

**WORLDWIDE**

**Z200N**  
**LZ200N**

**USA, CANADA**

**Z200Y**  
**LZ200Y**

# **SERVICE MANUAL**

**290369**

**68F-28197-Z9-A1**

## PREFACE

This manual has been prepared by the Yamaha Motor Company, Ltd. 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 the Yamaha Motor Company, Ltd. 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.

## CAUTION

### USE UNLEADED STRAIGHT GASOLINE ONLY

- Gasoline containing lead can cause performance loss and engine damage.
- Do not use gasoline mixed with oil (premix).
- Use YAMALUBE 2 stroke outboard oil or another 2-stroke engine oil with a BIA-certified TC-W3 rate.

**Z200N, LZ200N**

**SERVICE MANUAL**

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**1st Edition, October 1999**

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**Printed in Japan**

**P/N 68F-28197-Z9-A1**

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## HOW TO USE THIS MANUAL

### MANUAL FORMAT

All of the procedures in this manual are organized in a sequential, step-by-step format. The information has been compiled to provide the mechanic with an easy to read, handy reference that contains comprehensive explanations of all disassembly, repair, assembly, and check operations.

In this revised format, the condition of a faulty component will precede an arrow symbol and the course of action required will follow the symbol, e.g.,

- Bearings  
Pitting/scratches → Replace.

To assist you in finding your way through this manual, the section title and major heading is given at the top of every page.

### MODEL INDICATION

Multiple models are mentioned in this manual and their model indications are noted as follows.

Model name	Z200NETO	LZ200NETO
USA and Canada name	Z200TR	LZ200TR
Indication	Z200NETO	LZ200NETO

### ILLUSTRATIONS

The illustrations within this service manual represent all of the designated models.

### CROSS REFERENCES

The cross references have been kept to a minimum. Cross references will direct you to the appropriate section or chapter.

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## IMPORTANT INFORMATION

In this Service Manual particularly important information is distinguished in the following ways.

 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.

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### CAUTION:

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

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### NOTE:

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

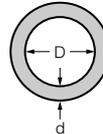
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## HOW TO USE THIS MANUAL

- ① The main points regarding removing/installing and disassembling/assembling procedures are shown in the exploded views.
- ② The numbers in the exploded views indicate the required sequence of the procedure and should be observed accordingly.
- ③ Symbols are used in the exploded views to indicate important aspects of the procedure. A list of meanings for these symbols is provided on the following page.
- ④ It is important to refer to the job instruction charts at the same time as the exploded views. These charts list the sequence that the procedures should be carried out in, as well as providing explanations on part names, quantities, dimensions and important points relating to each relevant task.

Example:

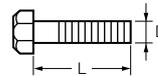
O-ring size  $39.5 \times 2.5$  mm: inside diameter (D)  $\times$  ring diameter (d)



- ⑤ In addition to tightening torques, the dimensions of the bolts or screws are also mentioned.

Example:

Bolt or screw size  $10 \times 25$  mm : diameter (D)  $\times$  length (L)



- ⑥ In addition to the exploded views and job instruction charts, this manual provides individual illustrations when further explanations are required to explain the relevant procedure.

**LOWR** LOWER UNIT (REGULAR ROTATION MODELS) E

**LOWER UNIT (REGULAR ROTATION MODELS)**  
REMOVING/INSTALLING THE LOWER UNIT

Order	Job/Part	Qty	Remarks
1	Speedometer hose	1	
2	Propeller nut	1	
3	Washer	1	
4	Propeller	1	
5	Spacer	1	
6	Bolt	1	
7	Trim tab	1	
8	Bolt	1	(with washer)
9	Bolt	6	(with washer)
10	Lower unit	1	
11	Dowel pin	2	

For installation, reverse the removal procedure.

6-1

**LOWR** DRIVE SHAFT (REGULAR ROTATION MODELS) E

**REMOVING THE DRIVE SHAFT**

Loosen:

- Pinion nut

	Drive shaft holder..... ①
	YB-06201 / 90890-06520..... ②
	Pinion nut holder..... ③
	90890-06505
	Pinion nut holder attachment..... ④
	90890-06507

**DISASSEMBLING THE DRIVE SHAFT HOUSING ASSEMBLY**

Remove:

- Needle bearing

	Bearing/oil seal attachment.... ①
	YB-06196 / 90890-06610..... ②
	Driver rod..... ③
	YB-06071 / 90890-06652

