bracket ② and washer ③.



61U70500

2. Install the swivel bracket ④ to the clamp bracket ②.

3. Install the washer ⑤ and starboard clamp bracket ⑥.

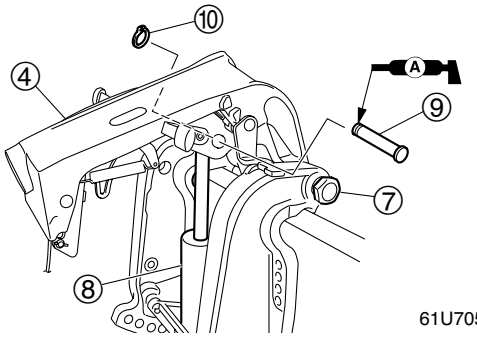


61U70510

4. Tighten the self-locking nut ⑦ in temporary tight.

5. Install the shock absorber ⑧ into the swivel bracket ④.

6. Install the pin ⑨ with the circlip ⑩.

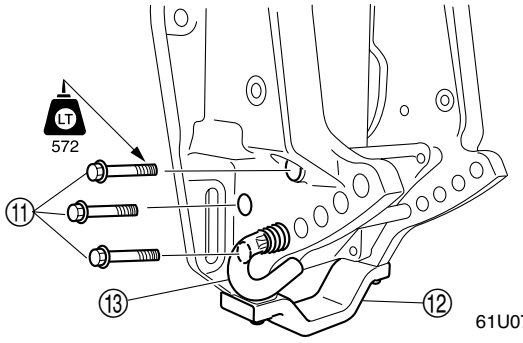


61U70520

7. Tighten the self-locking nut ⑦ in the specified torque.

	Self-locking nut ⑦: 15 N·m (1.5 kgf·m, 11.1 ft·lb)

8. Install the clamp bracket bolt ⑪, anode ⑫ and tilt pin ⑬.

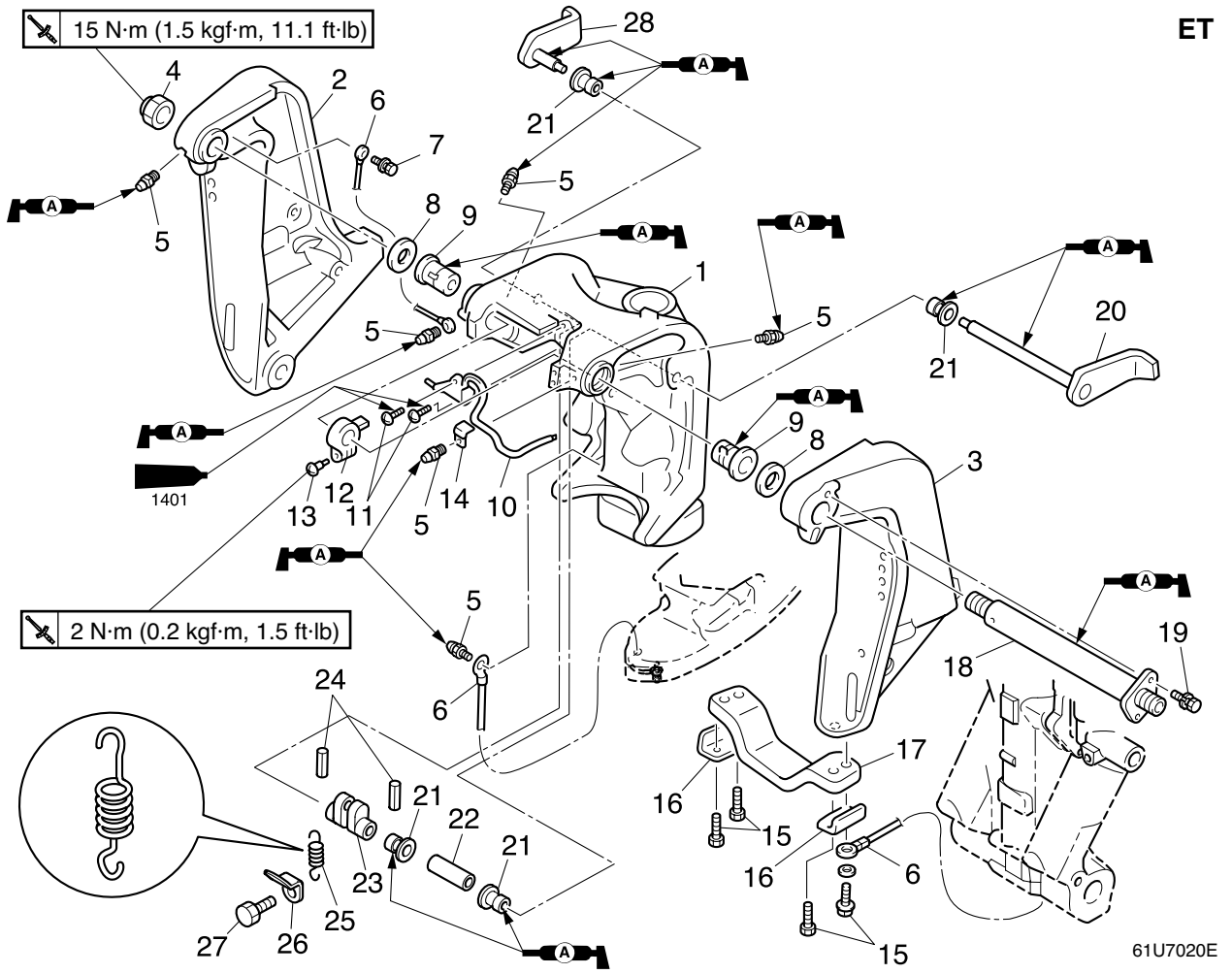


61U070530

9. Install the ground lead and caps.

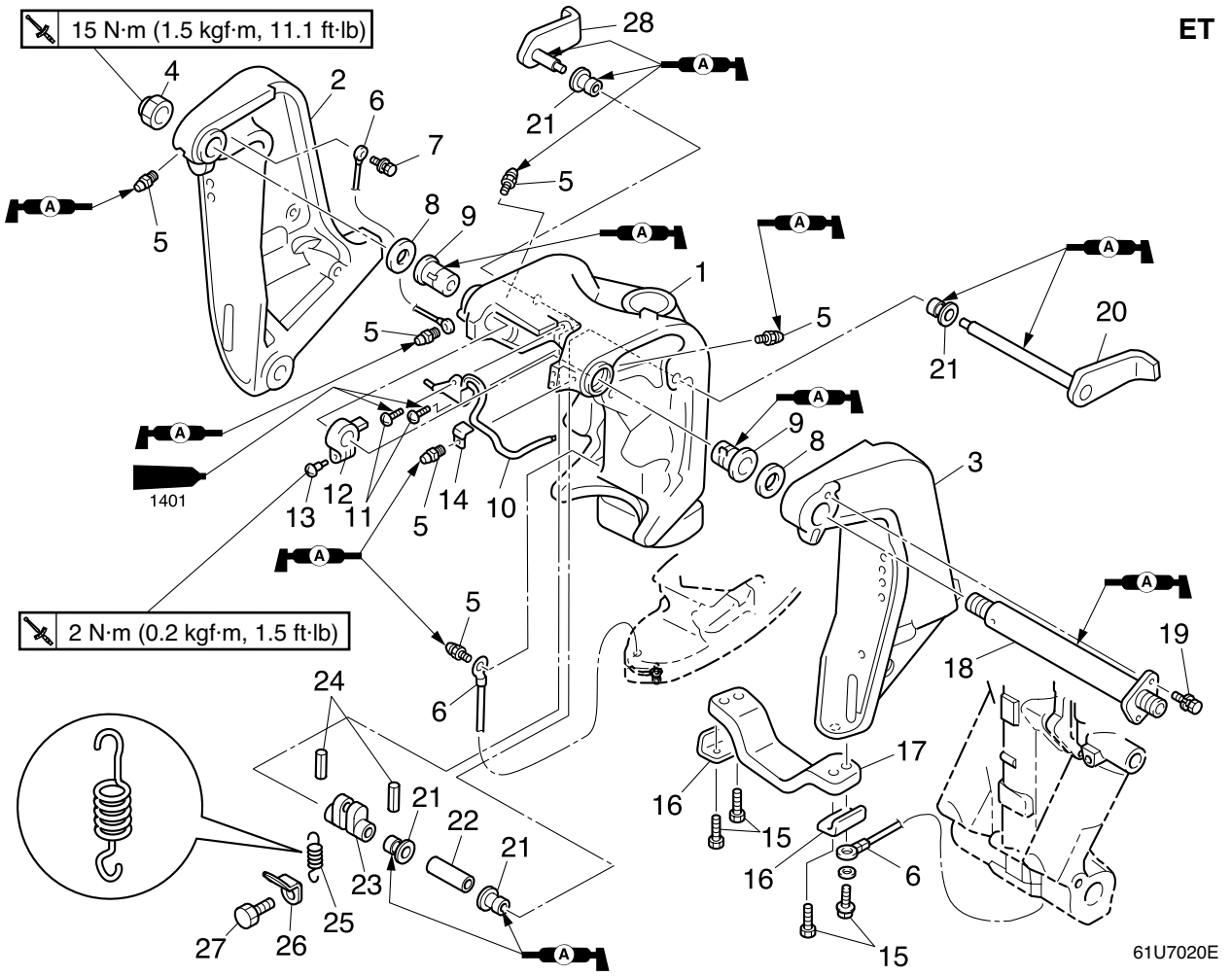
7

ET



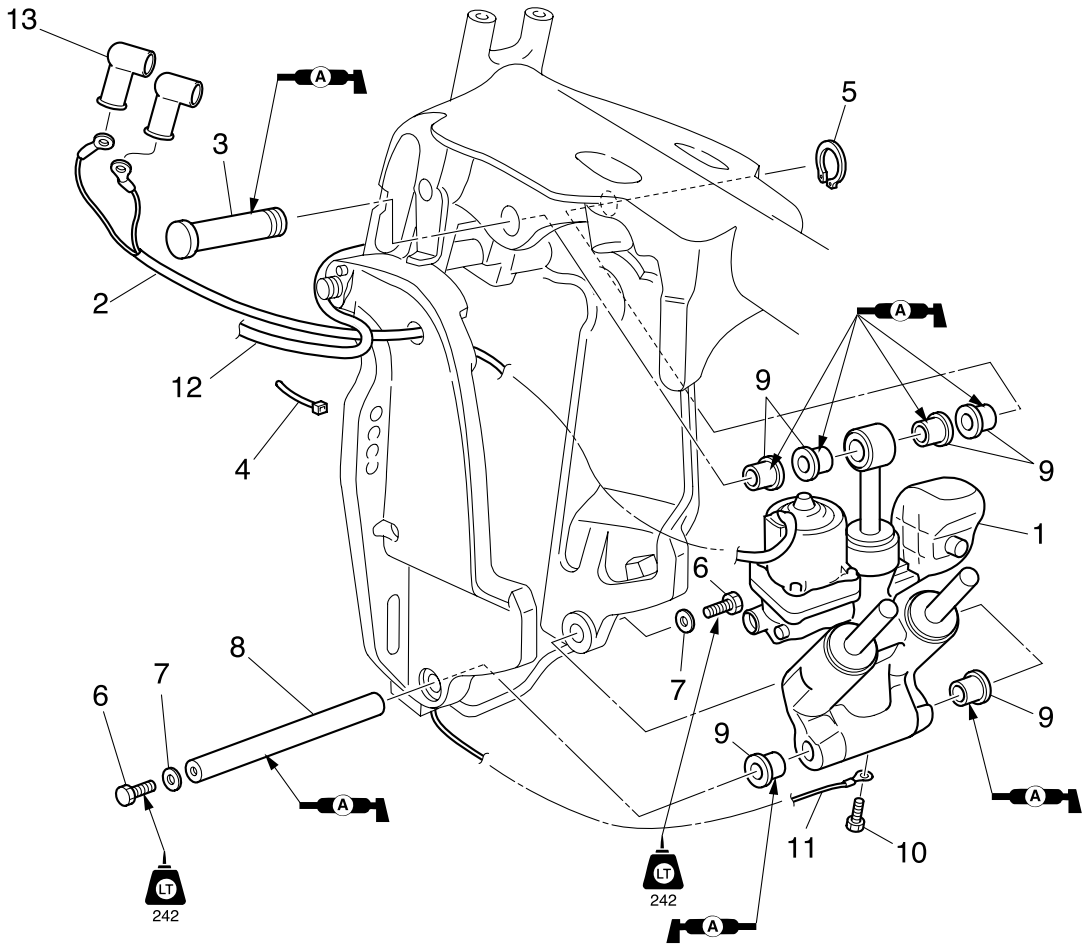
No.	Part name	Q'ty	Remarks
1	Swivel bracket	1	
2	Clamp bracket	1	
3	Clamp bracket	1	
4	Self-locking nut	1	
5	Grease nipple	6	
6	Ground lead	3	
7	Screw	1	ø6 × 12 mm
8	Washer	2	
9	Bushing	2	
10	Trim sensor	1	
11	Screw	2	ø6 × 15 mm
12	Trim sensor cam	1	
13	Screw	1	ø6 × 25 mm
14	Clamp	1	
15	Bolt	4	M6 × 30 mm
16	Bracket	2	
17	Anode	1	

ET



No.	Part name	Q'ty	Remarks
18	Through tube	1	
19	Bolt	1	M8 × 20 mm
20	Tilt stop lever	1	
21	Bushing	4	
22	Collar	1	
23	Distance collar	1	
24	Spring pin	2	
25	Spring	1	
26	Spring hook	1	
27	Bolt	1	M6 × 10 mm
28	Tilt stop lever	1	

7

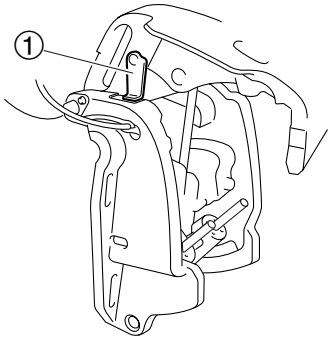


61U7090E

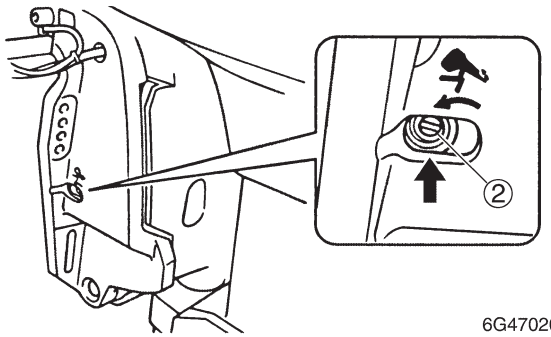
No.	Part name	Q'ty	Remarks
1	PTT unit	1	
2	PTT motor lead	1	
3	Pin	1	
4	Lock tie	3	Not reusable
5	Circlip	1	
6	Bolt	2	M8 × 16 mm
7	Washer	2	
8	Shaft	1	
9	Bushing	6	
10	Bolt	1	M6 × 10 mm
11	Ground lead	1	
12	Trim sensor lead	1	
13	Cap	2	

Removing the PTT unit (ET)

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



6G470190



6G470200

⚠WARNING

- **After tilting up the outboard motor, be sure to support it with the tilt stop lever. Otherwise, the outboard motor could suddenly lower if the PTT unit should lose fluid pressure.**
- **When removing the PTT unit without removing the power unit, be sure to suspend the outboard motor. Otherwise, the outboard motor could suddenly fall and result in injury.**

NOTE:

If the PTT does not operate, turn the manual valve ② counterclockwise and tilt the outboard motor up manually.

2. Disconnect the ground lead ③ at the bottom of the PTT unit.

3. Remove the anode ④.

4. Loosen the self-locking nut ⑤, and then move the clamp brackets slightly in the direction of the arrows.

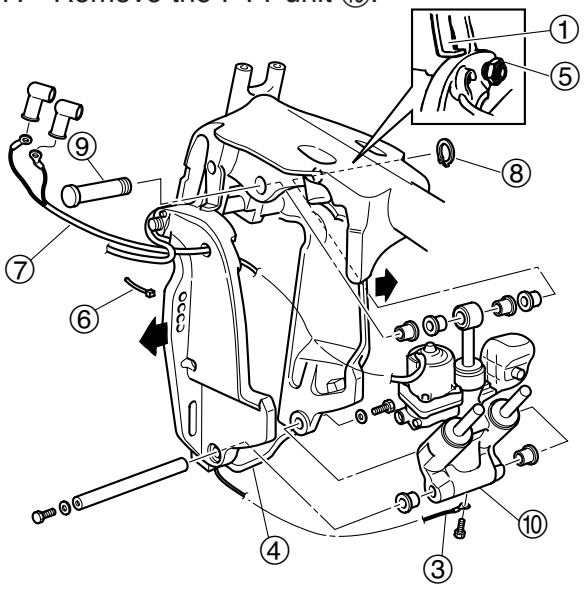
⚠WARNING

Do not remove the tilt stop lever ① from the clamp brackets.

5. Remove the lock ties ⑥, and then pull out the PTT motor lead ⑦.

6. Remove the circlip ⑧, and then remove the pin ⑨.

7. Remove the PTT unit ⑩.



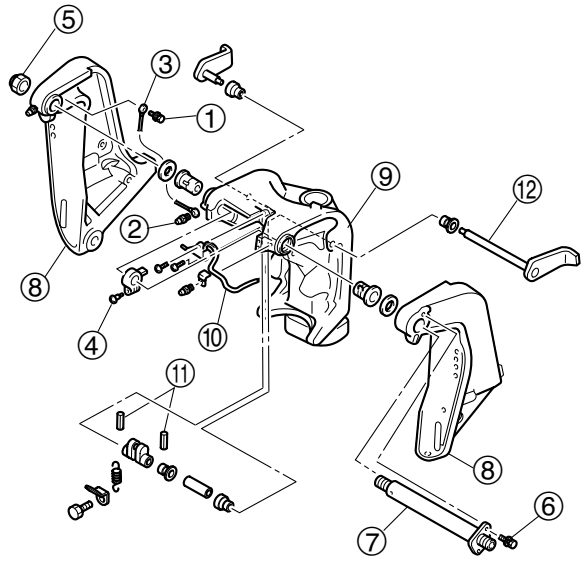
61U70260

Removing the clamp bracket (ET)

1. Remove the PTT unit. For removal procedures, see “Removing the PTT unit.”

2. Remove the screw ① and grease nipples ②, and then disconnect the ground leads ③.

7



61U70360

3. Remove the trim sensor cam screw ④.

4. Remove the self-locking nut ⑤ and bolt ⑥.

5. Remove the through tube ⑦, then disassemble the clamp brackets ⑧ and then remove the swivel bracket ⑨.

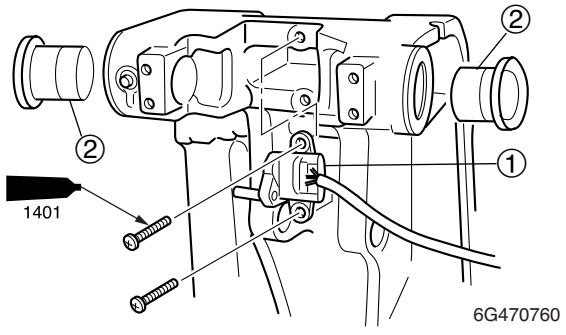
6. Remove the trim sensor ⑩.

7. Remove the pins ⑪ and tilt stop levers ⑫.

Installing the clamp bracket (ET)

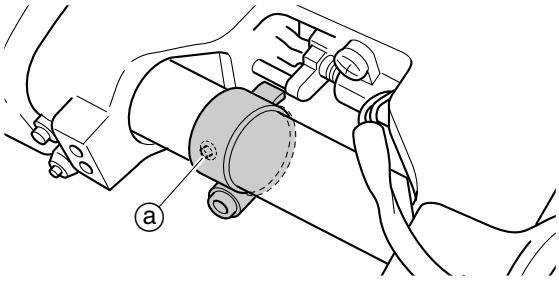
1. Install the tilt stop levers onto the swivel bracket assembly.

2. Install the trim sensor ① and bushings ② onto the swivel bracket assembly.



6G470760

3. Assemble the clamp brackets, washers, swivel bracket, trim sensor, and then install the through tube.



6G470765

NOTE:

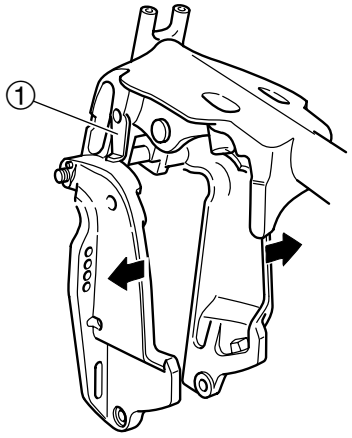
- Align the projection inside of the trim sensor cam with the through tube hole ⓐ, and then install it.
- Adjust the trim sensor cam after installing the PTT.

4. Install the bolts on the through tube.

5. Install the ground lead between the clamp brackets and the swivel bracket.

Installing the PTT unit (ET)

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



⚠WARNING

- **When installing the PTT unit without removing the power unit, be sure to suspend the outboard motor. Otherwise, the outboard motor could suddenly fall and result in injury.**
- **After tilting the outboard motor up, be sure to support it with the tilt stop lever.**

2. Lift the PTT unit up, install the lower mounting shaft ② and then tighten the bolts ③.

3. Install the tilt ram upper end into the swivel bracket with the pin ④ and circlip ⑤.

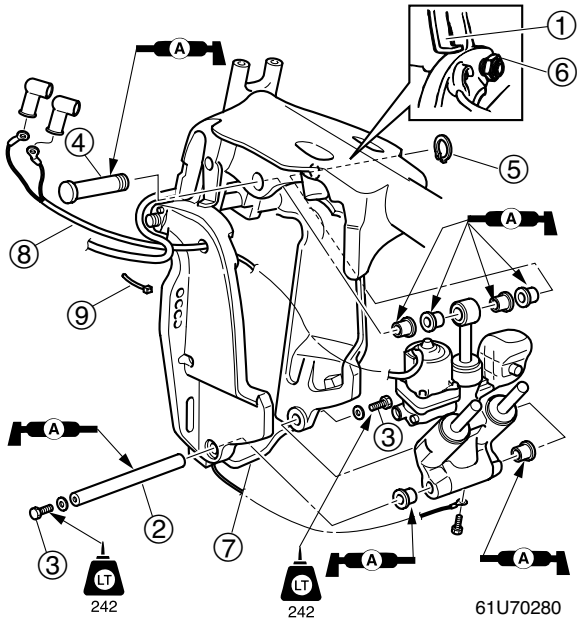
4. Tighten the self-locking nut ⑥ to the specified torque.

	Self-locking nut ⑥: 15 N·m (1.5 kgf·m, 11.1 ft·lb)

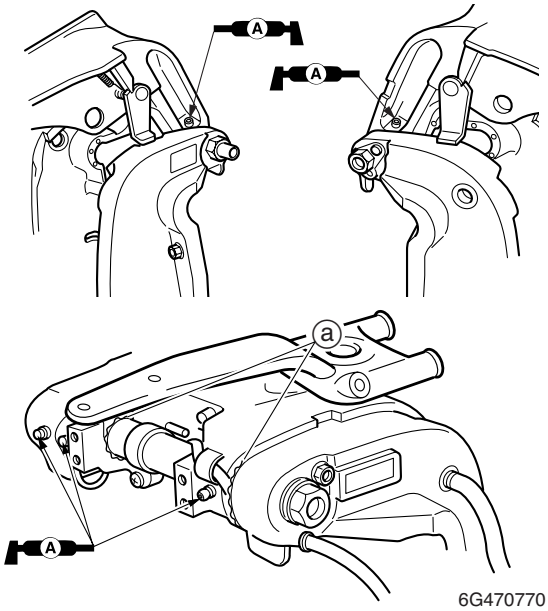
5. Install the anode ⑦.