**DISASSEMBLING THE FORWARD GEAR ASSEMBLY**

1. Remove:

- Tapered roller bearing

	Bearing separator..... ①
	YB-06219 / 90890-06534

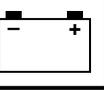
**CAUTION:**

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

2. Remove:

- Needle bearing

	Slide hammer..... ①
	YB-06096
	Guide plate..... ②
	90890-06501
	Guide plate stand..... ③
	90890-06538
	Bearing puller..... ④
	90890-06535
	Small universal claws..... ⑤
	90890-06536

① <b>GEN INFO</b> 	② <b>SPEC</b> 
③ <b>INSP ADJ</b> 	④ <b>FUEL</b> 
⑤ <b>POWR</b> 	⑥ <b>LOWR</b> 
⑦ <b>BRKT</b> 	⑧ <b>ELEC</b> 
⑨ <b>TRBL ANLS</b> 	⑩ 
⑪ 	⑫ 
⑬ 	⑭ 
⑮ 	⑯ 
⑰ 	⑱ 
⑲ 	⑳ 
㉑  271	㉒  242
㉓  572	㉔  SS

## SYMBOLS

Symbols ① to ⑨ are designed as thumb-tabs to indicate the content of a chapter.

- ① General information
- ② Specifications
- ③ Periodic inspections and adjustments
- ④ Fuel system
- ⑤ Power unit
- ⑥ Lower unit
- ⑦ Bracket unit
- ⑧ Electrical systems
- ⑨ Trouble analysis

Symbols ⑩ to ⑮ indicate specific data.

- ⑩ Special tool
- ⑪ Specified liquid
- ⑫ Specified engine speed
- ⑬ Specified torque
- ⑭ Specified measurement
- ⑮ Specified electrical value  
[Resistance (Ω), Voltage (V), Electric current (A)]

Symbol ⑯ to ⑱ in an exploded diagram indicate the grade of lubricant and the location of the lubrication point.

- ⑯ Apply Yamaha 2-stroke outboard motor oil (TC-W3)
- ⑰ Apply water resistant grease (Yamaha grease A, Yamaha marine grease)
- ⑱ Apply molybdenum disulfide oil

Symbols ⑲ to ㉔ in an exploded diagram indicate the grade of the sealing or locking agent and the location of the application point.

- ⑲ Apply Gasket Maker®
- ⑳ Apply Yamabond #4 (Yamaha bond number 4)
- ㉑ Apply LOCTITE® No. 271 (Red LOCTITE)
- ㉒ Apply LOCTITE® No. 242 (Blue LOCTITE)
- ㉓ Apply LOCTITE® No. 572
- ㉔ Apply silicon sealant

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<b>POWER UNIT</b>	 POWR	<b>5</b>
<b>LOWER UNIT</b>	 LOWR	<b>6</b>
<b>BRACKET UNIT</b>	 BRKT	<b>7</b>
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<b>TROUBLE ANALYSIS</b>	 TRBL ANLS	<b>9</b>



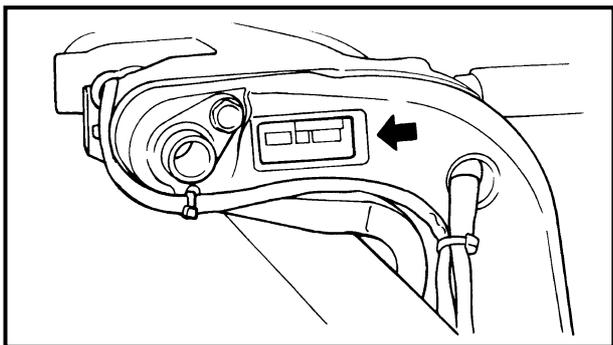
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# CHAPTER 1

## GENERAL INFORMATION

<b>IDENTIFICATION</b> .....	1-1
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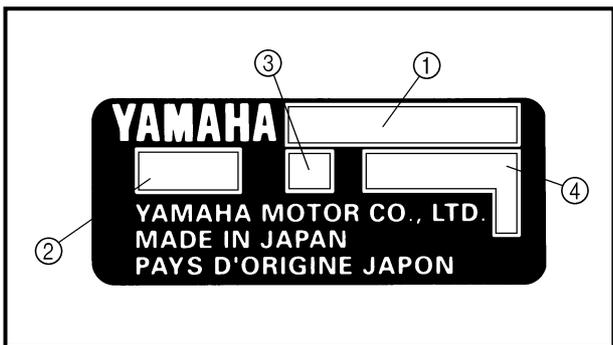


**IDENTIFICATION**

**SERIAL NUMBER**

The outboard motor's serial number is stamped on a label which is attached to the port side of the clamp bracket.

**NOTE:** \_\_\_\_\_  
If the serial number label is removed, "VOID" marks will be appear on the label.



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

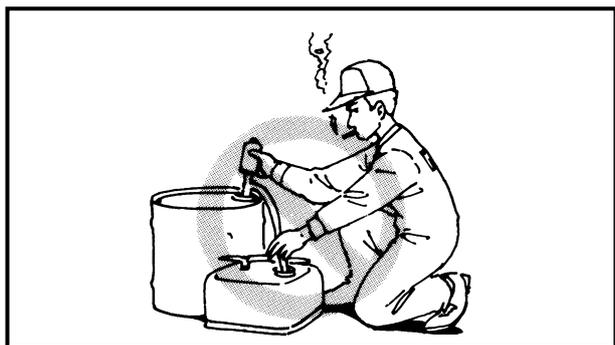
**STARTING SERIAL NUMBERS**

The starting serial number blocks are as follows:

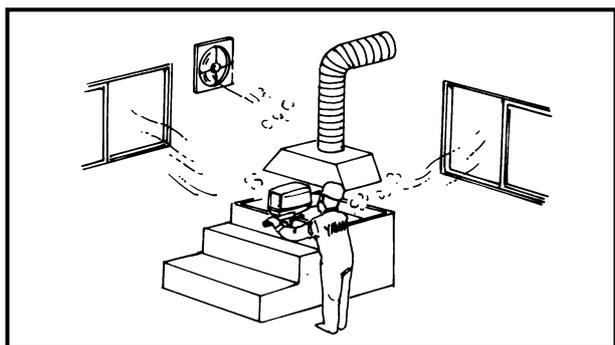
Model name			Approved model code	Starting serial number
Worldwide	USA	Canada		
Z200NETO	Z200TR	Z200TR	6G6	X: 100101 -
LZ200NETO	LZ200TR	—	6K1	X: 100101 -

**SAFETY WHILE WORKING**

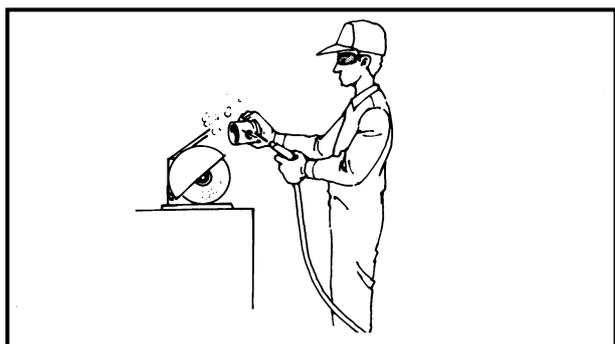
The procedures given in this manual are those recommended by Yamaha to be followed by Yamaha dealers and their mechanics.

**FIRE PREVENTION**

Gasoline (petrol) is highly flammable. Petroleum vapor is explosive if ignited. Do not smoke while handling gasoline and keep it away from heat, sparks and open flames.

**VENTILATION**

Petroleum vapor is heavier than air and is deadly if inhaled in large quantities. Engine exhaust gases are harmful to breathe. When test-running an engine indoors, maintain good ventilation.

**SELF-PROTECTION**

Protect your eyes with suitable safety glasses or safety goggles, when grinding or when doing any operation which may cause particles to fly off. Protect hands and feet by wearing safety gloves or protective shoes if appropriate to the work you are doing.

**OILS, GREASES AND SEALING FLUIDS**

Use only genuine Yamaha oils, greases and sealing fluids or those recommended by Yamaha.

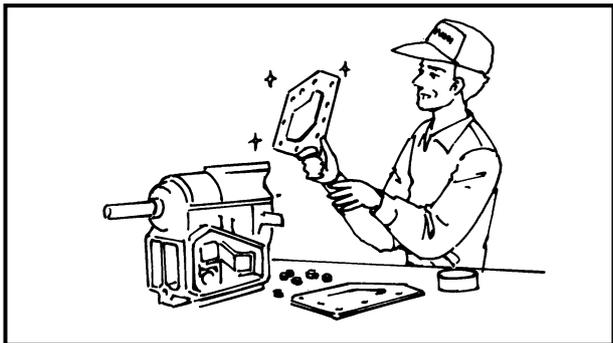
Under normal conditions of use, there should be no hazards from the use of the lubricants mentioned in this manual, but safety is all-important, and by adopting good safety practices, any risk is minimized. A summary of the most important precautions is as follows:

1. While working, maintain good standards of personal and industrial hygiene.
2. Clothing which has become contaminated with lubricants should be changed as soon as practicable, and laundered before further use.
3. Avoid skin contact with lubricants; do not, for example, place a soiled wiping-rag in your pocket.
4. Hands and any other part of the body which have been in contact with lubricants or lubricant-contaminated clothing, should be thoroughly washed with hot water and soap as soon as practicable.
5. To protect the skin, the application of a suitable barrier cream to the hands before working, is recommended.
6. A supply of clean lint-free cloths should be available for wiping purposes.