6. Pass the PTT motor lead ⑧ through the hole of the port clamp bracket.

7. Fasten the PTT motor lead and trim sensor lead with the lock ties ⑨.



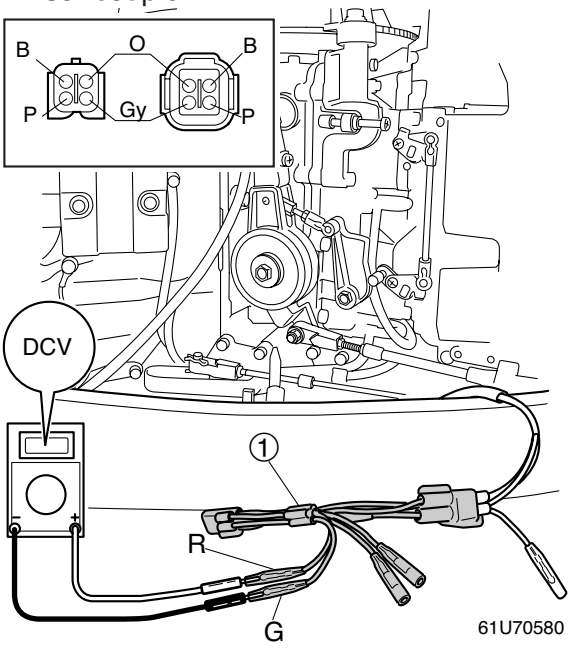
8. Inject grease into all grease nipples until grease comes out from the bushings ⓐ.



7

Adjusting the trim sensor cam (ET)

1. Fully retract the PTT unit.
2. Connect the test harness to the trim sensor coupler.

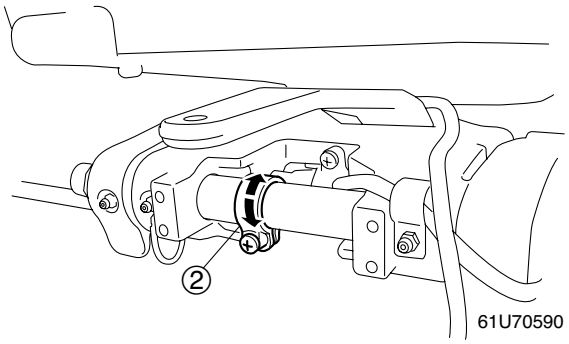


Test harness ①:
90890-06878
Digital circuit tester:
90890-03174

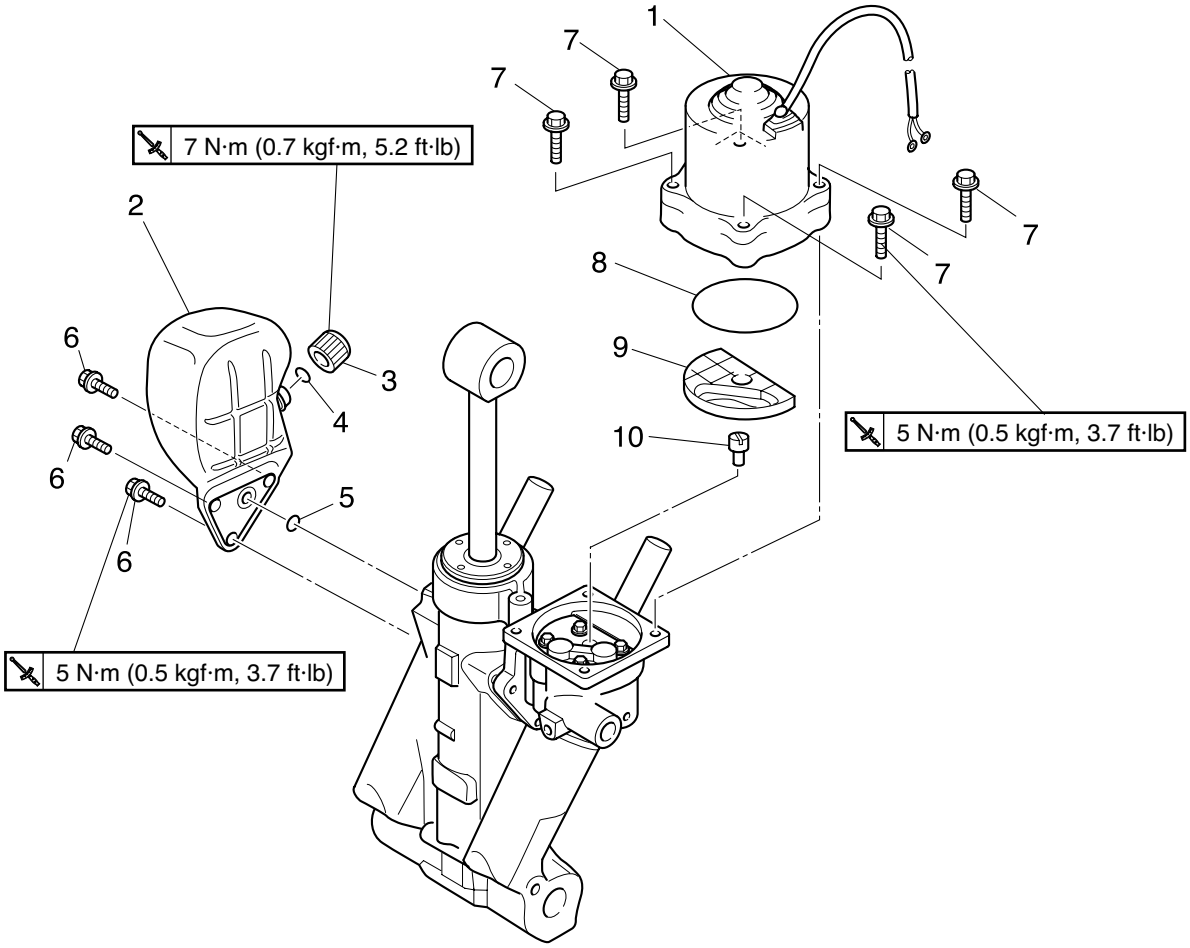
3. Turn the engine start switch to ON.
4. Measure the trim sensor voltage.

Trim sensor voltage:
Pink (P)–Black (B)
0.03–0.11 V

5. If the trim sensor voltage is out of specification, adjust the trim sensor cam ② until the specified trim sensor setting voltage is obtained.



PTT unit



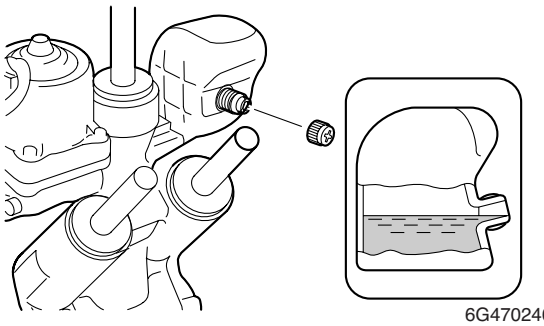
61U7100E

No.	Part name	Q'ty	Remarks
1	PTT motor	1	
2	Reservoir	1	
3	Reservoir cap	1	
4	O-ring	1	Not reusable
5	O-ring	1	Not reusable
6	Bolt	3	M6 × 13 mm
7	Bolt	4	M6 × 34 mm
8	O-ring	1	Not reusable
9	Filter	1	
10	Joint	1	

7

Checking the hydraulic pressure

1. Fully extend the trim and tilt rams.
2. Remove the reservoir cap, and then check the fluid level in the reservoir.


6G470240

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

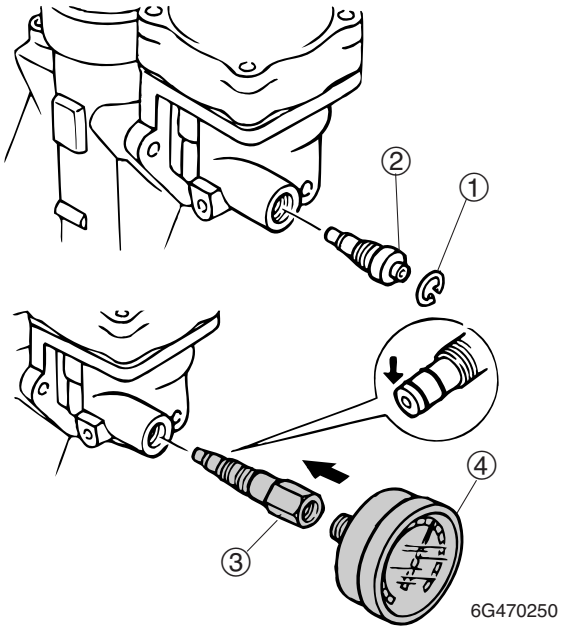
3. If necessary, add sufficient fluid of the recommended type until it overflows out of the filler hole.

Recommended PTT fluid:
ATF Dexron Ⅱ

4. Install the reservoir cap, and then tighten it to the specified torque.

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

5. Remove the circlip ①, then remove the manual valve ②.
6. Install the up relief fitting ③ and hydraulic pressure gauge ④.

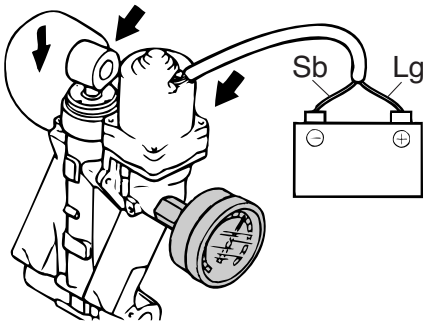


6G470250

NOTE:
Quickly install the special service tools before any fluid flows out of the hole.

Up relief fitting ③: 90890-06773
Hydraulic pressure gauge ④:
90890-06776

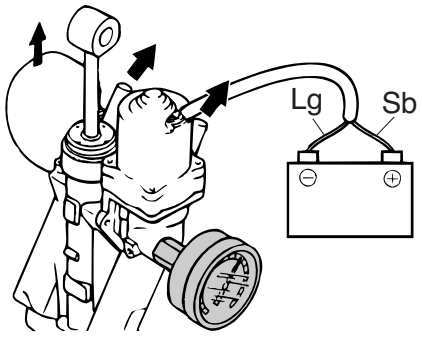
7. Connect the PTT motor leads to the battery terminals to fully retract the trim and tilt rams.



6G470260

Rams	PTT motor lead	Battery terminal
Down	Light green (Lg)	⊕
	Sky blue (Sb)	⊖

8. Reverse the PTT motor leads between the battery terminals to fully extend the trim and tilt rams, and then measure the hydraulic pressure.

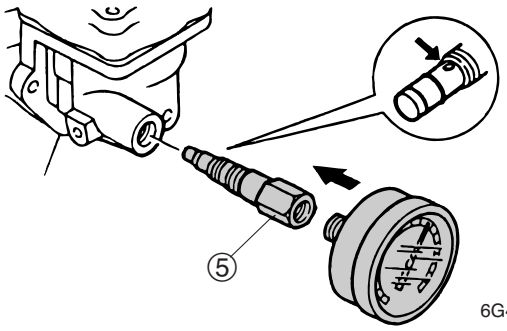


6G470270

Rams	PTT motor lead	Battery terminal
Up	Sky blue (Sb)	⊕
	Light green (Lg)	⊖

Hydraulic pressure (up):
10–12 MPa (100–120 kgf/cm²)

9. Replace the up relief fitting with the down relief fitting ⑤.

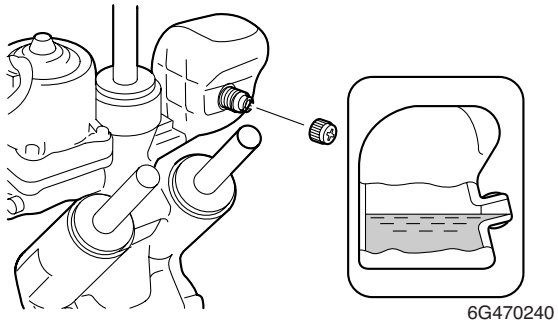


6G470280

NOTE:
Quickly install the special service tools before any fluid flows out of the hole.

Down relief fitting ⑤: 90890-06774
Hydraulic pressure gauge:
90890-06776

10. Remove the reservoir cap, and then check the fluid level.


6G470240

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

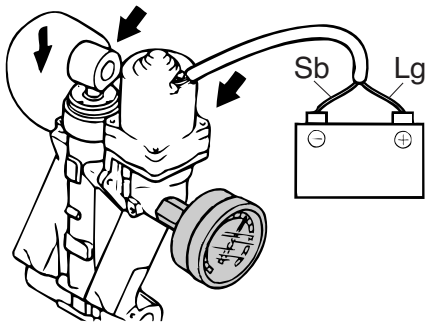
11. If necessary, add sufficient fluid of the recommended type until it overflows out of the filler hole.

12. Install the reservoir cap, and then tighten it to the specified torque.

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

7

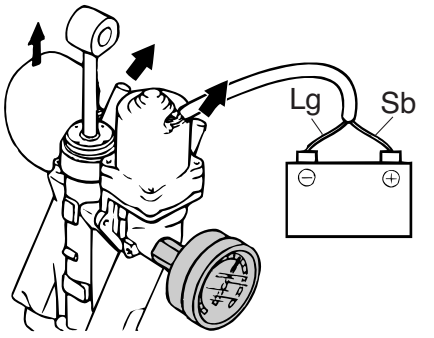
13. Connect the PTT motor leads to the battery terminals to fully retract the trim and tilt rams, and then measure the hydraulic pressure. If out of specification, overhaul the PTT unit.



Rams	PTT motor lead	Battery terminal
Down	Light green (Lg)	⊕
	Sky blue (Sb)	⊖

Hydraulic pressure (down):
6–9 MPa (60–90 kgf/cm²)

14. Reverse the PTT motor leads between the battery terminals to fully extend the trim and tilt rams.



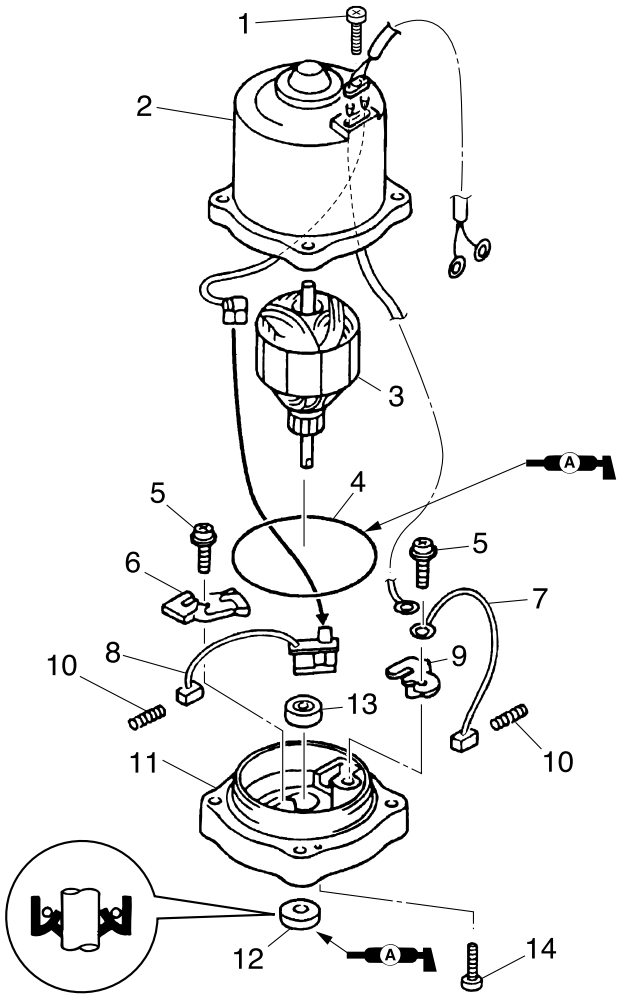
Rams	PTT motor lead	Battery terminal
Up	Sky blue (Sb)	⊕
	Light green (Lg)	⊖

15. Remove the special service tools, and then install the manual valve and circlip.

NOTE:
Quickly install the manual valve before any fluid flows out of the hole.

Manual valve:
3 N·m (0.3 kgf·m, 2.2 ft·lb)

PTT motor



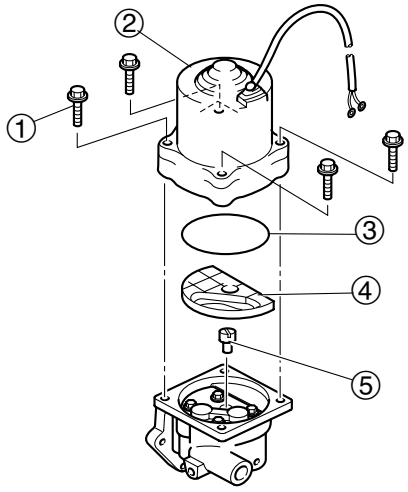
61U7110E

No.	Part name	Q'ty	Remarks
1	Screw	1	ø4 × 15 mm
2	Stator	1	
3	Armature	1	
4	O-ring	1	Not reusable
5	Screw	2	ø4 × 12 mm
6	Brush holder	1	
7	Brush 1	1	
8	Brush 2	1	
9	Brush holder	1	
10	Brush spring	2	
11	PTT motor base	1	
12	Oil seal	1	Not reusable
13	Bearing	1	
14	Screw	2	ø4 × 15 mm

7

Disassembling the PTT motor

1. Loosen the bolts ①, remove the PTT motor ②, O-ring ③, gear pump filter ④, and joint ⑤ from the gear pump housing.



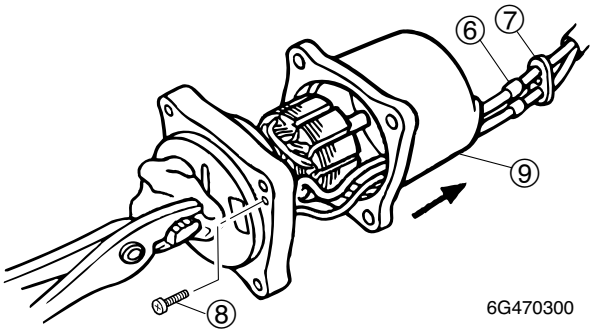
61U70140

⚠WARNING

- **Make sure that the trim and tilt rams are fully extended when removing the PTT motor, otherwise fluid can spurt out from the unit due to internal pressure.**
- **Do not push the trim and tilt rams down while the PTT motor is removed from the PTT unit, otherwise fluid can spurt out.**

2. Remove the lead holder ⑥ and rubber spacers ⑦ from the stator, and then slide them away from the stator.

3. Remove the screws ⑧ and the stator ⑨.



6G470300

NOTE:

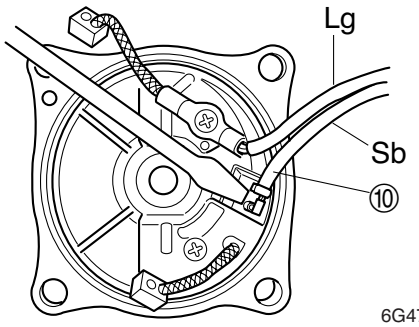
Place a clean cloth over the end of the armature shaft, hold it with a pair of pliers, and then carefully slide the stator off of the armature.

4. Remove the armature from the PTT motor base.

CAUTION:

Do not allow grease or oil to contact the commutator.

5. Disconnect the PTT motor lead ⑩.

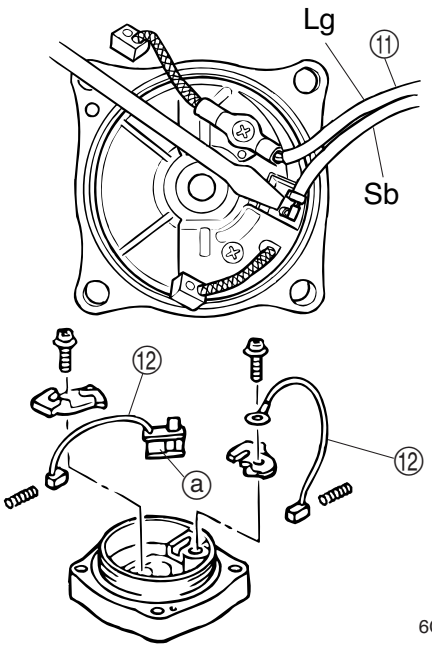


6G470310

NOTE:

Hold the brush with a screwdriver as shown, and then disconnect the PTT motor lead ⑩.

6. Remove the screw, disconnect the PTT motor lead ⑪, and then remove the brushes ⑫.



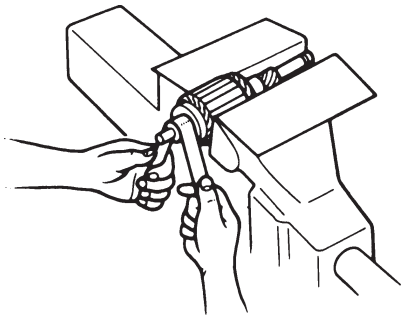
6G470320

CAUTION:

- **Do not pull the PTT motor leads out from the stator.**
- **Do not touch the bimetal ⓐ, otherwise the operation of the circuit breaker can be affected.**

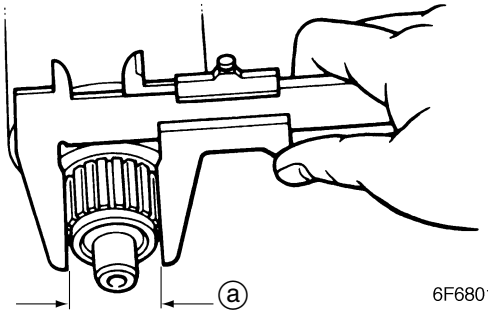
Checking the PTT motor

1. Check the commutator. Clean with 600 – grit sandpaper and compressed air if dirty.



6G480220

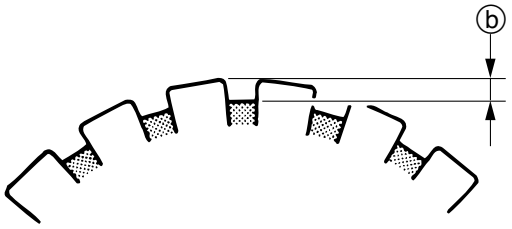
2. Measure the commutator diameter. Replace the armature if below specification limit.



6F680175

Commutator standard diameter ⓐ:
22.0 mm (0.87 in)
Wear limit:
21.0 mm (0.83 in)

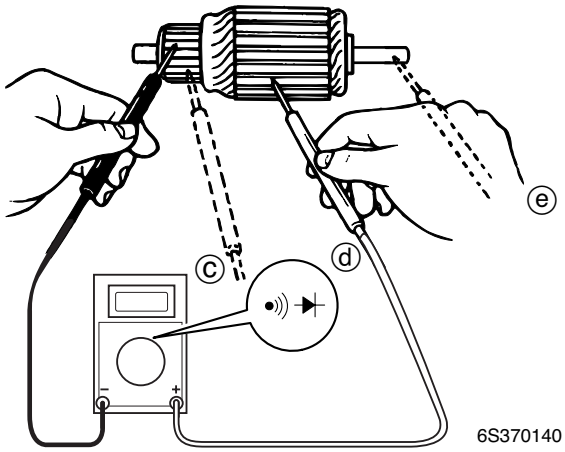
3. Measure the commutator undercut ⓑ. Replace the armature if below specification limit.



6F680180

Commutator standard undercut ⓑ:
1.35 mm (0.053 in)
Wear limit: 0.85 mm (0.033 in)

4. Check the armature for continuity. Replace if not shown as below chart.



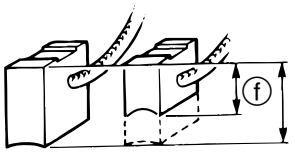
6S370140

Armature continuity

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

7

5. Measure the brush length. Replace if below specification limit.



6S370150

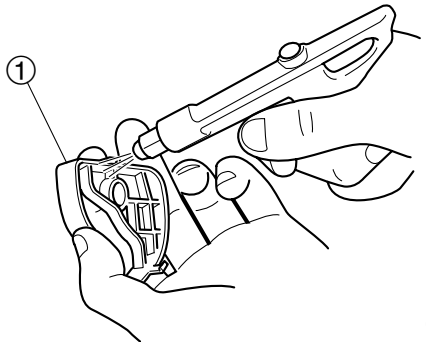
Brush standard length:
9.8 mm (0.39 in)
Wear limit ⓕ:
4.8 mm (0.19 in)

6. Check the base. Replace if cracked or damaged.

7. Check the bearing and oil seal. Replace if damaged or worn.

Checking the filter

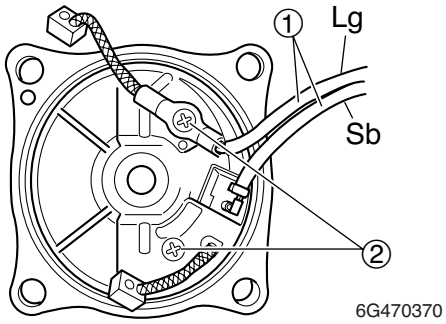
1. Check gear pump filter ①. Clean if there is dirt or residue.



61U70210

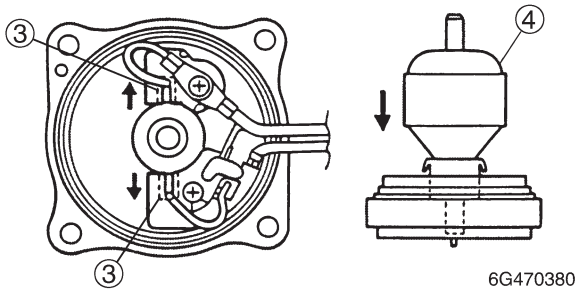
Assembling the PTT motor

1. Connect the PTT motor leads ①, and then tighten the screws ②.



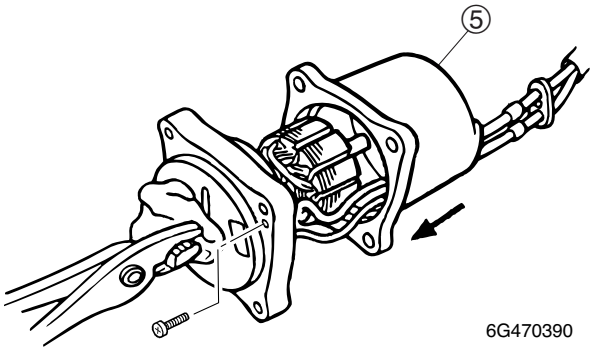
6G470370

2. Install the spring and push the brushes ③ into the brush holder, and then install the armature ④.



6G470380

3. Install the stator ⑤ onto the base.

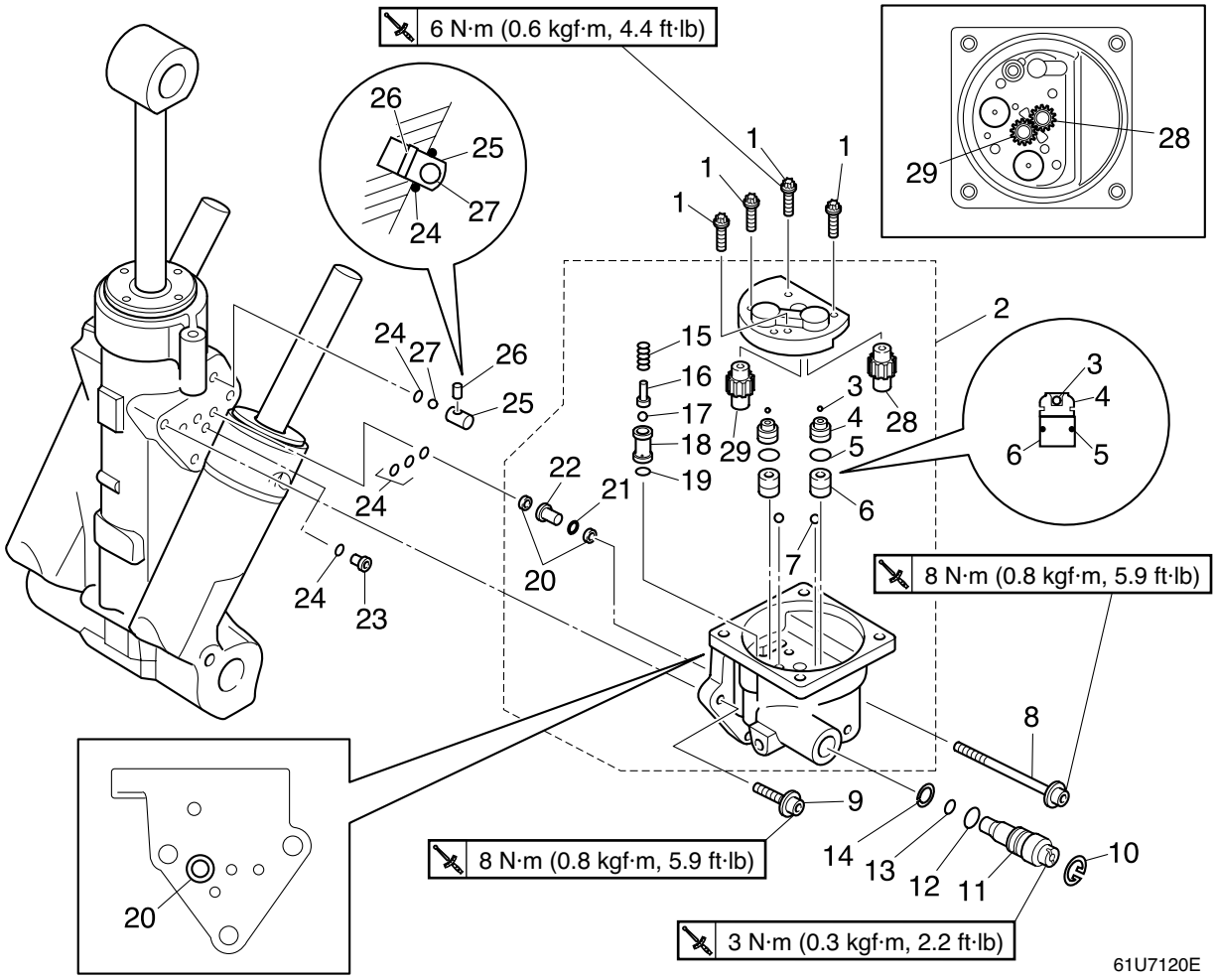


6G470390

NOTE:

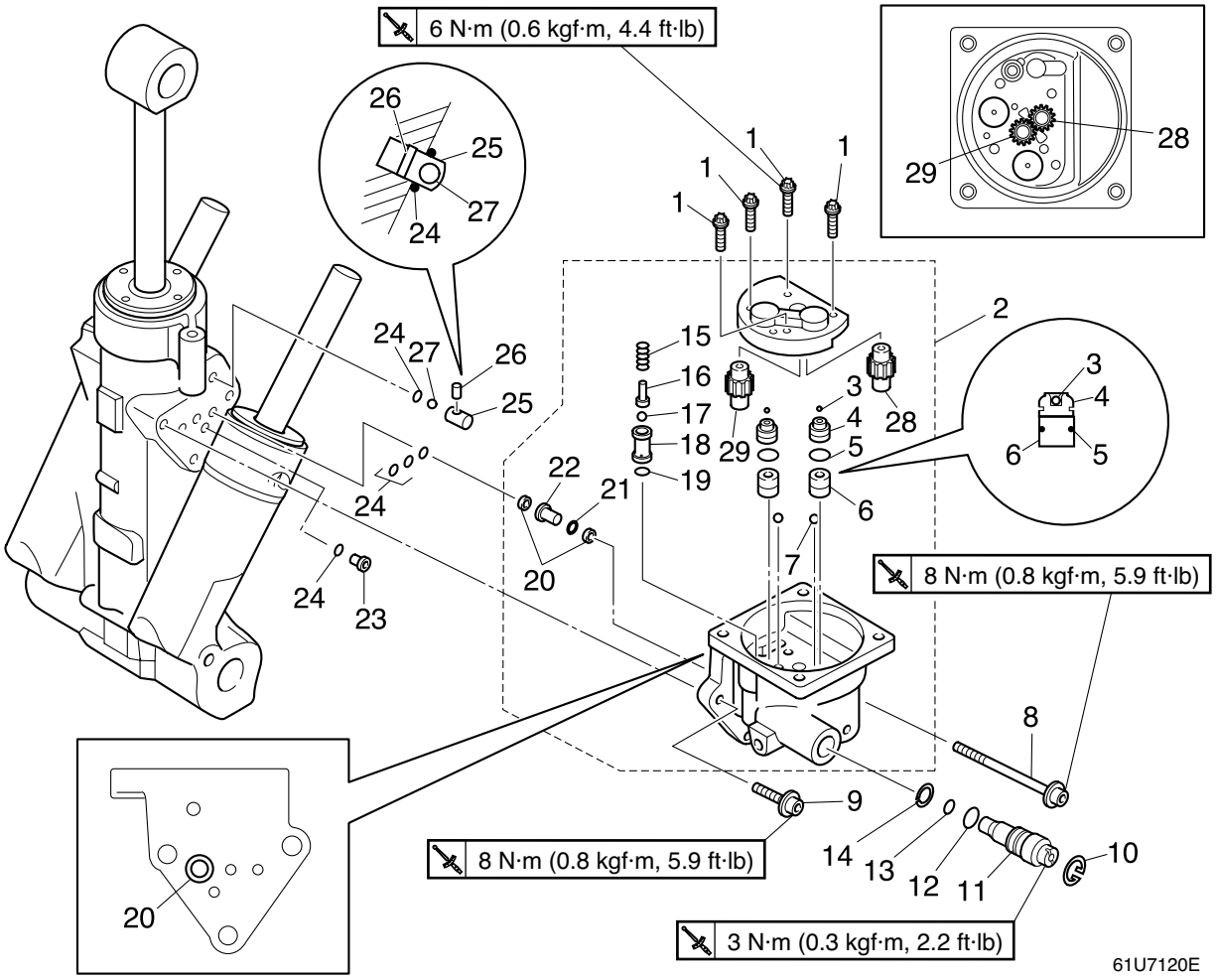
Place a clean cloth over the end of the armature shaft, hold it with a pair of pliers, and then carefully slide the stator over the armature.

Gear pump



No.	Part name	Q'ty	Remarks
1	Bolt	4	M5 × 16 mm
2	Gear pump assembly	1	
3	Ball	2	
4	Shuttle piston	2	
5	O-ring	2	Not reusable
6	Main valve	2	
7	Ball	2	
8	Bolt	1	
9	Bolt	2	
10	Circlip	1	
11	Manual valve	1	
12	O-ring	1	Not reusable
13	O-ring	1	Not reusable
14	Backup ring	1	
15	Spring	1	
16	Absorber valve pin	1	
17	Ball	1	

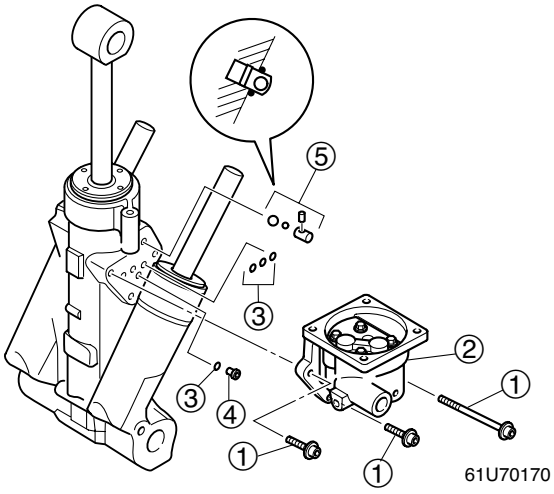
7



No.	Part name	Q'ty	Remarks
18	Up-relief valve seat	1	
19	O-ring	1	Not reusable
20	Filter	2	
21	O-ring	1	Not reusable
22	Down-relief valve	1	
23	Valve pin	1	
24	O-ring	5	Not reusable
25	Valve seat	1	
26	Pin	1	
27	Ball	1	
28	Drive gear	1	
29	Driven gear	1	

Disassembling the gear pump housing

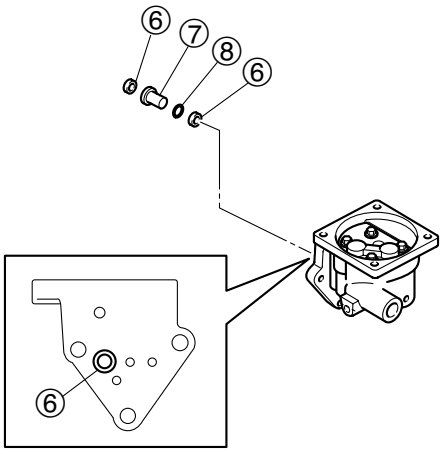
1. Remove the bolts ① and gear pump housing ②.



61U70170

NOTE:
Make sure that the O-rings ③, valve pin ④, and valve seat assembly ⑤ are removed.

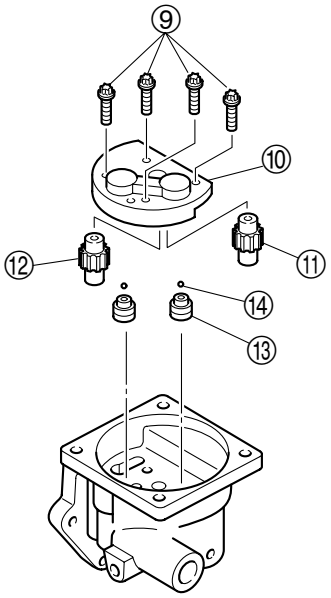
2. Remove the filters ⑥, down-relief valve ⑦, and O-ring ⑧ from the gear pump housing.



61U70370

NOTE:
Use compressed air to remove the filter deep inside of the gear pump housing, and be careful not to blow the filter out abruptly.

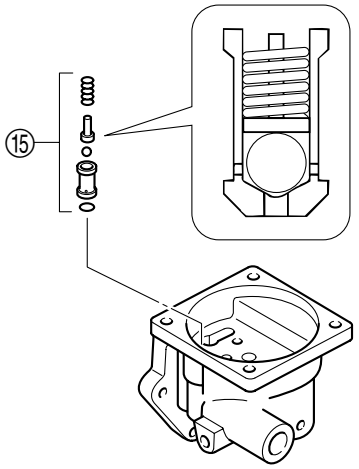
3. Remove the bolts ⑨, gear pump cover ⑩, drive gear ⑪ and driven gear ⑫.



61U70180

NOTE:
Make sure that the shuttle pistons ⑬ and balls ⑭ are removed, so that they tend to stick to the gear pump cover.

4. Remove the up-relief valve assembly ⑮ and balls.

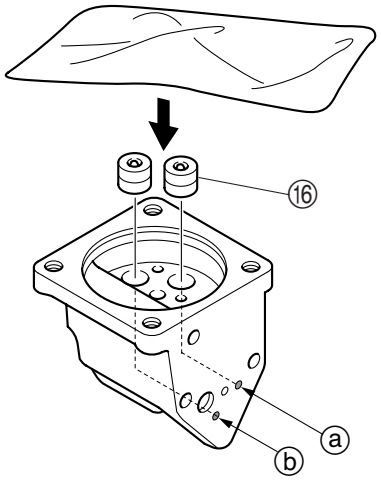


61U70380

7

5. Cover the pump housing with a clean cloth, and then blow compressed air through holes ⓐ and ⓑ while holding the cloth down.

6. Remove the main valves ⑯.

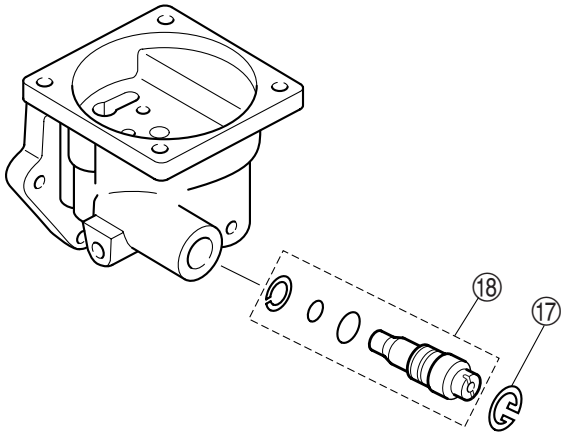


6G470430

⚠WARNING

Never look into the pump housing opening while removing the main valves because the main valves and PTT fluid can be forcefully expelled out.

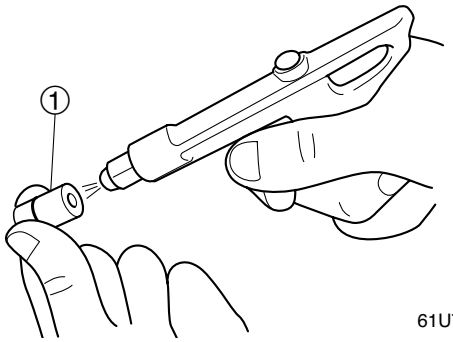
7. Remove the circlip ⑰ and then remove the manual valve ⑱.



6G470440

Checking the main valve

1. Check the main valve ①. Clean if there is dirt or residue.



61U70290

Checking the gear pump

1. Check the drive gear and driven gear. Replace the gear pump assembly if there are damage or wear.

Checking the gear pump housing

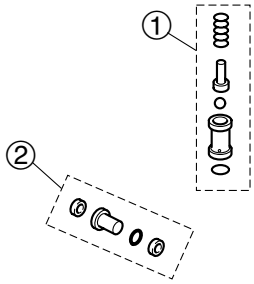
1. Check the inside of the gear pump housing. Replace if scratched or worn.

Checking the reservoir

1. Check the reservoir and O-ring. Replace if deteriorated and cracked.

Checking the relief valve

1. Check the up-relief valve ① and down-relief valve ②. Clean if there is dirt or residue.

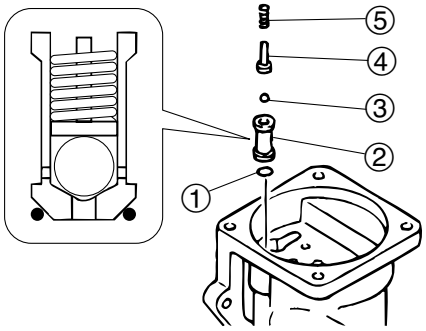


61U70300

2. Check the valve seat. Clean if there is dirt. Replace if damaged or worn.

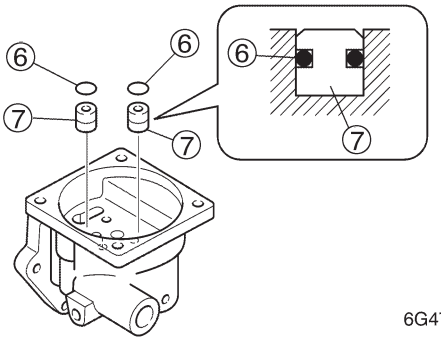
Assembling the gear pump housing

1. Install a new O-ring ①, up-relief valve seat ②, ball ③, absorber valve pin ④, and spring ⑤ into the gear pump housing.



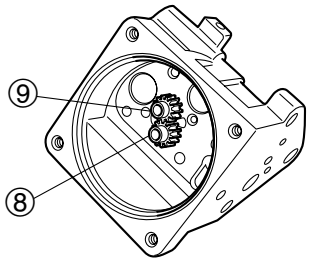
6G470450

2. Install new O-rings ⑥ onto the main valves ⑦, and then install the main valves into the gear pump housing.



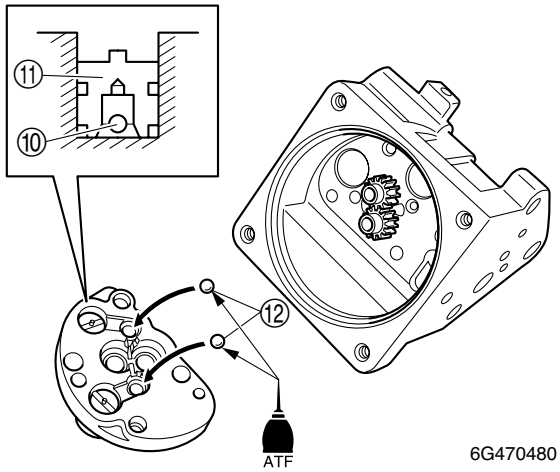
6G470460

3. Install the drive gear ⑧ and driven gear ⑨ into the gear pump housing as shown.



6G470470

4. Install the balls ⑩, shuttle pistons ⑪, and balls ⑫ into the gear pump cover.

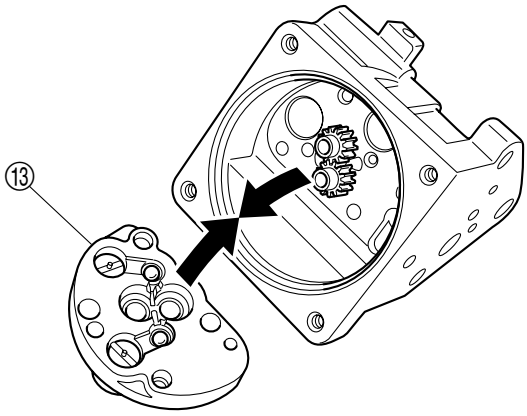


6G470480

NOTE:

Apply fluid to the balls ⑫ and shuttle pistons ⑪ to prevent them from falling out of the gear pump cover.

5. Install the gear pump cover ⑬ into the gear pump housing, and then tighten the bolts.



61U70200

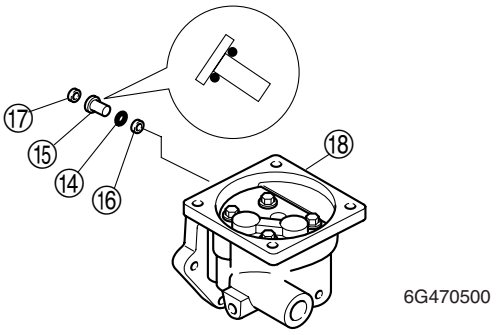
6. Check that the gear pump turns smoothly, and then tighten the gear pump cover bolts to the specified torque.

	Gear pump cover bolt: 6 N·m (0.6 kgf·m, 4.4 ft·lb)

7

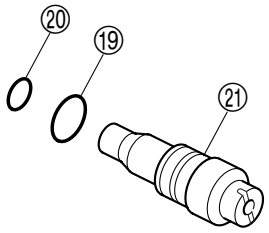
7. Install a new O-ring ⑭ onto the down-relief valve ⑮.