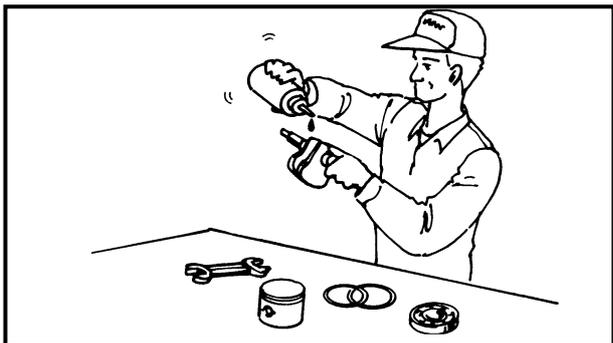
### **GOOD WORKING PRACTICES**

1. The right tools  
Use the recommended special tools to protect parts from damage. Use the right tool in the right manner – do not improvise.
2. Tightening torque  
Follow the tightening torque instructions. When tightening bolts, nuts and screws, tighten the large sizes first, and tighten inner-positioned fixings before outer-positioned ones.



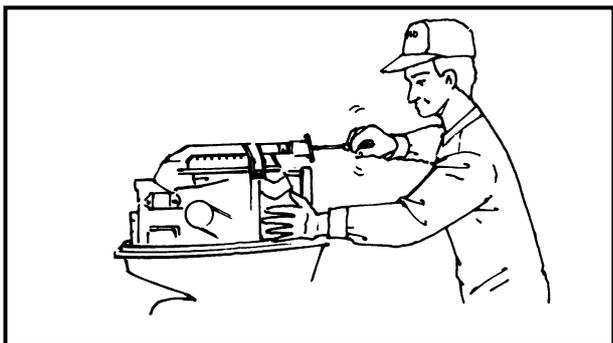
**3. Non-reusable items**

Always use new gaskets, packings, O-rings, split-pins, circlips, etc., on reassembly.



**DISASSEMBLY AND ASSEMBLY**

1. Clean parts with compressed air when disassembling.
2. Oil the contact surfaces of moving parts before assembly.



3. After assembly, check that moving parts operate normally.

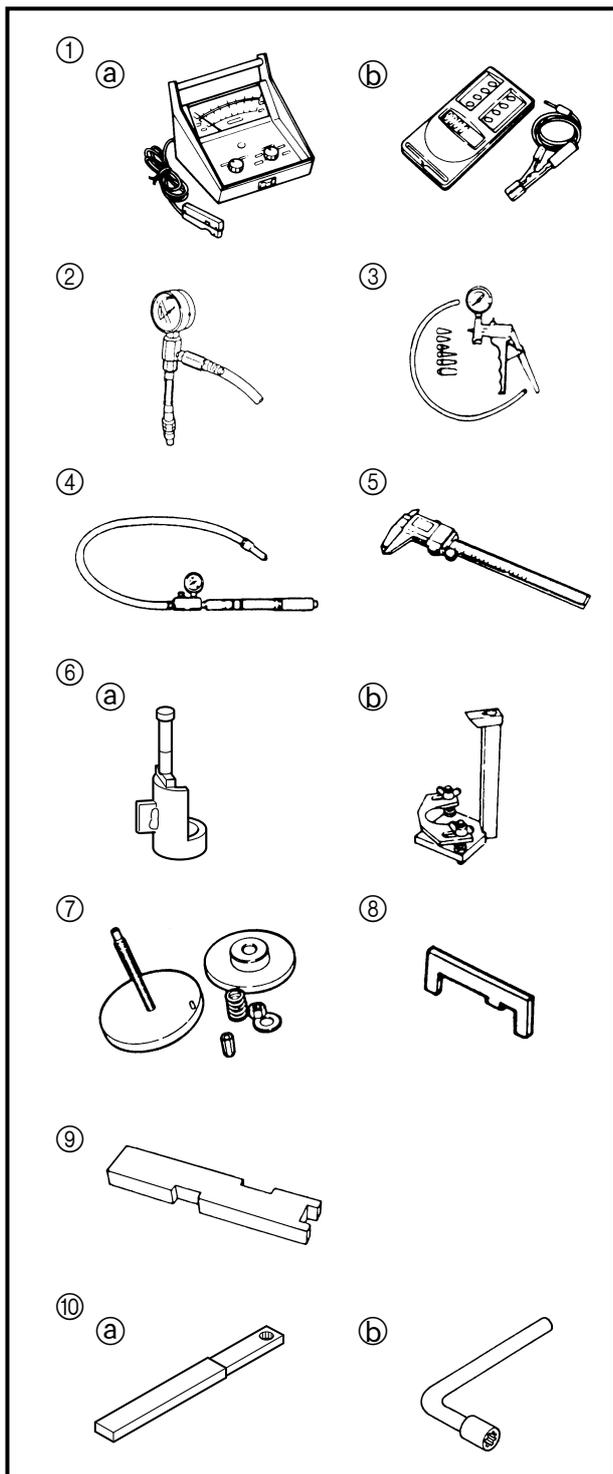
4. Install bearings with the manufacturer's markings on the side exposed to view, and liberally oil the bearings.
5. When installing oil seals, apply a light coating of water-resistant grease to the outside diameter.