8. Install the filter ⑯, down-relief valve ⑮, and filter ⑰ into the gear pump housing ⑱.



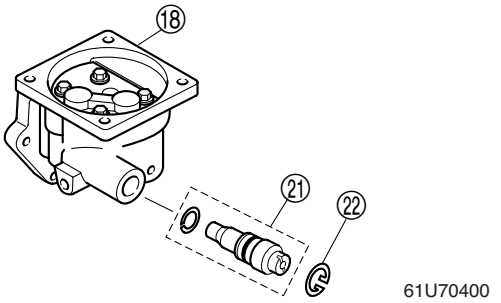
6G470500

9. Install a new O-ring ⑲, ⑳ onto the manual valve ㉑.



61U70390

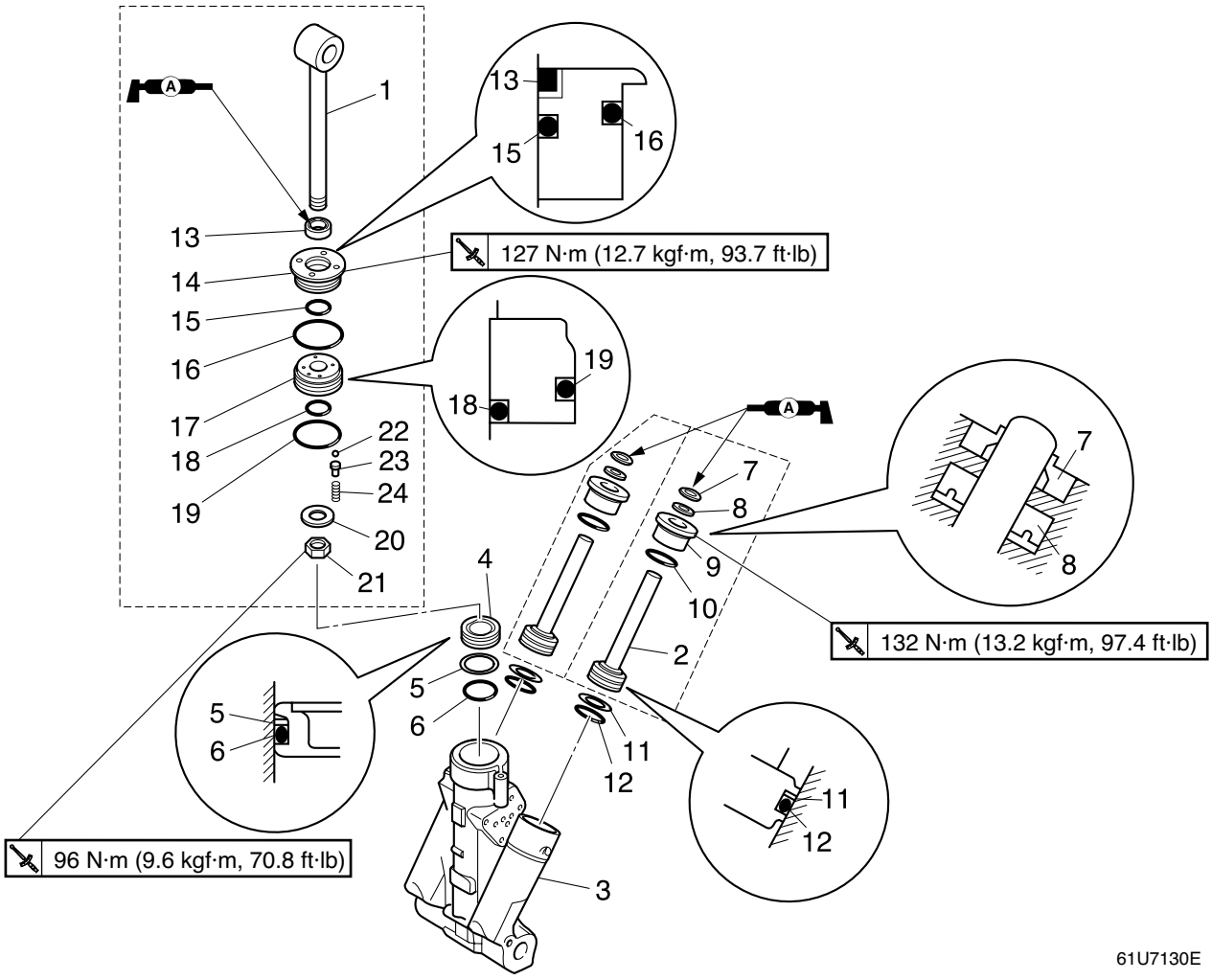
10. Install the manual valve ㉑ and circlip ㉒ into the gear pump housing ⑱.



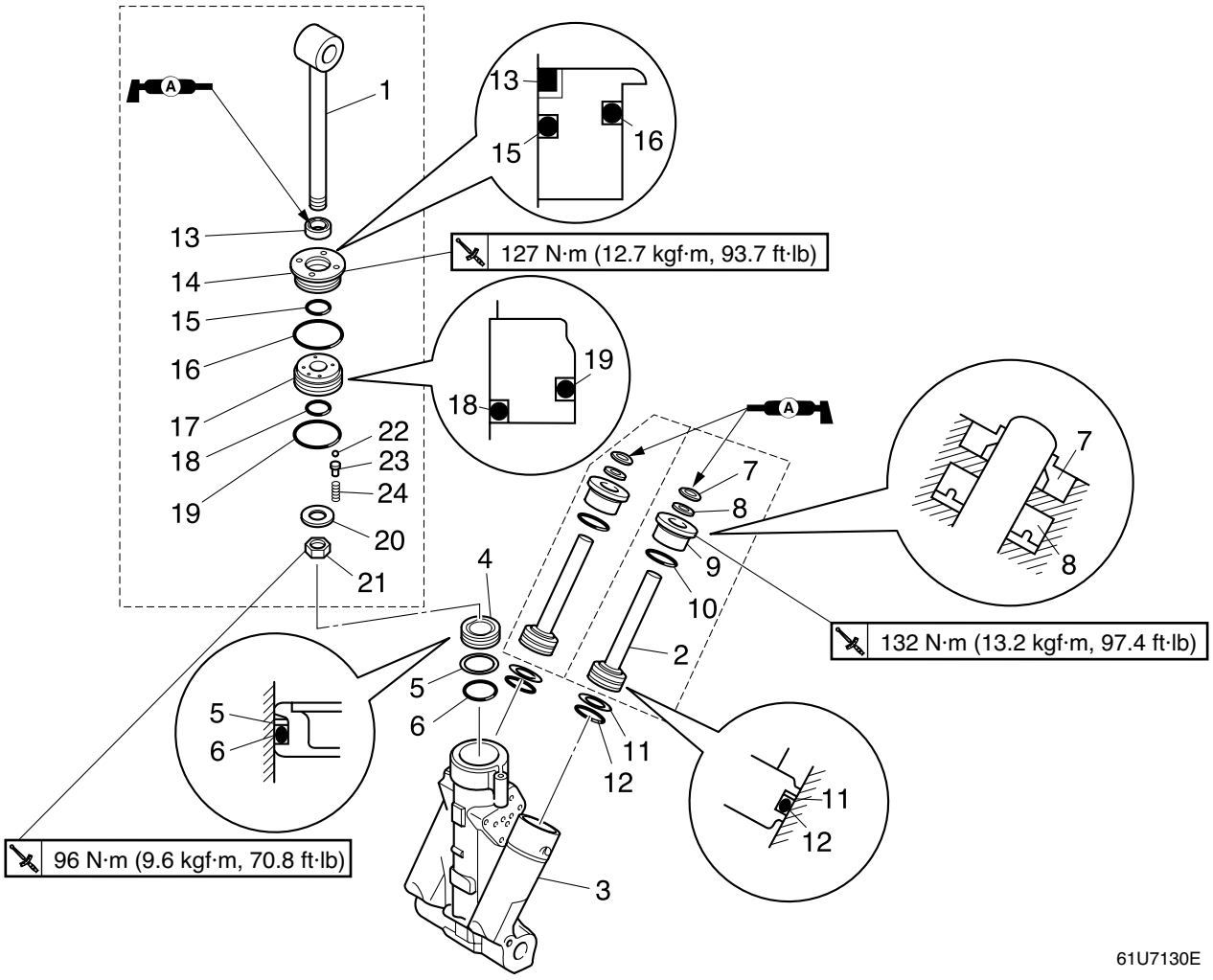
61U70400

	Manual valve ㉑: 3 N·m (0.3 kgf·m, 2.2 ft·lb)

Tilt cylinder and trim cylinder



No.	Part name	Q'ty	Remarks
1	Tilt ram	1	
2	Trim ram	2	
3	Cylinder body	1	
4	Free piston	1	
5	Backup ring	1	
6	O-ring	1	Not reusable
7	Dust seal	2	Not reusable
8	Seal	2	Not reusable
9	Trim cylinder end screw	2	
10	O-ring	2	Not reusable
11	Backup ring	2	
12	O-ring	2	Not reusable
13	Dust seal	1	Not reusable
14	Tilt cylinder end screw	1	
15	O-ring	1	Not reusable
16	O-ring	1	Not reusable
17	Tilt piston	1	

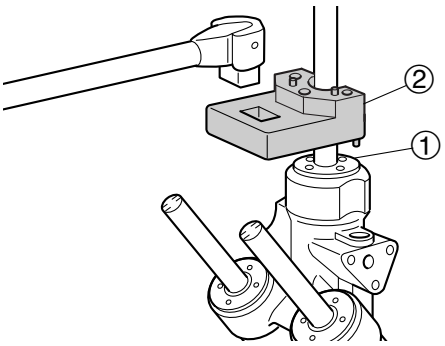


No.	Part name	Q'ty	Remarks
18	O-ring	1	Not reusable
19	O-ring	1	Not reusable
20	Washer	1	
21	Nut	1	
22	Ball	4	
23	Valve	4	
24	Spring	4	

Disassembling the tilt cylinder and trim cylinder

1. Hold the PTT body in a vise using aluminum plates on the both sides.

2. Loosen the tilt cylinder end screw ①, and then remove the tilt piston assembly.



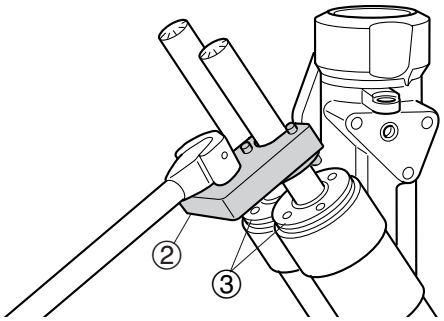
CAUTION:

Make sure that the ram are fully extended before removing the end screw.

	Trim and tilt wrench ②: 90890-06587

3. Drain the fluid.

4. Loosen the trim cylinder end screws ③, and then remove the trim piston assemblies.

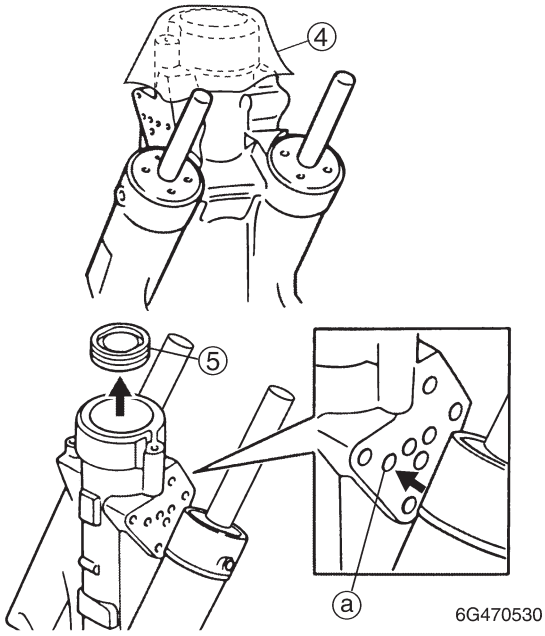


	Trim and tilt wrench ②: 90890-06587

5. Drain the fluid.

6. Install the trim piston assemblies, and then temporarily tighten the trim cylinder end screws.

7. Cover the tilt cylinder opening with a clean cloth ④, and then blow compressed air through the hole ⓐ to remove the free piston ⑤.



⚠WARNING

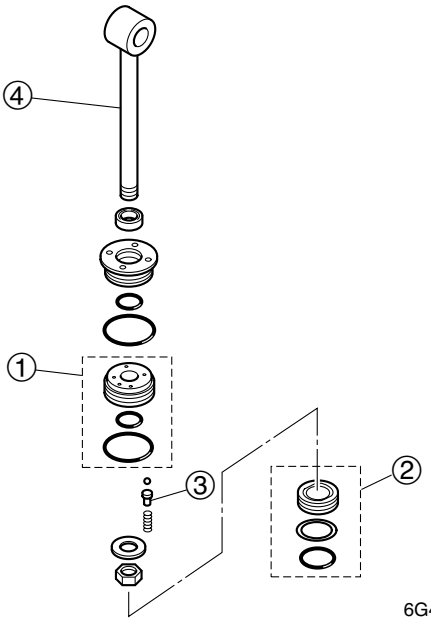
Never look into the tilt cylinder opening while removing the free piston because the free piston and PTT fluid can be forcefully expelled out.

8. Loosen the trim cylinder end screws, and then remove the trim piston assemblies.

7

Checking the tilt cylinder and trim cylinder

1. Disassemble the tilt piston assembly.



2. Check the tilt piston ① and free piston ②. Replace tilt piston and free piston if worn or deteriorated.

3. Blow the tilt piston absorber valve ③ with compressed air to remove any dust. Check the valve and spring. Replace if worn or deteriorated.

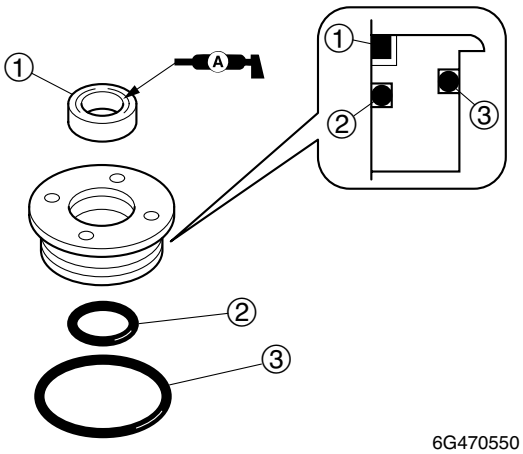
4. Check the tilt ram ④ and trim rams for bends or excessive corrosion. Polish with 400–600 grit sandpaper if there is light rust or replace if necessary.

5. Check the trim pistons. Replace if scratched.

6. Check the inner walls of the trim and tilt cylinders. Replace if scratched.

Assembling the tilt piston and trim piston

1. Install the new dust seal ① and new O-rings ② and ③ onto the tilt cylinder end screw.

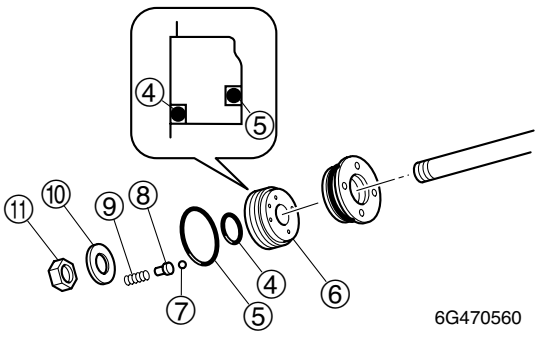


2. Install the tilt cylinder end screw onto the tilt ram.

3. Install the new O-rings ④ and ⑤ onto the tilt piston ⑥.

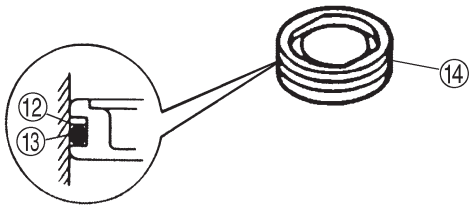
4. Install the ball ⑦, valve ⑧, and spring ⑨, in this order.

5. Install the tilt piston assembly and washer ⑩ onto the tilt ram, and then tighten the tilt piston nut ⑪ to the specified torque.



	Tilt piston nut ⑪: 96 N·m (9.6 kgf·m, 70.8 ft·lb)

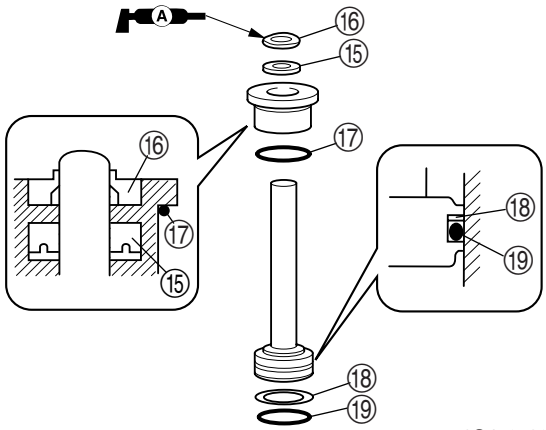
6. Install a new backup ring ⑫ and a new O-ring ⑬ onto the free piston ⑭.



6G470570

7. Install a new seal ⑮, a new dust seal ⑯, and a new O-ring ⑰ onto each trim cylinder end screw.

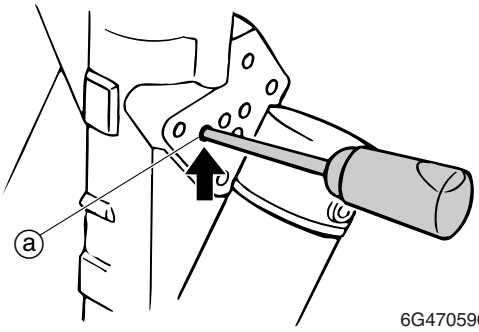
8. Install the backup ring ⑱ and a new O-ring ⑲ onto each trim piston.



6G470580

Assembling the PTT unit

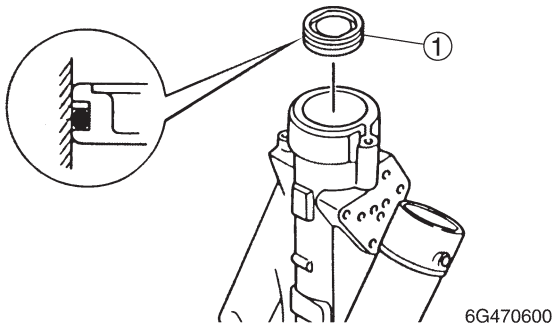
1. Fill the tilt cylinder with the specified amount of the recommended fluid through the hole ⓐ to bleed the fluid passage.



6G470590

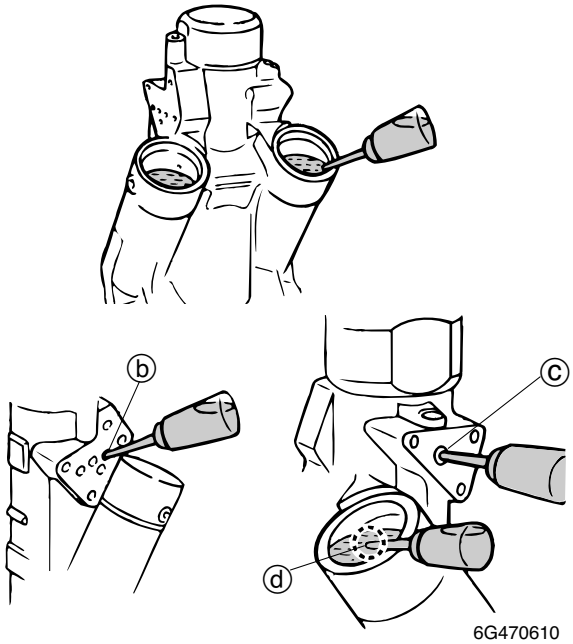
Recommended PTT fluid:
ATF Dexron II
Fluid quantity:
30 cm³ (1.0 US oz, 1.1 Imp oz)

2. Push the free piston ① into the tilt cylinder until it bottoms out.



6G470600

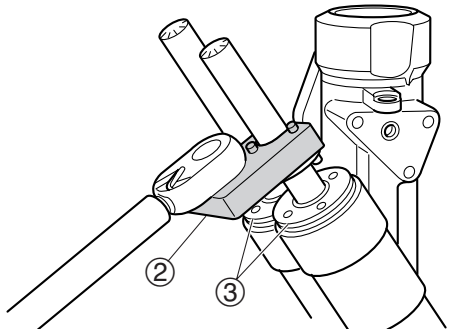
3. Fill the trim cylinders with the recommended fluid to the correct level through holes ⓑ and ⓒ, and ⓓ as shown.



6G470610

7

4. Install the trim piston assemblies into the trim cylinders, and then tighten the trim cylinder end screws to the specified torque.



6G470525

CAUTION:
- **Make sure that the trim rams are fully extended when installing them.**
- **Once installed, never push the trim rams down, otherwise fluid can spurt out.**

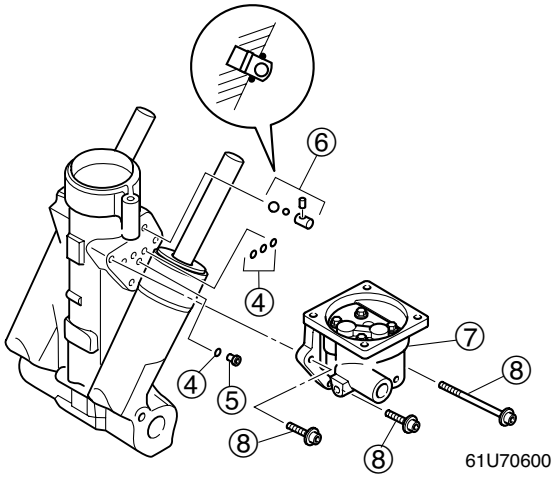
Trim and tilt wrench ②:
90890-06587

Trim cylinder end screw ③:
132 N·m (13.2 kgf·m, 97.4 ft·lb)

5. Install the new O-rings ④, valve pin ⑤, and valve seat assembly ⑥ onto the tilt cylinder.

NOTE:
Refer to the illustration for valve pin and valve seat assembly installation.

6. Install the gear pump housing ⑦ with the bolts ⑧.



61U70600

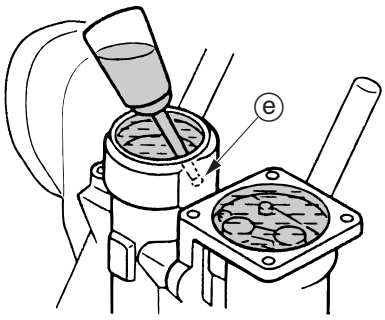
Gear pump housing mounting bolt ⑧:
8 N·m (0.8 kgf·m, 5.9 ft·lb)

7. Install the O-ring into the reservoir cap.

8. Install the reservoir and new O-ring onto the gear pump housing.

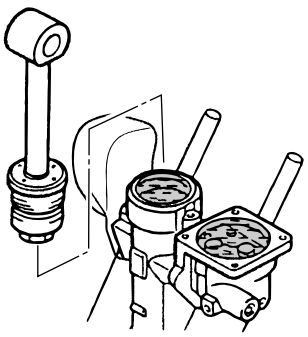
Reservoir tank mounting bolt:
5 N·m (0.5 kgf·m, 3.7 ft·lb)

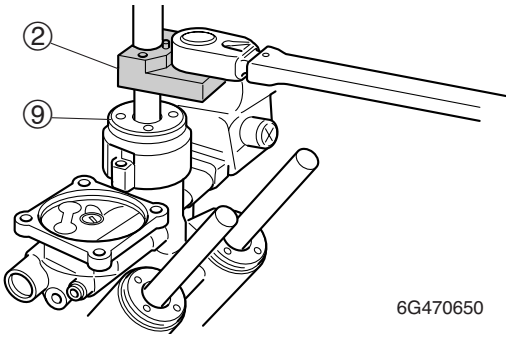
9. Fill the tilt cylinder with the recommended fluid to the correct level through the hole ⓔ as shown.



6G470630

10. Install the tilt piston assembly into the tilt cylinder, and then tighten the tilt cylinder end screw ⑨ to the specified torque.


6G470640



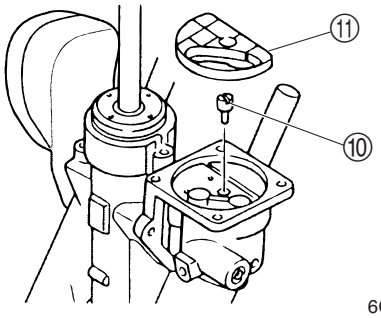
6G470650

CAUTION:
- **Make sure that the tilt ram is fully extended when installing it.**
- **Once installed, never push the tilt ram down, otherwise fluid can spurt out.**

Trim and tilt wrench ②:
90890-06587

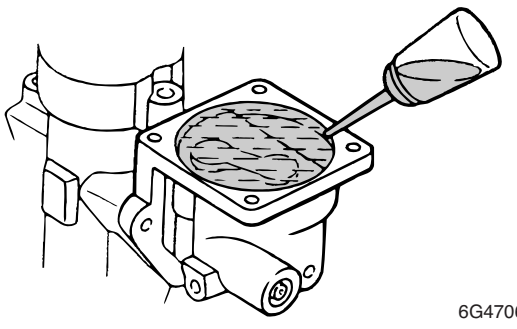
Tilt cylinder end screw ⑨:
127 N·m (12.7 kgf·m, 93.7 ft·lb)

11. Install the joint ⑩ and gear pump filter ⑪ into the gear pump housing.



6G470660

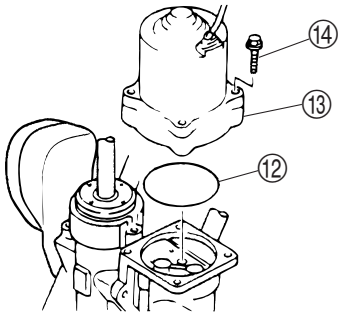
12. Fill the gear pump housing with the recommended fluid to the correct level as shown.


6G470670

13. Remove all of the air bubble using a syringe or suitable tool.

NOTE:
Turn the joint with a screwdriver to bleed the gear pump.

14. Install a new O-ring ⑫ and the PTT motor ⑬, and then tighten the bolts ⑭ to the specified torque.



6G470680

NOTE:
Align the armature shaft with the recess in the joint.

PTT motor mount bolt ⑭:
5 N·m (0.5 kgf·m, 3.7 ft·lb)

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

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

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

17. Install the reservoir cap, and then tighten it to the specified torque.

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

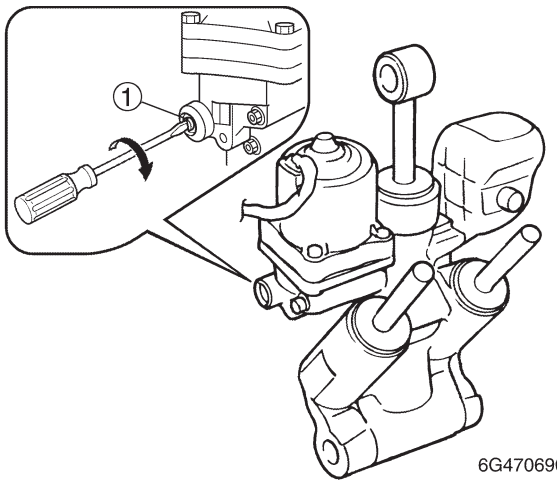
18. Bleed the PTT unit.

19. Check the hydraulic pressure of the PTT unit.

7

Bleeding the PTT unit

1. Tighten the manual valve ① clockwise.



2. Place the PTT unit in an upright position.

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

NOTE:

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

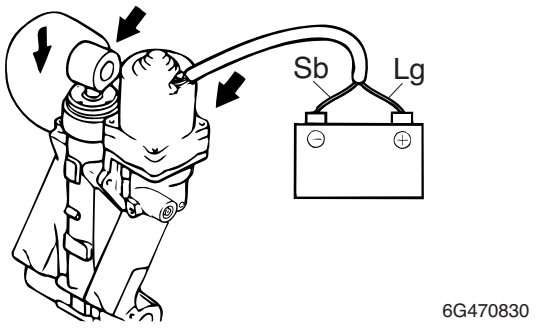
4. If necessary, add sufficient fluid of the recommended type until it overflows out of the filler hole.

Recommended PTT fluid:
ATF Dexron II

5. Install the reservoir cap, and then tighten it to the specified torque.

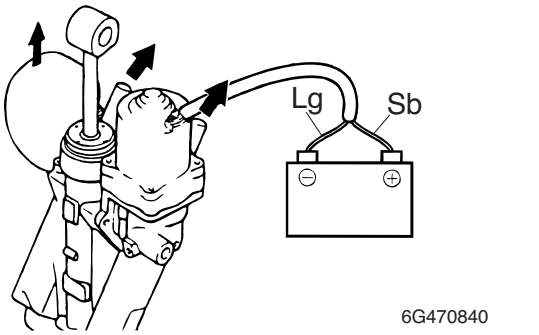
Reservoir cap:
7 N·m (0.7 kgf·m, 5.2 ft·lb)

6. Connect the PTT motor leads to the battery terminals to fully retract the trim and tilt rams.



Rams	PTT motor lead	Battery terminal
Down	Light green (Lg)	⊕
	Sky blue (Sb)	⊖

7. Reverse the PTT motor leads between the battery terminals to fully extend the trim and tilt rams.



Rams	PTT motor lead	Battery terminal
Up	Sky blue (Sb)	⊕
	Light green (Lg)	⊖

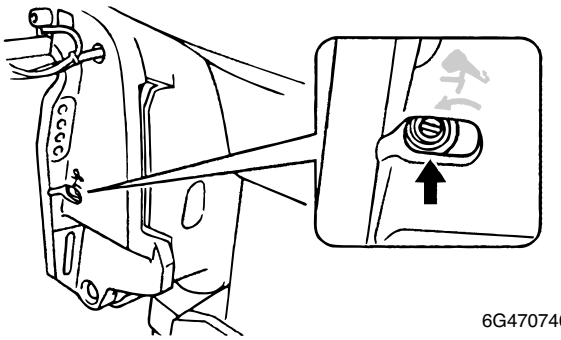
NOTE:

- Repeat this procedure so that the rams go up and down 4 or 5 times (be sure to wait a few seconds before switching the leads).
- If the rams do not move up and down easily, push and pull on the rams to assist operation.

8. Check the fluid level when the tilt ram is fully extended. Add sufficient fluid if necessary.

Bleeding the PTT unit (built-in)

1. Check the manual valve is fully tightened, and then connect the battery to the battery leads.



6G470740

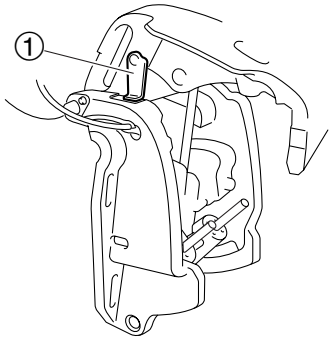
NOTE:

If the manual valve is loosened, be sure to tighten it to the specified torque before tilting the outboard motor up.

Manual valve:
3 N·m (0.3 kgf·m, 2.2 ft·lb)

2. Operate the PTT switch of the remote control box to fully tilt the outboard motor up and fully tilt it down. Repeat this procedure 4 or 5 times.

3. Support the outboard motor with the tilt stop lever ①.



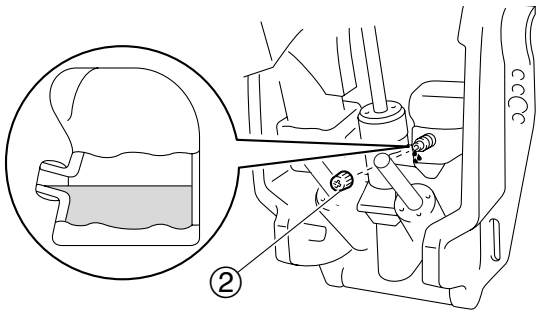
6G470190

⚠WARNING

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

4. Let the fluid settle for 5 minutes.

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



6G470750

NOTE:

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

6. If necessary, add sufficient fluid of the recommended type to the correct level.

Recommended PTT fluid:
ATF Dexron II

7

7. Install the reservoir cap, and then tighten it to the specified torque.

NOTE:
Repeat this procedure until the fluid is at the correct level.

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

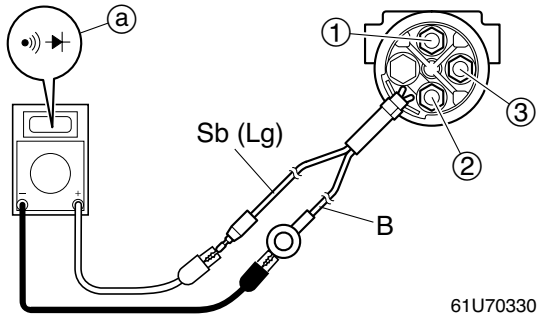
PTT electrical system

Checking the fuse

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

Checking the PTT relay

1. Check the PTT relay for continuity. Replace the PTT relay if not shown as below chart.

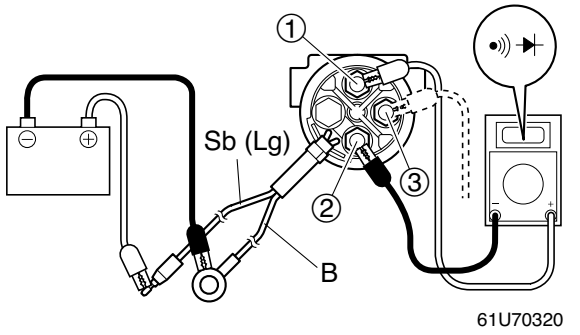


NOTE:
Be sure to set the measurement range ⓐ shown in the illustration when checking for continuity.

PTT relay continuity

Sky blue (Sb) – Black (B) Light green (Lg) – Black (B)	Continuity
Terminal ① – Terminal ②	No continuity
Terminal ② – Terminal ③	Continuity

2. Connect the digital circuit tester between PTT relay terminals ① and ②.
3. Connect the sky blue (Sb) lead or the light green (Lg) lead to the positive battery terminal and the black (B) lead to the negative battery terminal as shown.



4. Check for continuity between terminals. Replace the PTT relay if not shown as below chart.

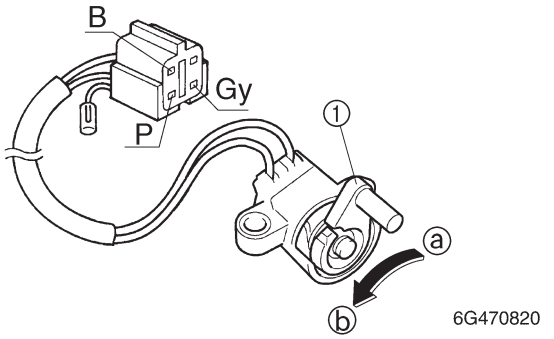
PTT relay continuity (battery connected)

Terminal ① – Terminal ②	Continuity
Terminal ② – Terminal ③	No continuity

Checking the trim sensor

1. Measure the trim sensor resistance. Replace sensor if out of specification.

NOTE:
Turn the lever ① and measure the resistance as it gradually changes.



Trim sensor resistance:
Pink (P)–Black (B)
239–379 Ω at 20°C (68°F) ⓐ
9–11 Ω at 20°C (68°F) ⓑ

Electrical system

Checking the electrical component 8-1
Measuring the peak voltage 8-1

Electrical component 8-2
Port view 8-2
Starboard view 8-3
Aft view 8-4
Top view 8-5

Ignition and ignition control system 8-6
Checking the ignition spark gap 8-6
Checking the spark plug cap 8-6
Checking the ignition coil 8-7
Checking the CDI unit 8-7
Checking the pulser coil 8-8
Checking the charge coil 8-8
Checking the thermoswitch 8-9

Starting system 8-9
Checking the fuse (WH, E, ET) 8-9
Checking the engine start switch (WH, E, ET) 8-10
Checking the engine stop lanyard switch 8-10
Checking the starter relay (WH, E, ET) 8-11
Checking the neutral switch (WH) 8-11

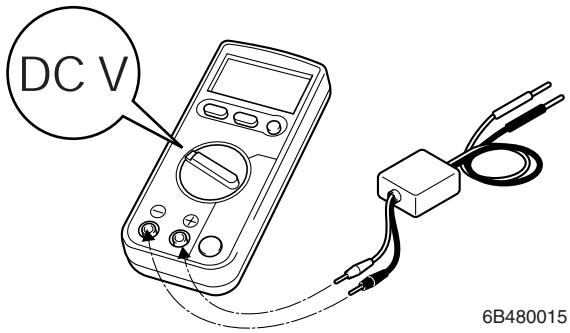
Starter motor (WH, E, ET) 8-12
Removing the starter motor pinion 8-14
Checking the starter motor pinion 8-14
Checking the armature 8-14
Checking the brush 8-15
Checking the starter motor operation 8-15
Checking the choke solenoid 8-15

Charging system 8-16
Checking the lighting coil 8-16
Checking the Rectifier Regulator 8-16
Checking the hour meter 8-17

Checking the electrical component

Measuring the peak voltage

To check the electrical components or measure the peak voltage, use the special service tools. A faulty electrical components can be easily checked by measuring the peak voltage. The specified engine speed when measuring the peak voltage is effected by many factors such as fouled spark plugs or a weak battery. If one of these factors is present, the peak voltage cannot be measured properly.



⚠WARNING

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

CAUTION:

When measuring the voltage of an electrical component with the digital circuit tester, make sure that the tester leads do not contact each other. Otherwise, the electrical component could be damaged.

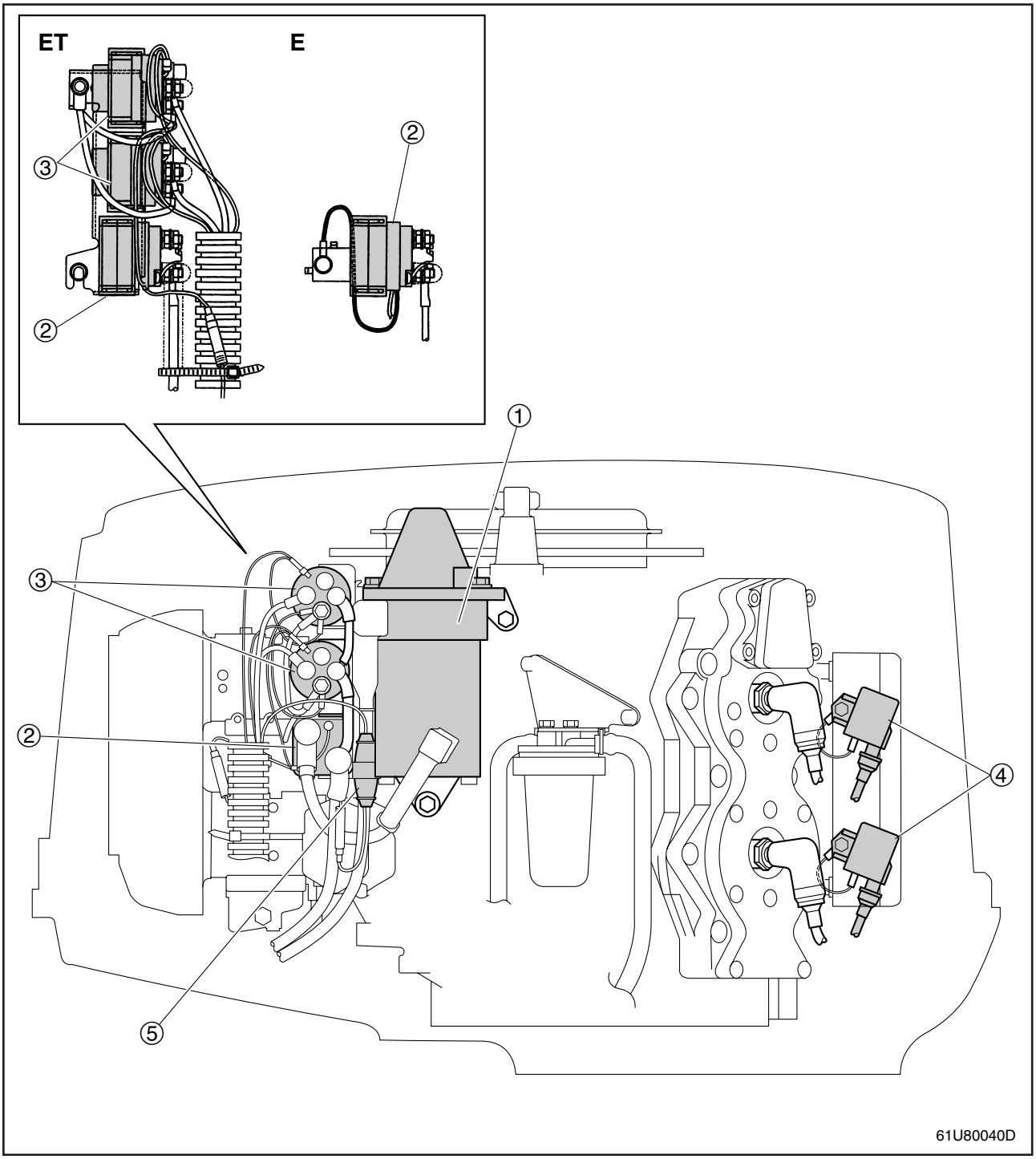
NOTE:

- Before measuring the peak voltage, check all wiring for proper connection and corrosion, and check that the battery is fully charged.
- Use the peak voltage adapter with the recommended digital circuit tester.
- Connect the positive pin of the peak voltage adapter to the positive terminal of the digital tester, and the negative pin to the negative terminal.
- When measuring the peak voltage, set the selector on the digital circuit tester to the **DC voltage mode.**

Digital circuit tester: 90890-03174
Peak voltage adaptor B:
90890-03172

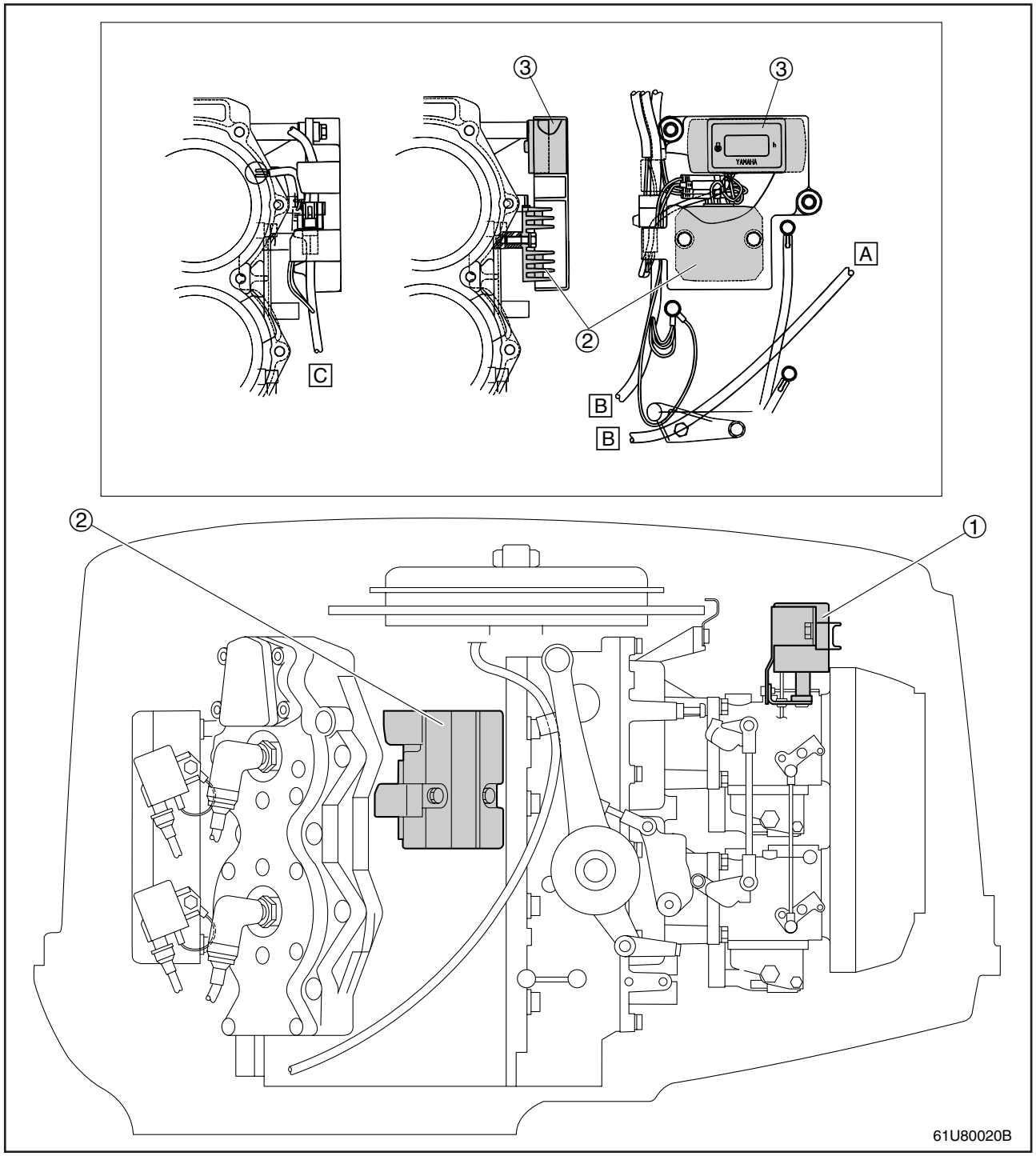
Electrical component

Port view



① Starter motor (WH, E, ET)
② Starter relay (WH, E, ET)
③ PTT relay (ET)
④ Ignition coil
⑤ Fuse holder (20A: WH, E, ET)

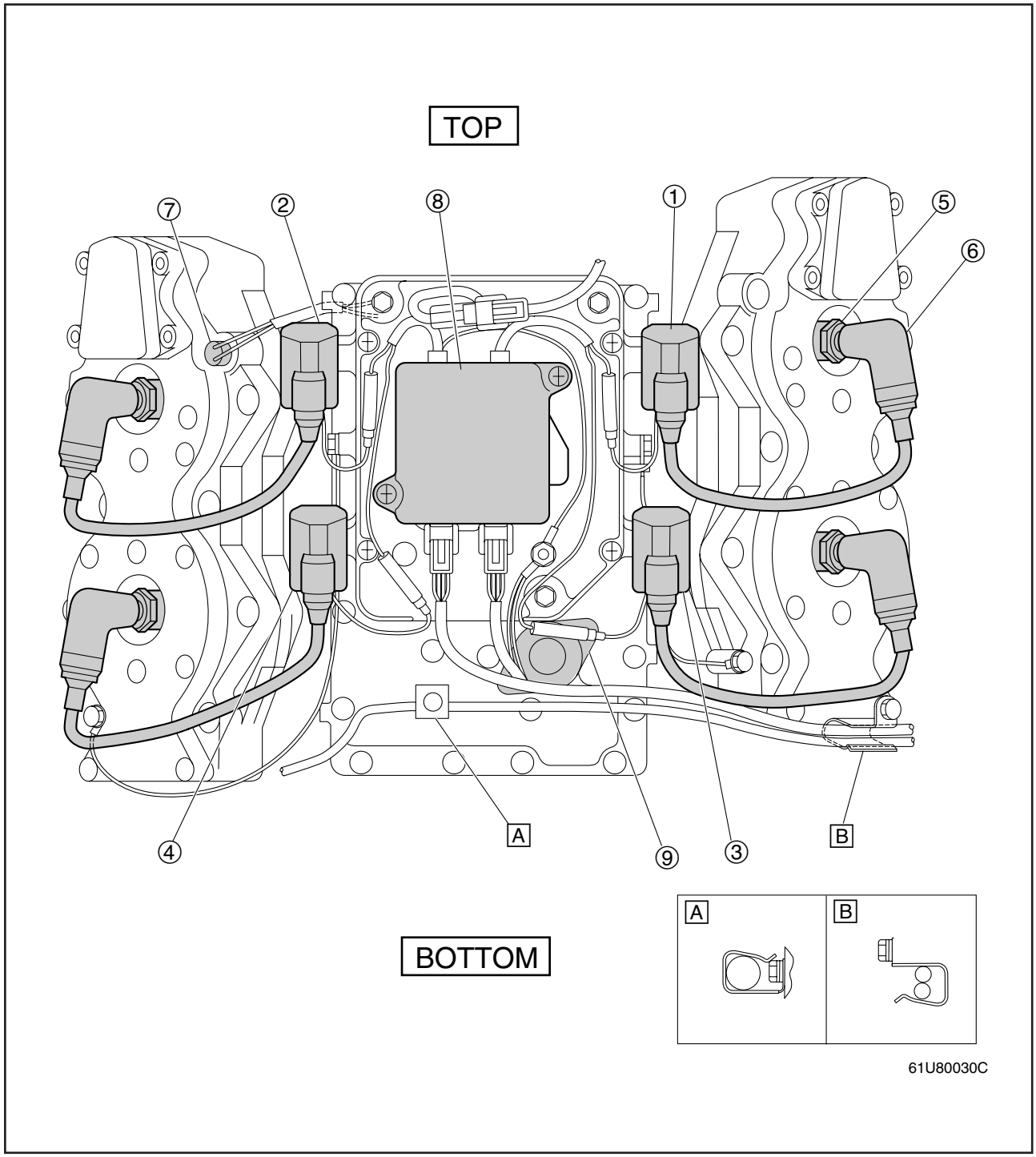
Starboard view



① Choke solenoid (E, ET)
② Rectifier Regulator
③ Hour meter (if equipped)