**SPECIAL TOOLS**

Using the correct special tools recommended by Yamaha, will aid the work and enable accurate assembly and tune-up. Improvising and using improper tools can damage the equipment.

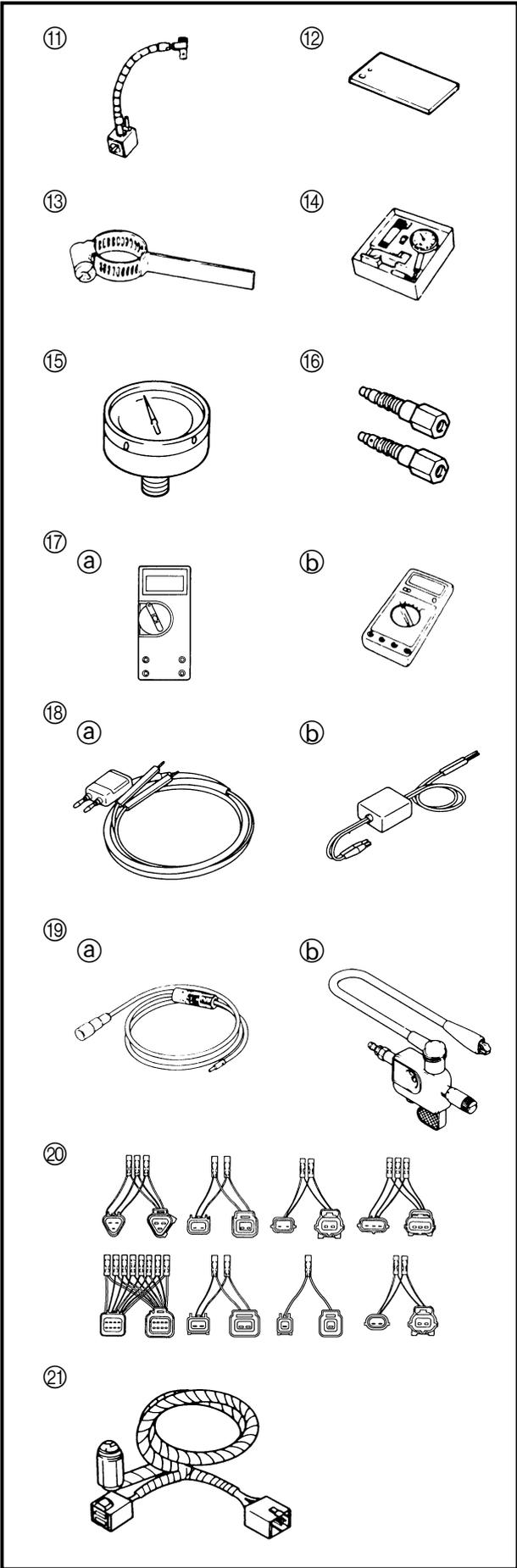
**NOTE:**

- For USA and Canada, use part numbers that start with "J-", "YB-", "YM-", "YS-", "YU-" or "YW-".
- For worldwide, use part numbers that start with "90890-".