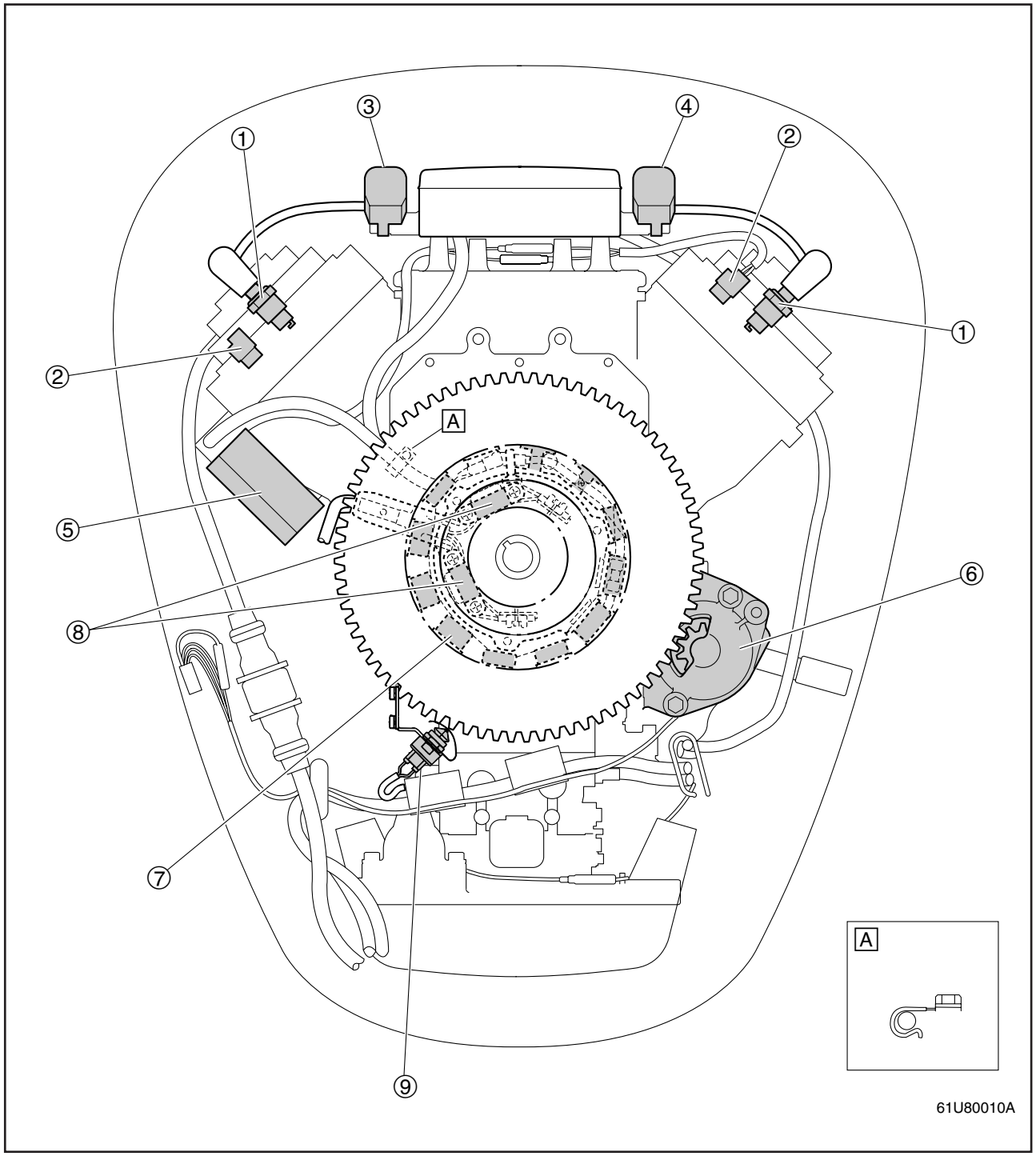
A To pulser coil assembly.
B To CDI unit.
C To wire harness.

Aft view



① Ignition coil #1
② Ignition coil #2
③ Ignition coil #3
④ Ignition coil #4
⑤ Spark plug
⑥ Spark plug cap
⑦ Thermoswitch
⑧ CDI unit
⑨ PCV

Top view



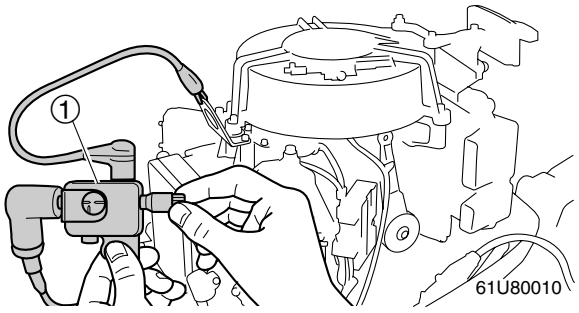
① Spark plug
② Thermoswitch
③ Ignition coil #1
④ Ignition coil #2
⑤ Rectifier Regulator
⑥ Starter motor (WH, E, ET)
⑦ Stator assembly
⑧ Pulser coil assembly
⑨ Neutral switch (WH)

Ignition and ignition control system

Checking the ignition spark gap

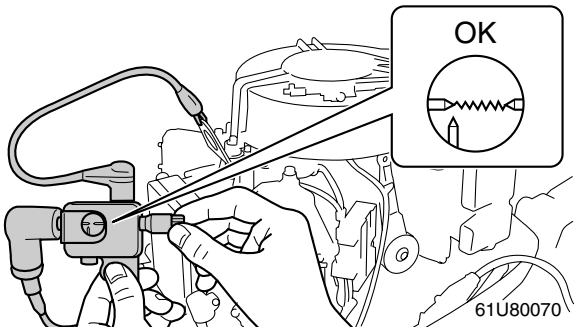
1. Disconnect the spark plug caps from the spark plugs.

2. Connect a spark plug cap to the special service tool shown as below illustration.



	Ignition tester ①: 90890-06754

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

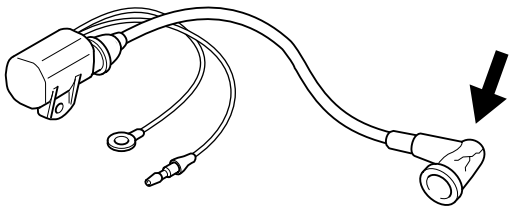


⚠WARNING

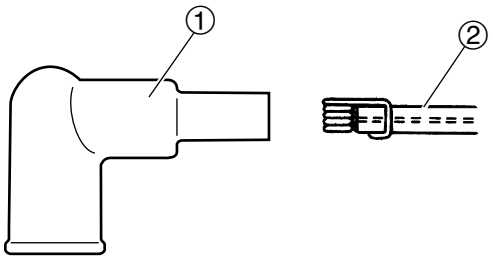
- **Do not touch any of the connections of the ignition tester leads.**
- **Keep flammable gas or liquids away, since this test can produce sparks.**

Checking the spark plug cap

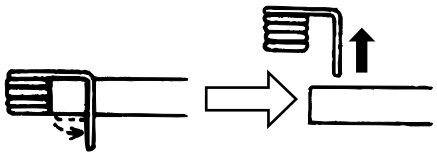
1. Check the spark plug caps. Replace if cracked or damaged.



2. Remove the spark plug cap ① from the spark plug wire ②.



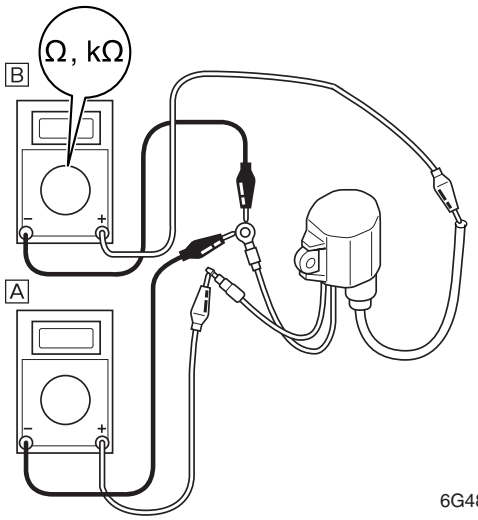
3. Check the spark plug wire. Replace if cracked or damaged.



8

Checking the ignition coil

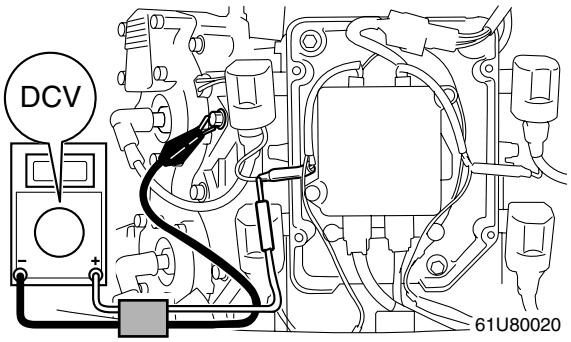
1. Remove the spark plug cap from the spark plug.
2. Disconnect the ignition coil connectors.
3. Measure the ignition coil resistance. Replace the ignition coil if out of specification.



Ignition coil resistance:
A Primary coil:
Black/white (B/W) – Black (B)
0.18–0.24 Ω at 20°C (68°F)
B Secondary coil:
Black/white (B/W) – Spark plug wire
3.26–4.88 kΩ at 20°C (68°F)

Checking the CDI unit

1. Remove the CDI unit cover.
2. Connect the digital circuit tester with peak voltage adaptor B to the ignition coil lead and the ground.
3. Measure the CDI unit output peak voltage. If less than specification, measure the charge coil output peak voltage. Replace the CDI unit if the output peak voltage of the charge coil is more than specification.



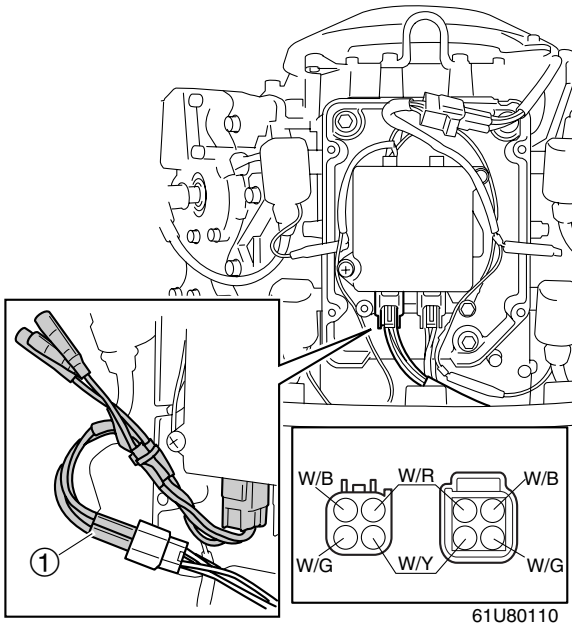
CDI unit output peak voltage:
Black/white (B/W) – Ground (B)

r/min	Loaded		
	Cranking	1,500	3,500
DC V	120	150	150

NOTE:
Remove the all spark plug caps to prevent the engine ignite, when measure the CDI unit peak voltage at engine cranking.

Checking the pulser coil

1. Remove the CDI unit cover.
2. Connect the test harness to the pulser coil.
3. Measure the pulser coil output peak voltage. Replace the pulser coil if less than specification.



61U80110

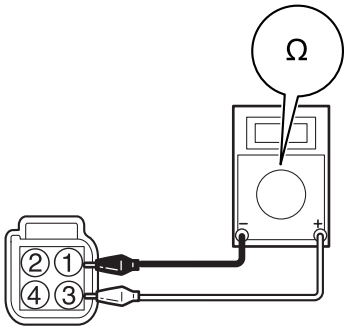
Test harness ①: 90890-06871

Pulser coil output peak voltage:
White/red (W/R) – White/yellow (W/Y)
White/black (W/B) – White/green (W/G)

r/min	Unloaded	Loaded		
	Cranking		1,500	3,500
DC V	4.8 (2.7)	3.8 (2.2)	8.8	14.2

( ): Manual start

4. Disconnect the pulser coil coupler.
5. Connect the digital circuit tester to the pulser coil coupler (pulser coil side).
6. Measure the pulser coil resistance. Replace the pulser coil resistance if out of specification.

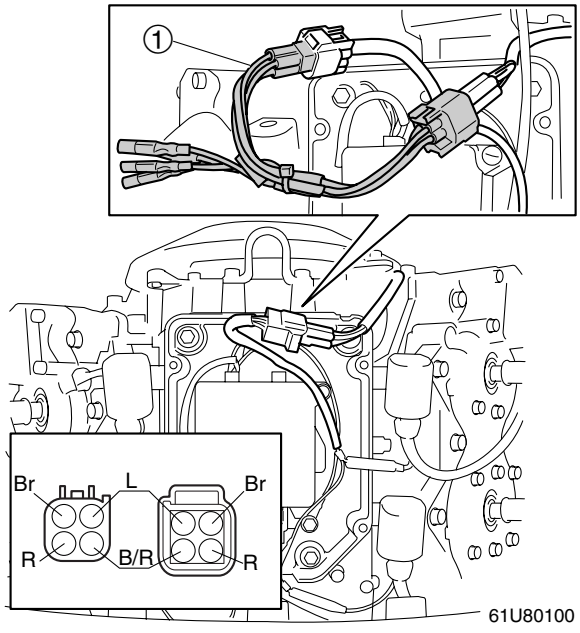


61U80120

Pulser coil resistance
(reference data):
White/red (W/R) ② –
White/yellow (W/Y) ④
White/black (W/B) ① –
White/green (W/G) ③
256–384 Ω at 20°C (68°F)

Checking the charge coil

1. Remove the CDI unit cover.
2. Connect the test harness to the charge coil.
3. Measure the charge coil output peak voltage. Replace the stator assembly if less than specification.



61U80100

8

Test harness ①: 90890-06871

Charge coil output peak voltage:
(low-speed)
Red (R) – Brown (Br)

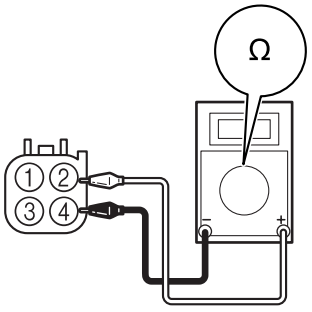
r/min	Unloaded	Loaded		
	Cranking		1,500	3,500
DC V	130 (100)	140 (80)	160	160

Charge coil output peak voltage:
(high-speed)
Black/red (B/R) – Blue (L)

r/min	Unloaded	Loaded		
	Cranking		1,500	3,500
DC V	45 (30)	45 (30)	160	160

( ): Manual start

4. Disconnect the charge coil coupler.
5. Connect the digital circuit tester to the charge coil coupler (charge coil side).
6. Measure the charge coil resistance. Replace the stator assembly if out of specification.

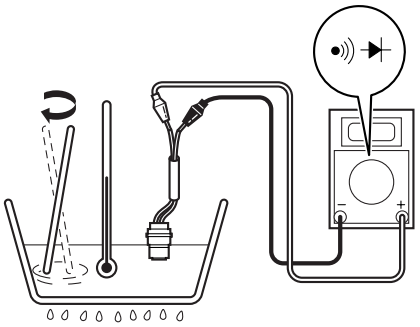


6S380145

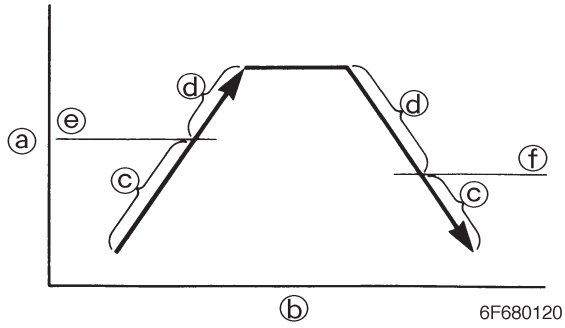
Charge coil resistance
(reference data):
Brown (Br) ① – Red (R) ③
428–642 Ω at 20°C (68°F)
Blue (L) ② – Black/red (B/R) ④
48–72 Ω at 20°C (68°F)

Checking the thermoswitch

1. Place the thermoswitches in a container of water and slowly heat the water.


S6P28750

2. Check the switches for continuity at the specified temperatures. Replace the thermoswitches if out of specification.



6F680120

ⓐ Temperature
ⓑ Time
ⓒ No continuity
ⓓ Continuity

Thermoswitch continuity
temperature:
Pink (P) – Black (B)
ⓔ: 84.0–90.0 °C (183–194°F)
ⓕ: 60.0–74.0 °C (140–165°F)

Starting system

Checking the fuse (WH, E, ET)

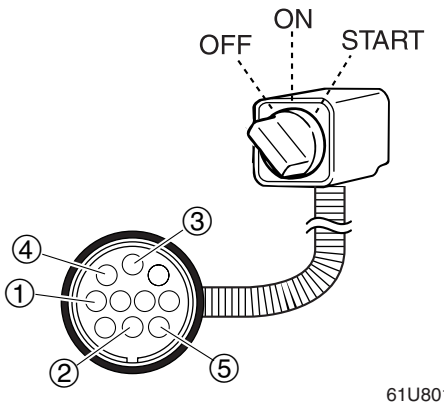
1. Check the fuse (20A) for continuity. Replace the fuse if there is no continuity.

Checking the engine start switch (WH, E, ET)

1. Disconnect the 10-pin main harness coupler.

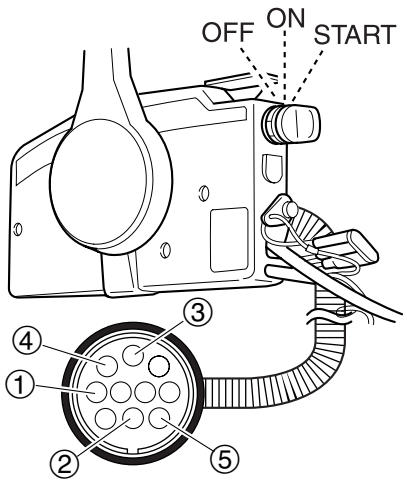
2. Check the engine start switch for continuity at the 10-pin main harness coupler (engine start switch side). Check the wiring harness or replace the engine start switch if there is no continuity.

A



61U80130

B



69D80206

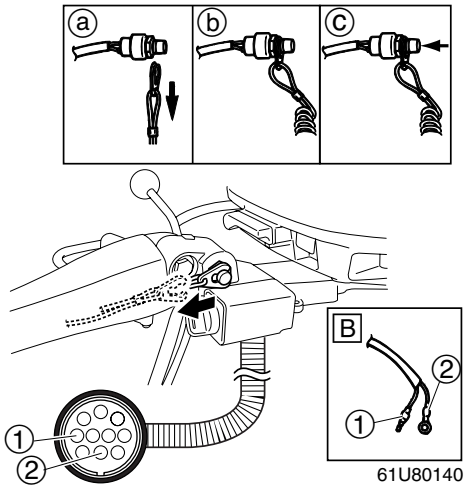
Switch position	Lead color				
	White (W) ①	Black (B) ②	Red (R) ③	Yellow (Y) ④	Brown (Br) ⑤
OFF	○	○			
ON			○	○	
START			○	○	○

A WH
B E, ET

Checking the engine stop lanyard switch

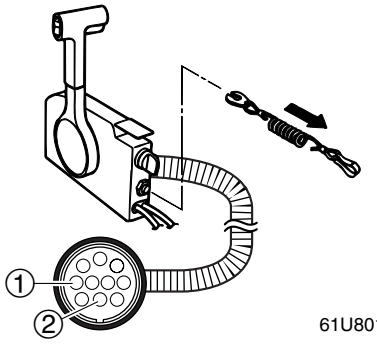
1. Check the engine stop lanyard switch for continuity. Replace if there is no continuity.

A



61U80140

C



61U80150

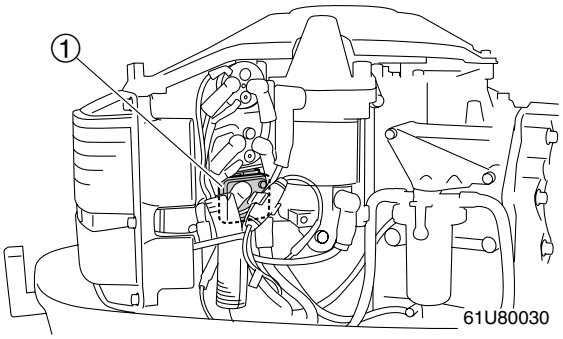
Switch position	Lead color	
	White (W) ①	Black (B) ②
Lock plate removed ⓐ		
Lock plate inserted ⓑ	○	○
Engine stop lanyard switch pushed ⓒ		

A WH
B MH
C E, ET

8

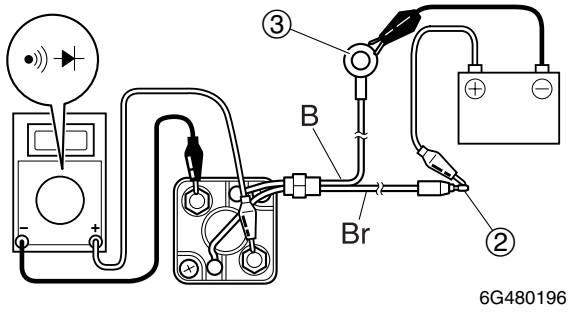
Checking the starter relay (WH, E, ET)

1. Remove the starter relay ①.



2. Connect the digital circuit tester leads to the starter relay terminals.

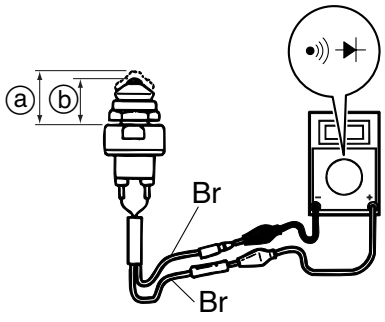
3. Connect the positive battery terminal to the brown (Br) lead ②, also connect the negative battery terminal to the black (B) lead ③, and then check for continuity between the starter relay terminals. Replace the starter relay if there is no continuity.



4. Check that there is no continuity between the starter relay terminals after disconnecting a battery terminal from the brown ② or black lead ③. Replace the starter relay if there is continuity.

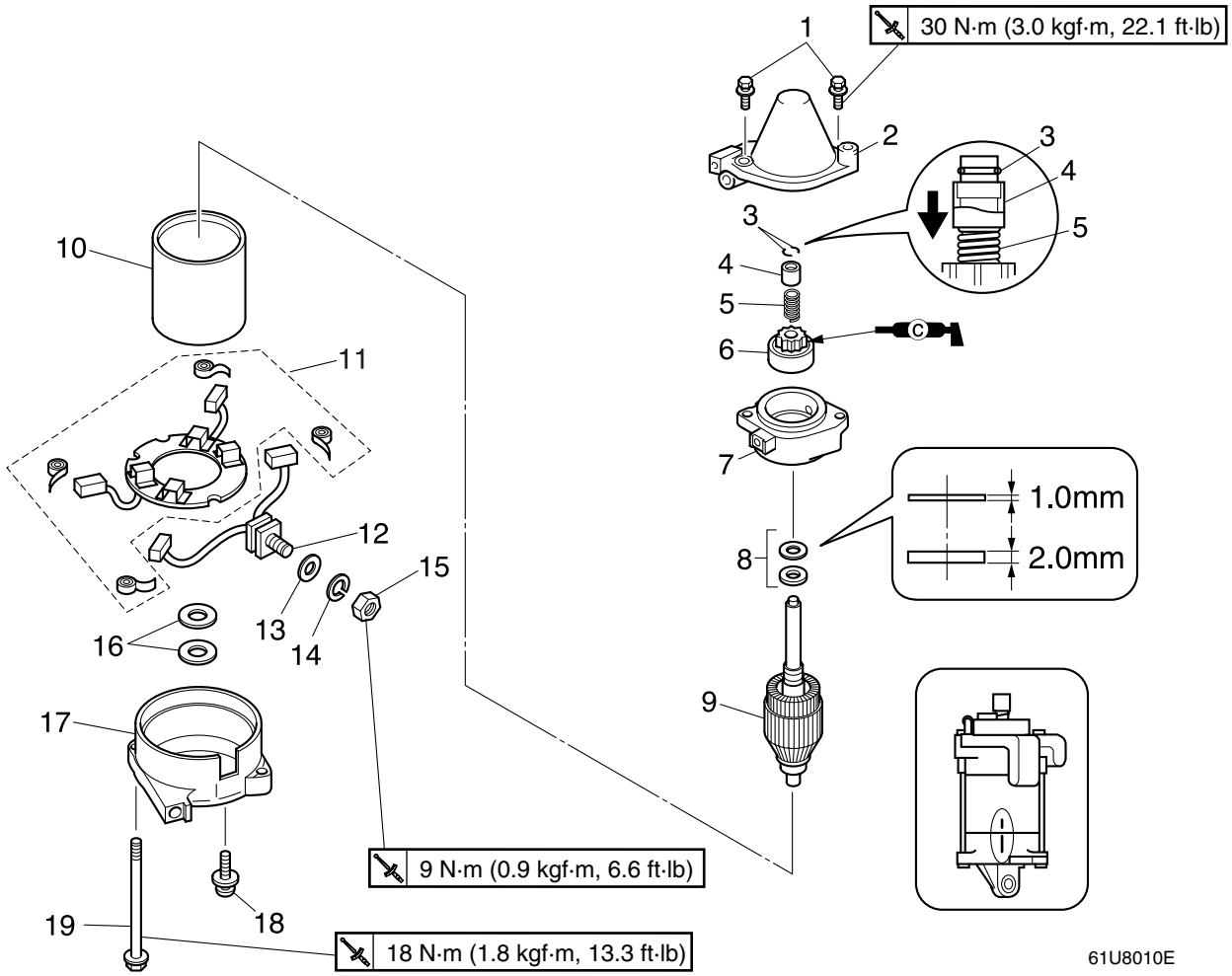
Checking the neutral switch (WH)

1. Check the neutral switch for continuity. Replace if there is no continuity.

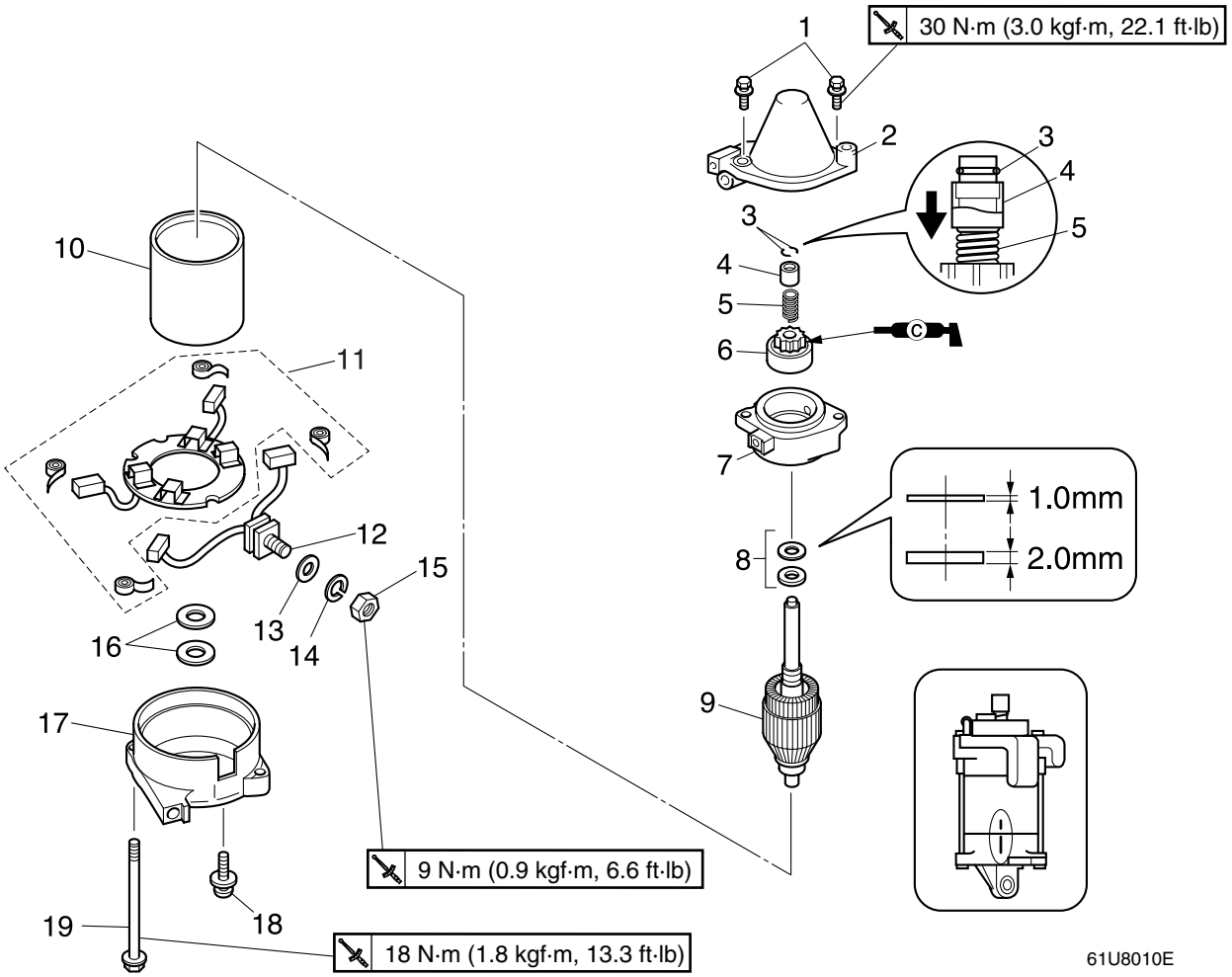


Switch position	Lead color	
	Brown (Br)	Brown (Br)
Free ⓐ		
Push ⓑ	○	○

Starter motor (WH, E, ET)



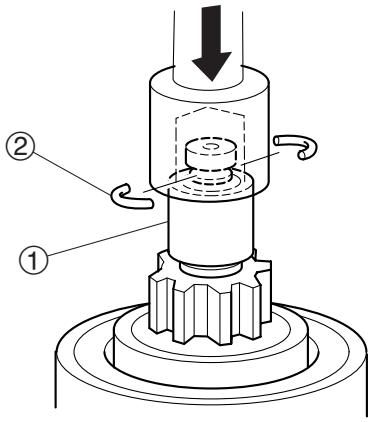
No.	Part name	Q'ty	Remarks
1	Bolt	2	M8 × 25 mm
2	Starter motor bracket	1	
3	Clip	2	
4	Pinion stopper	1	
5	Spring	1	
6	Pinion	1	
7	Front bracket	1	
8	Washer	—	
9	Armature	1	
10	Stator	1	
11	Brush holder	1	
12	Brush	1	
13	Washer	1	
14	Washer	1	
15	Nut	1	
16	Washer	2	
17	Rear bracket	1	



No.	Part name	Q'ty	Remarks
18	Screw	2	
19	Bolt	2	M6 × 115 mm

Removing the starter motor pinion

1. Slide the pinion stopper ① down using the box wrench, and then remove the clips ②.



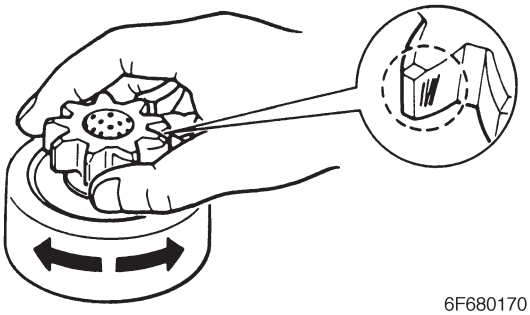
6S380195

2. Remove the starter motor pinion.

Checking the starter motor pinion

1. Check the teeth of the pinion. Replace if cracked or worn.

2. Check the pinion for smooth operation. Replace pinion if necessary.



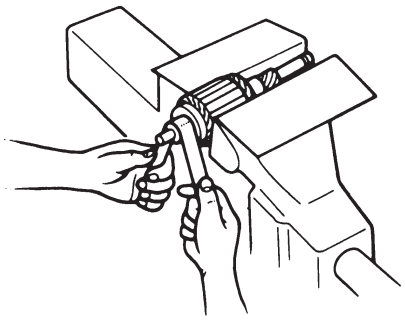
6F680170

NOTE:

Turn the pinion counterclockwise to check that it operates smoothly and turn it clockwise to check that it locks in place.

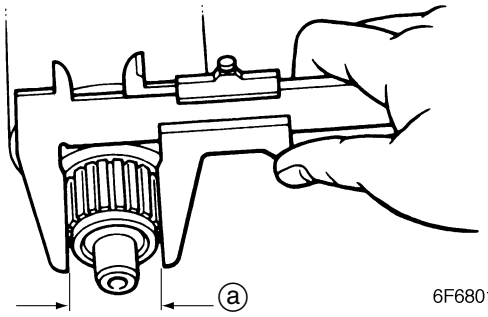
Checking the armature

1. Check the commutator for dirt. Clean with 600 – grit sandpaper and compressed air if necessary.



6G480220

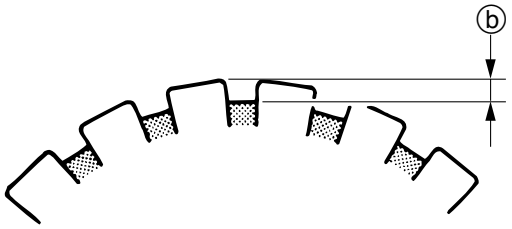
2. Measure the commutator diameter ⓐ. Replace the armature if below specification limit.



6F680175

Standard diameter ⓐ:
33.0 mm (1.30 in)
Wear limit:
32.0 mm (1.26 in)

3. Measure the commutator undercut ⓑ. Replace the armature if below specification limit.

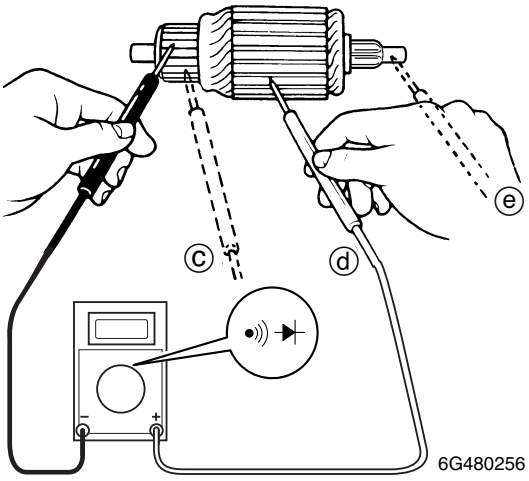


6F680180

Standard undercut ⓑ:
0.8 mm (0.03 in)
Wear limit :
0.2 mm (0.01 in)

8

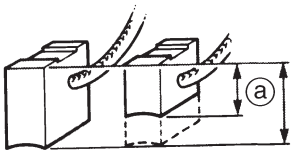
4. Check the armature for continuity. Replace the armature if not shown as below chart.



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

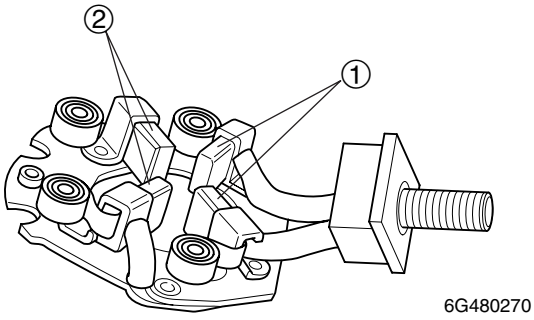
Checking the brush

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



Standard length:
17.0 mm (0.67 in)
Wear limit ⓐ:
10.0 mm (0.39 in)

2. Check the brush holder assembly for continuity. Replace the brush holder if not shown as below chart.



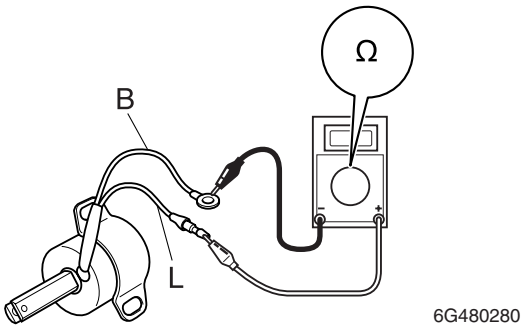
Brush continuity:	
Brush ① – Brush ②	No continuity

Checking the starter motor operation

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

Checking the choke solenoid

1. Disconnect the choke solenoid leads.
2. Connect the digital circuit tester to the choke solenoid leads.
3. Measure the resistance of the choke solenoid. Replace the choke solenoid if out of specification.

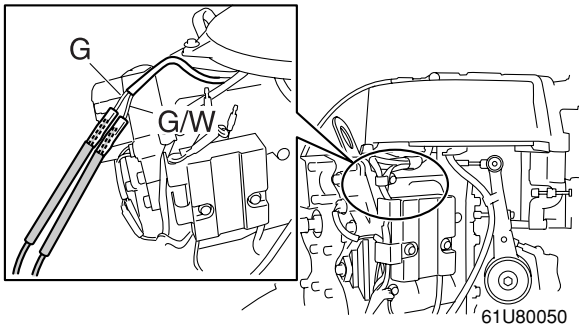


Choke solenoid resistance:
3.4–4.0 Ω

Charging system

Checking the lighting coil

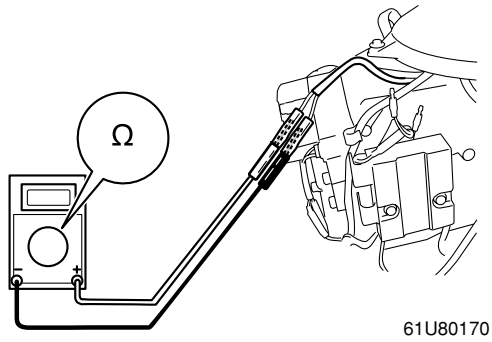
1. Disconnect the lighting coil connector.
2. Connect the probe to the lighting coil.
3. Measure the lighting coil output peak voltage. Replace the stator assembly if less than specification.



Lighting coil output peak voltage: Green (G) – Green/white (G/W)

r/min	Unloaded		
	Cranking	1,500	3,500
DC V	8.0	31.0	72.0

4. Connect the digital circuit tester to the lighting coil connector.

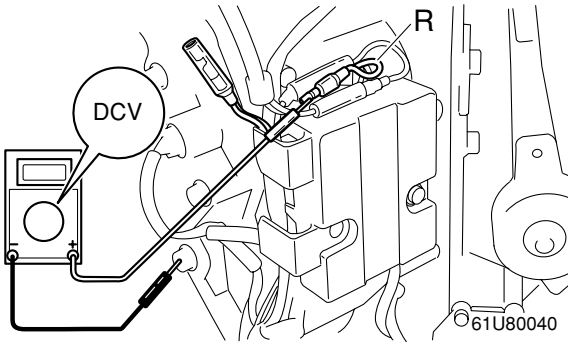


5. Measure the lighting coil resistance. Replace the stator assembly if out of specification.

Lighting coil resistance (reference data):
Green(G) – Green/white (G/W)
0.36–0.54 Ω at 20°C (68°F)

Checking the Rectifier Regulator

1. Disconnect the Rectifier Regulator (R) connector, then connect the digital circuit tester to Rectifier Regulator (R) connector and ground
2. Measure the Rectifier Regulator output peak voltage. If less than specification, measure the lighting coil output peak voltage. Replace the Rectifier Regulator if the output peak voltage of the lighting coil is more than specification.



NOTE:
Do not use the peak voltage adaptor when measuring the output peak voltage of the Rectifier Regulator.

Rectifier Regulator output peak voltage: Red (R) – Ground (B)

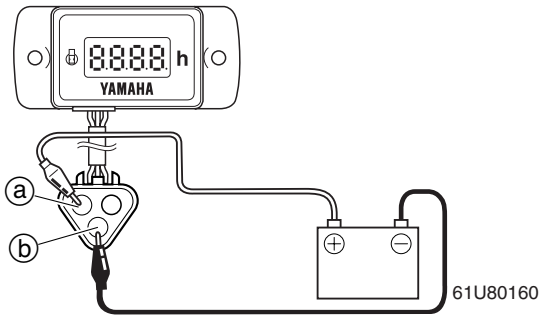
r/min	Unloaded	
	1,500	3,500
DC V	13	13

8

Checking the hour meter

1. Disconnect the hour meter coupler from the wiring harness.

2. Connect the positive battery lead to the yellow (Y) terminal ⓐ, also connect the negative battery lead to the black (B) terminal ⓑ, and then check that the hour meter displayed the all segments which has been illuminated for 2 seconds. Replace the hour meter if there is no illuminated.



TRBL SHTG ?

Troubleshooting

Troubleshooting the power unit 9-1
Troubleshooting the power unit.....9-1
Troubleshooting the PTT unit.....9-6
Troubleshooting the lower unit.....9-7

9

Troubleshooting the power unit

Troubleshooting the power unit (trouble code not available)

The trouble shooting when a trouble code is not available consists of the following 4 items.
Symptom 1: Specific trouble conditions.
Symptom 2: Trouble conditions of an area or individual part.
Cause 1: The content considered as the trouble factors of symptom 2.
Cause 2: The content considered as the trouble causes of cause 1 (described if necessary).

Symptom 1: Engine does not crank

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Manual starter does not operate	Gear shift not in the neutral position	—	Shift the gear shift lever to neutral.	3-7
	Broken spiral spring	—	Disassemble and check the spiral spring.	5-14
	Start-in-gear protection system malfunction	—	Check and adjust or replace the start-in-gear protection cable.	3-4
Starter motor does not operate	Gear shift not in the neutral position	—	Shift the remote control lever to neutral.	3-7
	Discharged battery	—	Check the battery for electrolyte level, gravity and voltage.	3-14
	Loose connection of battery terminal	—	Check the battery terminal connection.	—
	Blown fuse (20A)	—	Check the fuse (20A).	8-9
	Starter relay malfunction	—	Check the starter relay.	8-11
	Engine start switch malfunction	—	Check the engine start switch.	8-10
	Short, open, or loose connection in starter motor circuit	—	Check the wiring harness continuity.	*1
	Starter motor malfunction	—	Disassemble and check the starter motor.	8-14

*1 See the wiring diagram

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Manual starter or starter motor operates, but the engine does not crank	Stuck piston	—	Disassemble and check the power unit.	5-17
	Piston lock due to water or oil in the combustion chamber			
	Salt buildup on the drive shaft and bushing	—	Disassemble and check the upper case.	7-13

Symptom 1: Engine will not start (engine cranks)

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
—	Deterioration or dirty fuel	—	Replace the new fuel.	—
Fuel not supplied	Fuel supplied to the carburetor improperly	Fuel filter malfunction	Check the fuel filter for clog.	3-2
		Fuel joint malfunction	Check the fuel joint pressure.	4-17
		Fuel pump malfunction	Check the fuel pump.	4-16
	Carburetor malfunction	—	Adjust and check the carburetor.	4-12
Spark plug does not spark	Engine stop lanyard switch malfunction	—	Check for continuity.	8-10
	Spark plug malfunction	Spark plug gap improperly	Check the spark plug gap and condition.	3-3
	Short, open or loose connection in ignition coil circuit and ground circuit	—	Check the wiring harness continuity.	*1
	Ignition coil malfunction	Ignition coil resistance out of specifications	Change the ignition coil and check the ignition spark.	5-8 8-6
	CDI unit malfunction	CDI unit output peak voltage less than specifications	Measure the charge coil output peak voltage and resistance.	8-8
			Change the CDI unit and check the ignition spark.	5-8 8-6

*1 See the wiring diagram

9

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Spark plug does not spark	Pulser coil malfunction	Pulser coil output peak voltage less than specifications	Measure the pulser coil resistance.	8-8
			Change the pulser coil and check the ignition spark.	5-4 8-6
	Charge coil malfunction	Charge coil output peak voltage less than specifications	Measure the charge coil resistance.	8-8
			Change the stator assembly and check the ignition spark.	5-4 8-6
Low compression pressure	Cylinder head gasket malfunction	—	Check the compression pressure.	5-1
	Reed valves malfunction	—	Disassemble and check the reed valves.	5-24
	Scratched piston or wear the piston rings	—	Check the compression pressure and disassembling the power unit.	5-1 5-35
	Scratched cylinder wall			

Symptom 1: Unstable engine idle speed, poor acceleration, poor performance

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
—	Throttle cable adjusting improperly	—	Check and adjust the throttle cable.	3-6
	Throttle link length improperly	—	Check and adjust the throttle link length.	3-5
Fuel not supplied properly	Fuel supplied to the carburetor improperly	Fuel filter malfunction	Check the fuel filter for clog.	3-2
		Fuel joint malfunction	Check the fuel joint pressure.	4-17
		Fuel pump malfunction	Check the fuel pump.	4-16
	Carburetor malfunction	Pilot screw settings improperly	Check and adjust the pilot screw settings.	4-13
		Throttle valve stuck or damage	Disassemble and check the carburetor.	4-12
		Jet or nozzle clogged and or float damaged		

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Fuel not supplied properly	Carburetor malfunction	Float height improperly	Disassemble and check the carburetor.	4-12
Spark plug sparks improperly	Spark plug malfunction	Spark plug gap improperly	Check the spark plug gap and condition.	3-3
	Short, open or loose connection in ignition coil circuit and ground circuit	—	Check the wiring harness continuity.	*1
	Ignition coil malfunction	Ignition coil resistance out of specifications	Change the ignition coil and check the ignition spark.	5-8 8-6
	CDI unit malfunction	CDI unit output peak voltage less than specifications	Measure the charge coil output peak voltage and resistance.	8-8
			Change the CDI unit and check the ignition spark.	5-8 8-6
Low compression pressure	Cylinder head gasket malfunction	—	Check the compression pressure.	5-1
	Reed valves malfunction	—	Disassemble and check the reed valves.	5-24
	Scratched piston or wear the piston rings	—	Check the compression pressure and disassembling the power unit.	5-1 5-35
	Scratched cylinder wall			

*1 See the wiring diagram

9

Symptom 1: Limited engine speed (below 2,000 r/min)

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
• Buzzer comes on • Overheat warning indicator comes on • Cooling water does not discharge from the cooling water pilot hole	Clogged cooling water inlet	—	Check the cooling water inlet.	3-4
	Water pump malfunction	Water pump impeller malfunction	Check the impeller.	6-5
			Check the Woodruff key.	6-5
		Water leakage from water pump housing	Check the water pump housing.	6-5
			Check the insert cartridge.	6-5
			Check the outer plate cartridge.	6-5
	Clogged cooling water passage	—	Check the cooling water passage (exhaust guide, upper case and water tube).	7-13
	Thermostat malfunction	—	Check the thermostat.	3-3

Troubleshooting the PTT unit

Symptom 1: PTT unit does not operate

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
PTT relay does not operate	Short, open, or loose connection of the wiring harness	—	Check the wiring harness continuity.	*1
	PTT relay malfunction	—	Check the PTT relay.	7-57
PTT motor does not operate	Discharge battery	—	Check the battery.	3-14
	Loose connection of the battery terminal	—	Check the battery terminal.	—
	Blown fuse (20A)	—	Check the fuse (20A).	7-57
	Short, open, or loose connection of the PTT motor lead	—	Check the PTT motor lead.	*1
	PTT motor malfunction	—	Disassemble and check the PTT motor.	7-39
Oil pressure does not increase	Manual valve opened	Manual valve malfunction	Check the manual valve for open.	—
	Insufficient PTT fluid	—	Add sufficient fluid.	3-10
	PTT fluid leakage	—	Check the PTT unit for leakage.	7-35
	Clogged filter	—	Disassemble and check the PTT unit.	7-44 7-50
	Clogged fluid passage			

*1 See the wiring diagram

9

Symptom 1: PTT unit does not hold the outboard motor up

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
—	Manual valve opened	Manual valve malfunction	Check the manual valve for open.	—
	Insufficient PTT fluid	—	Add sufficient fluid.	3-10
	PTT fluid leakage	—	Check the PTT unit for leakage.	7-35
	Clogged fluid passage	Main valves does not operate	Disassemble and check the PTT unit.	7-44

Troubleshooting the lower unit

Symptom 1: Shift mechanism of the forward gear and reverse gear does not operate properly

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
—	Remote control box malfunction	—	Check the remote control box.	—
	Shift cable and shift cable end malfunction	—	Check the shift cable and shift cable end.	3-7
			Adjust the shift cable.	3-7
	Shift rod operation malfunction	—	Disassemble the lower case and check the shift rod joint.	6-5
		Shift rod connection malfunction	Check the shift rod connection.	6-5

A.