**MEASURING**

- ① Tachometer  
P/N. YU-08036-A ..... (a)  
90890-06760 ..... (b)
- ② Fuel pressure gauge  
P/N. YB-06766  
90890-06786
- ③ Mity vac  
P/N. YB-35956  
90890-06756
- ④ Pressure tester  
P/N. YB-35956  
90890-06762
- ⑤ Digital caliper  
P/N. 90890-06704
- ⑥ Pinion height gauge  
P/N. YB-34432-7, YB-34432-11 ..... (a)  
90890-06702 ..... (b)
- ⑦ Shimming gauge  
P/N. YB-34446-1, YB-34446-3,  
YB-34446-4, YB-34446-7,  
YB-34446-8
- ⑧ Shimming gauge  
P/N. YB-34468-1, YB-34468-2
- ⑨ Shimming plate  
P/N. 90890-06701
- ⑩ Shift rod wrench  
P/N. YB-06052 ..... (a)  
90890-06052 ..... (b)



- ⑪ Magnetic base  
P/N. YU-34481  
90890-06705
- ⑫ Magnetic base attaching plate  
P/N. YB-07003  
90890-07003
- ⑬ Backlash indicator  
P/N. YB-06265  
90890-06706
- ⑭ Dial gauge set  
P/N. YU-03097  
90890-01252
- ⑮ Hydraulic pressure gauge  
P/N. 90890-06776
- ⑯ Up-relief valve attachment  
P/N. 90890-06773  
Down-relief valve attachment  
P/N. 90890-06774
- ⑰ Digital tester  
P/N. J-39299 ..... ①  
90890-06752 ..... ②
- ⑱ Peak voltage adapter  
P/N. YU-39991 ..... ①  
90890-03169 ..... ②
- ⑲ Spark gap tester  
P/N. YM-34487 ..... ①  
90890-06754 ..... ②
- ⑳ Test harness  
P/N. YB-06443, YB-06767,  
YB-06768, YB-06769,  
YB-06779, YB-06787,  
YB-06788  
90890-06757, 90890-06767,  
90890-06768, 90890-06769,  
90890-06779, 90890-06787,  
90890-06788
- ㉑ Diagnostic indicator  
P/N. YB-06765  
90890-06765

- ② Diagnostic unit  
Check the engine condition by using a personal computer when it is connected to the Electronic Control Unit (ECU).

**Diagnosis:**

Indicates the name of a failed part.

**Diagnosis record:**

Displays the name of the part whose diagnosis is detected, along with the engine running total hours.

**Static test:**

Checks operation sound and ignition sparks by activating the electric fuel pump, electric oil pump, injector and spark plug while the engine is stopped.

**Dynamic test:**

Checks the engine for operation through any change in its speed by stopping the operation of the spark plug on each cylinder while the engine is in the neutral position.

**Engine monitor:**

Indicates information on the sensors and switches by converting it to each value while the engine is running.

**Data logger:**

Indicates in numeric values the engine speed, throttle opening voltage, oxygen density sensor voltage, water temperature sensor voltage and fuel pressure sensor voltage that occurred within 13 minutes.

**ECU information:**

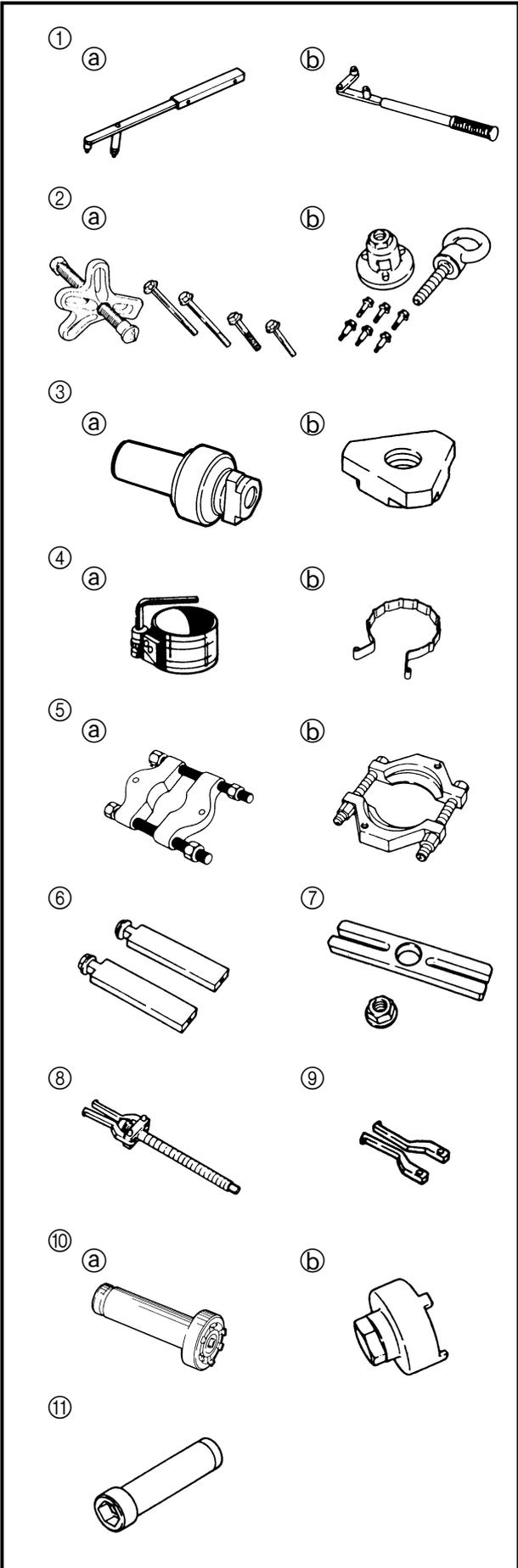
Displays the ECU identification number.

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

To use any of these functions a personal computer, connection cables, adapter and communication software are required.

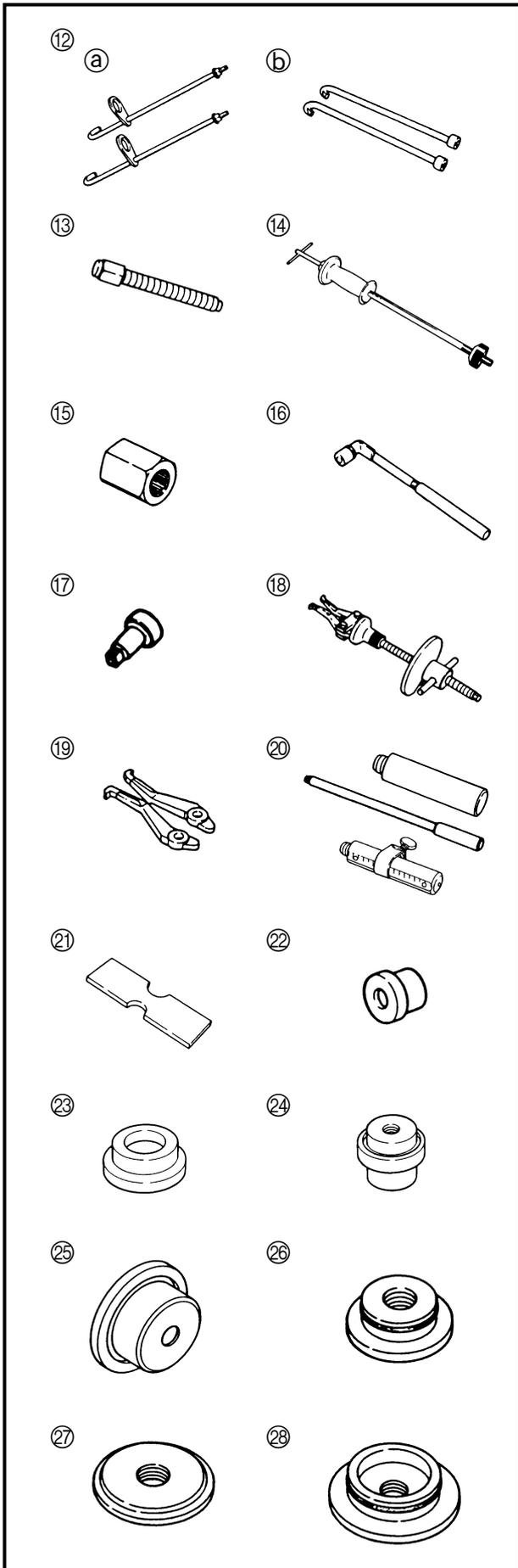
The personal computer should be compatible with Windows® 95/98, equipped with a CD-ROM and the RS232C terminal.