Adjusting the ignition timing stopper.....5-53
Adjusting the start-in-gear protection (MH, WH).....3-4
Adjusting the throttle cable.....3-6
Adjusting the timing plate.....5-52
Adjusting the trim sensor cam (ET).....7-33
Aft view.....8-4
After test run.....1-17
Applicable model.....1-5
Assembling the PTT motor.....7-41
Assembling the PTT unit.....7-52
Assembling the bearing housing.....5-41
Assembling the carburetor.....4-13
Assembling the clamp bracket (MH, WH, E).....7-26
Assembling the crankshaft.....5-40
Assembling the drive shaft housing.....6-16
Assembling the forward gear.....6-15
Assembling the fuel pump.....4-17
Assembling the gear pump housing.....7-46
Assembling the lower case.....6-15
Assembling the manual starter (MH, WH).....5-15
Assembling the oil seal housing.....5-41
Assembling the piston and connecting rod assembly.....5-42
Assembling the power unit.....5-42
Assembling the propeller shaft assembly.....6-9
Assembling the propeller shaft housing...6-10
Assembling the swivel bracket (MH, WH, E).....7-25
Assembling the tiller handle.....7-4
Assembling the tilt piston and trim piston.....7-51
Assembling the upper case.....7-13

B.

Backlash.....6-26
Bleeding the PTT unit.....7-55
Bleeding the PTT unit (built-in).....7-56
Bottom cowling.....7-5
Bracket.....3-10
Break-in.....1-16

C.

Carburetor.....4-6
Changing the gear oil.....3-12
Charging system.....8-16
Checking relief valve.....7-45
Checking the CDI unit.....8-7
Checking the PCV.....5-26
Checking the PTT fluid level (ET).....3-10
Checking the PTT motor.....7-40
Checking the PTT operation (ET).....3-10
Checking the PTT relay.....7-57
Checking the PTT system (ET).....1-15
Checking the Rectifier Regulator.....8-16
Checking the anode.....3-13
Checking the armature.....8-14
Checking the battery (WH, E, ET).....3-14
Checking the bearing.....5-35, 6-14
Checking the brush.....8-15
Checking the carburetor.....4-12
Checking the charge coil.....8-8
Checking the choke solenoid.....8-15
Checking the choke solenoid (E, ET).....3-9
Checking the compression pressure.....5-1
Checking the connecting rod big end side clearance.....5-39
Checking the connecting rod small end axial play.....5-39
Checking the control link and throttle link position.....3-5
Checking the cooling water passage.....3-4
Checking the cooling water pilot hole.....1-16
Checking the crankshaft.....5-39
Checking the cylinder bore.....5-37
Checking the cylinder head.....5-29
Checking the drive pawl (MH, WH).....5-15
Checking the drive shaft.....6-14
Checking the electrical component.....8-1
Checking the engine idle speed.....3-6
Checking the engine start switch (WH, E, ET).....8-10
Checking the engine start switch and engine stop lanyard switch.....1-15
Checking the engine stop lanyard switch.....8-10
Checking the exhaust cover.....5-26
Checking the filter.....7-41
Checking the fuel filter.....3-2
Checking the fuel joint.....4-17
Checking the fuel joint and fuel hose (fuel joint-to-carburetor).....3-2
Checking the fuel pump.....4-16
Checking the fuel system.....1-12
Checking the fuse.....7-57
Checking the fuse (WH, E, ET).....8-9
Checking the gear oil.....1-12
Checking the gear oil level.....3-11
Checking the gear pump housing.....7-45
Checking the gear shift and throttle operation.....1-14
Checking the gear shift operation.....3-7
Checking the hour meter.....8-17

Checking the hydraulic pressure 7-35
Checking the ignition coil 8-7
Checking the ignition spark gap 8-6
Checking the ignition timing 3-8
Checking the internal anode 5-38
Checking the lighting coil 8-16
Checking the lower case 6-15
Checking the lower unit for air leakage 3-13
Checking the main valve 7-45
Checking the neutral switch (WH) 8-11
Checking the outboard motor mounting height 1-12
Checking the pinion and forward gear 6-14
Checking the piston clearance 5-37
Checking the piston diameter 5-36
Checking the piston pin 5-38
Checking the piston pin boss bore 5-38
Checking the piston ring 5-37
Checking the piston ring side clearance 5-38
Checking the propeller 3-13
Checking the propeller shaft 6-9
Checking the propeller shaft housing 6-9
Checking the pulser coil 8-8
Checking the reed valve 5-24
Checking the remote control cable (Remote control model) 1-13
Checking the reservoir 7-45
Checking the spark plug 3-3
Checking the spark plug cap 8-6
Checking the spiral spring (MH, WH) 5-15
Checking the starter motor operation 8-15
Checking the starter motor pinion 8-14
Checking the starter relay (WH, E, ET) ...8-11
Checking the starter rope (MH, WH) 5-15
Checking the steering system 1-14
Checking the thermostat 3-3
Checking the thermoswitch 8-9
Checking the throttle cable and shift cable 7-4
Checking the tilt cylinder and trim cylinder 7-51
Checking the tilt operation (MH, WH, E) 3-11
Checking the top cowling 3-2
Checking the trim sensor 7-57
Checking the upper case 7-13
Checking the water pump and shift rod 6-5
Clamp bracket and swivel bracket 7-20
Control system 3-4
Crankcase 5-31
Cylinder head 5-27

D.

Dimension 2-15
Disassembling the PTT motor 7-39
Disassembling the bearing housing 5-34
Disassembling the carburetor 4-12
Disassembling the crankshaft 5-36
Disassembling the drive shaft housing 6-13
Disassembling the forward gear 6-13
Disassembling the fuel pump 4-16
Disassembling the gear pump housing ...7-44
Disassembling the lower case 6-14
Disassembling the manual starter (MH, WH) 5-14
Disassembling the oil seal housing 5-35
Disassembling the piston and connecting rod assembly 5-35
Disassembling the propeller shaft assembly 6-8
Disassembling the propeller shaft housing 6-8
Disassembling the swivel bracket (MH, WH, E) 7-25
Disassembling the tilt cylinder and trim cylinder 7-50
Disassembling the upper case 7-12
Disassembly and assembly 1-4
Drive shaft and lower case 6-12

E.

Electrical (115B, 140B models) 2-12
Electrical (E115A models) 2-7
Electrical component 8-2
Exhaust cover 5-25

F.

Fire prevention 1-3
Fuel hose and breather hose 4-1
Fuel line 4-3
Fuel pump 4-15
Fuel system 3-2

G.

Gear pump 7-42
General 3-13
General specification 2-1
General torque 2-21
Good working practice 1-4

H.

Hose routing 4-1
How to use this manual 1-1

I.

Identification....1-5
Ignition and ignition control system....8-6
Installing the PCV....5-26
Installing the PTT unit (ET)....7-31
Installing the clamp bracket (ET)....7-31
Installing the drive shaft....6-16
Installing the lower unit....6-19
Installing the power unit....5-49
Installing the propeller shaft housing....6-17
Installing the steering arm....7-18
Installing the upper case....7-19
Installing the water pump and shift rod....6-18
Intake manifold....5-22

L.

Lower unit....3-11, 6-1
Lower unit (115B, 140B models)....2-12
Lower unit (E115A models)....2-7
Lubricating the outboard motor....3-14
Lubricating the throttle gear....7-4

M.

Maintenance interval chart....3-1
Maintenance specification....2-5
Manual format....1-1
Measuring the forward and reverse gear backlash....6-26
Measuring the peak voltage....8-1

P.

PTT electrical system....7-57
PTT motor....7-38
PTT unit....7-34
Parts, lubricant, and sealant....1-3
Port view....8-2
Power unit....3-3, 5-1
Power unit (115B, 140B models)....2-10
Power unit (E115A models)....2-5
Predelivery check....1-12
Propeller selection....1-11
Propeller shaft housing....6-6
Propeller size....1-11

R.

Removing the PTT unit (ET)....7-30
Removing the clamp bracket (ET)....7-30
Removing the clamp bracket (MH, WH, E)....7-24
Removing the crankcase....5-34
Removing the cylinder head....5-29
Removing the drive shaft....6-13
Removing the electrical component....5-20
Removing the exhaust cover....5-26
Removing the flywheel magnet....5-19
Removing the intake manifold....5-24
Removing the lower unit....6-4
Removing the piston, connecting rod assembly and crankshaft assembly....5-35
Removing the power unit....5-17
Removing the propeller shaft housing assembly....6-8
Removing the starter motor pinion....8-14
Removing the steering arm....7-17
Removing the water pump and shift rod....6-5

S.

Safety while working....1-3
Selecting the forward gear shim....6-24
Selecting the pinion shim....6-23
Selecting the reverse gear shim....6-25
Selection....1-11
Self-protection....1-3
Serial number....1-5
Shimming....6-22, 6-23
Special service tool....1-6
Specified torque....2-19
Starboard view....8-3
Starter motor (WH, E, ET)....8-12
Starting system....8-9
Symbol....1-2
Synchronizing the carburetor....3-5

T.

Test run....1-16
Tightening torque....2-19
Tiller handle....7-1
Tilt cylinder and trim cylinder....7-48
Top cowling....3-2
Top view....8-5
Troubleshooting the PTT unit....9-6
Troubleshooting the lower unit....9-7
Troubleshooting the power unit....9-1

U.

Upper case, steering arm....7-8

V.

Ventilation....1-3

WIRING DIAGRAM
E115AMH

① Thermoswitch
② Spark plug
③ Ignition coil
④ CDI unit
⑤ Charge coil
⑥ Lighting coil
⑦ Pulser coil
⑧ Rectifier Regulator
⑨ Engine stop lanyard switch
⑩ Over revolution

Color code

B : Black
Br : Brown
G : Green
Gy : Gray
L : Blue
P : Pink
R : Red
W : White
B/R : Black/red
B/W : Black/white
G/W : Green/white
W/B : White/black
W/G : White/green
W/L : White/blue
W/R : White/red
W/Y : White/yellow

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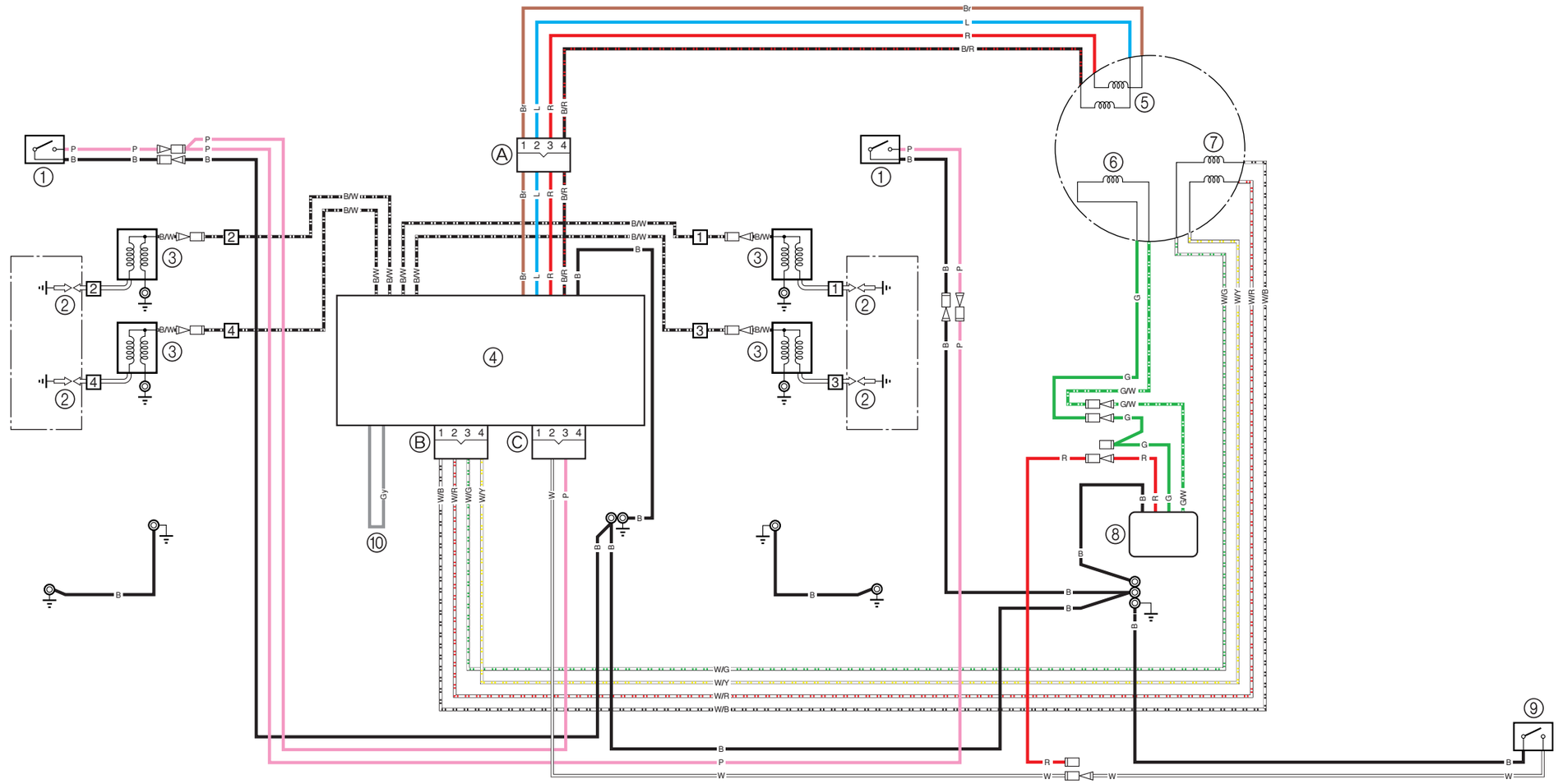
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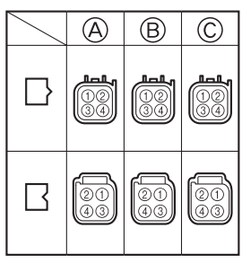
A
B
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1 2 3 4

WIRING DIAGRAM
E115AE, E115AWH, 115BE

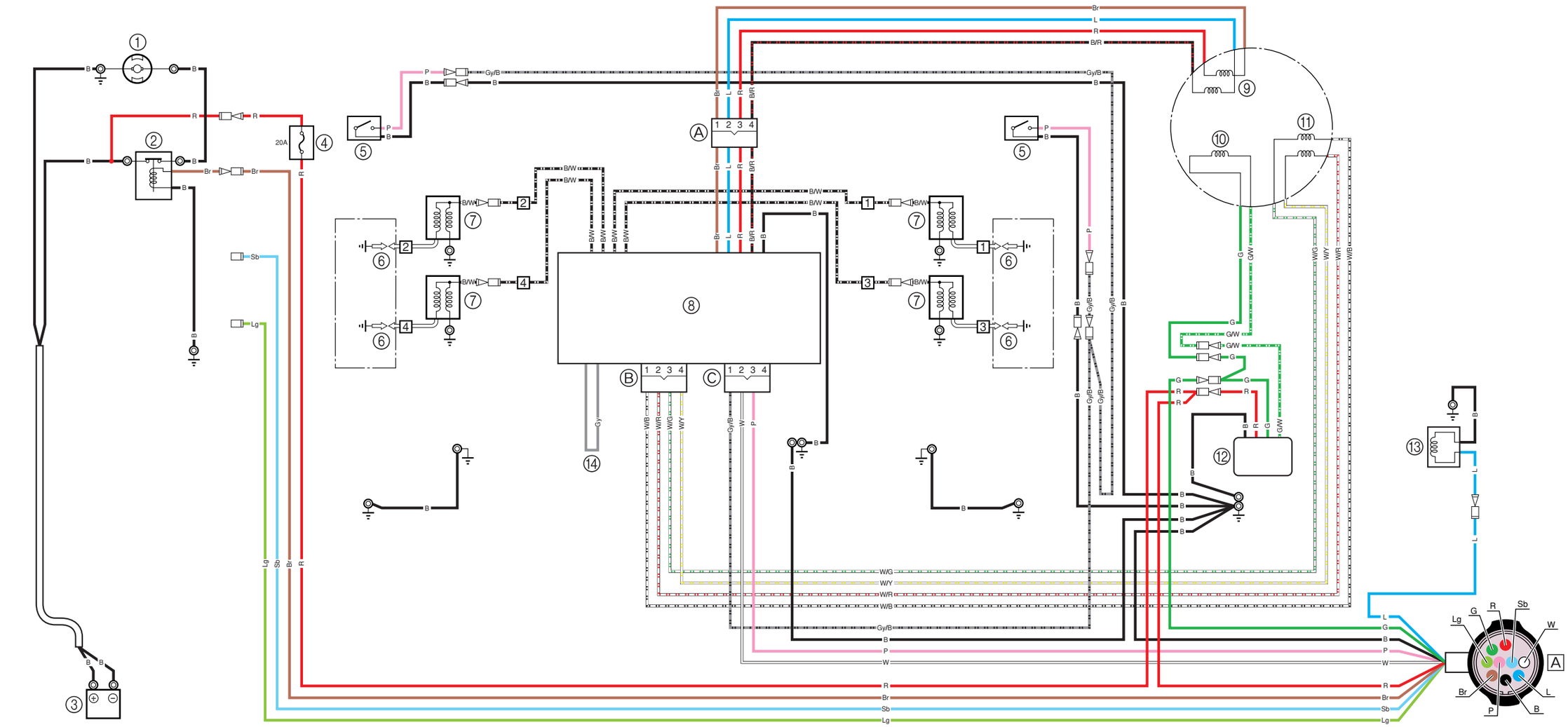
① Starter motor
② Starter relay
③ Battery
④ Fuse (20A)
⑤ Thermoswitch
⑥ Spark plug
⑦ Ignition coil
⑧ CDI unit
⑨ Charge coil
⑩ Lighting coil
⑪ Pulser coil
⑫ Rectifier Regulator
⑬ Choke solenoid (E115AE, 115BE)
⑭ Over revolution

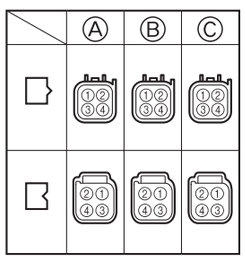
[A] To remote control box/switch panel

Color code

B : Black
Br : Brown
G : Green
Gy : Gray
L : Blue
Lg : Light green
P : Pink
R : Red
Sb : Sky blue
W : White
B/R : Black/red
B/W : Black/white
Gy/B : Gray/black
G/W : Green/white
W/B : White/black
W/G : White/green
W/L : White/blue
W/R : White/red
W/Y : White/yellow

E115AE,E115AWH,115BE





WIRING DIAGRAM
E115AET, 115BET, 140BET

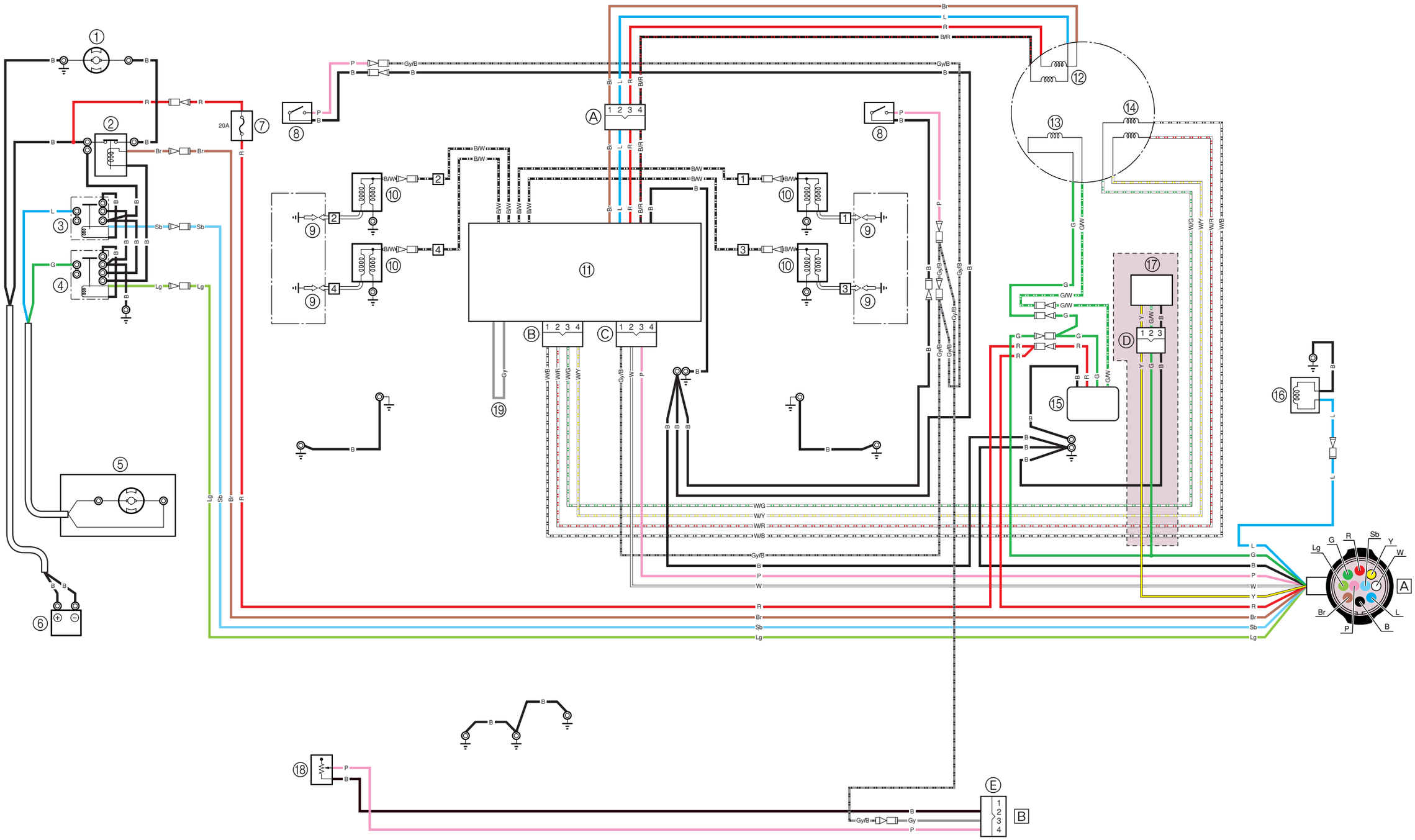
① Starter motor
② Starter relay
③ PTT relay (up)
④ PTT relay (down)
⑤ PTT motor
⑥ Battery
⑦ Fuse (20A)
⑧ Thermoswitch
⑨ Spark plug
⑩ Ignition coil
⑪ CDI unit
⑫ Charge coil
⑬ Lighting coil
⑭ Pulser coil
⑮ Rectifier Regulator
⑯ Choke solenoid
⑰ Hour meter (E115A)
⑱ Trim sender
⑲ Over revolution

[A] To remote control box/switch panel
[B] To trim meters

Color code

B : Black
Br : Brown
G : Green
Gy : Gray
L : Blue
Lg : Light green
P : Pink
R : Red
Sb : Sky blue
W : White
Y :Yellow
B/R : Black/red
B/W : Black/white
Gy/B : Gray/black
G/W : Green/white
W/B : White/black
W/G : White/green
W/L : White/blue
W/R : White/red
W/Y : White/yellow

E115AET,115BET,140BET



	A	B	C	D	E
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▯	②①④③	②①④③	②①④③	②①③	①②③④