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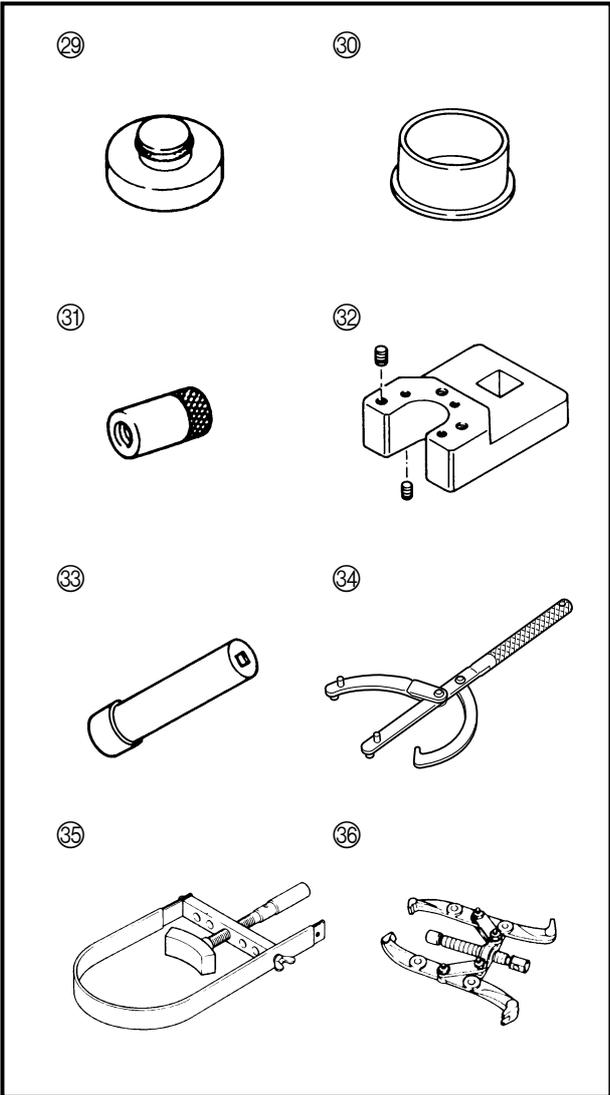


**REMOVING AND INSTALLING**

- ① Flywheel magnet assembly holder  
P/N. YB-06139 ..... (a)  
90890-06522 ..... (b)
- ② Universal puller  
P/N. YB-06117 ..... (a)  
90890-06521 ..... (b)
- ③ Bearing/oil seal attachment  
P/N. YB-06205 ..... (a)  
90890-06663 ..... (b)
- ④ Piston ring compressor  
P/N. YU-33294 ..... (a)  
90890-06530 ..... (b)
- ⑤ Bearing separator  
P/N. YB-06219 ..... (a)  
90890-06534 ..... (b)
- ⑥ Guide plate stand  
P/N. 90890-06538
- ⑦ Guide plate  
P/N. 90890-06501
- ⑧ Bearing puller  
P/N. 90890-06535
- ⑨ Small universal claws  
P/N. 90890-06536
- ⑩ Ring nut wrench  
P/N. YB-34447 ..... (a)  
90890-06512 ..... (b)
- ⑪ Ring nut wrench extension  
P/N. 90890-06513



- ⑫ Propeller shaft housing puller  
P/N. YB-06207 ..... ①  
90890-06502 ..... ②
- ⑬ Center bolt  
P/N. 90890-06504
- ⑭ Slide hammer  
P/N. YB-06096  
90890-06531
- ⑮ Drive shaft holder  
P/N. YB-06201  
90890-06520
- ⑯ Pinion nut holder  
P/N. 90890-06505
- ⑰ Pinion nut holder attachment  
P/N. 90890-06508
- ⑱ Bearing puller  
P/N. YB-06029, YB-06247  
90890-06523
- ⑲ Large universal claws  
P/N. 90890-06532
- ⑳ Driver rod  
P/N. YB-06071  
90890-06604, 90890-06605,  
90890-06606, 90890-06652
- ㉑ Bearing/oil seal depth plate  
P/N. 90890-06603
- ㉒ Bearing/oil seal attachment  
P/N. YB-06194, YB-06196, YB-06246
- ㉓ Bearing/oil seal attachment  
P/N. YB-06195, YB-06258
- ㉔ Bearing/oil seal attachment  
P/N. YB-06200
- ㉕ Bearing/oil seal attachment  
P/N. YB-06336
- ㉖ Bearing/oil seal attachment  
P/N. 90890-06610, 90890-06612,  
90890-06631, 90890-06633,  
90890-06636, 90890-06653,  
90890-06654
- ㉗ Bearing/oil seal attachment  
P/N. 90890-06619, 90890-06622
- ㉘ Bearing/oil seal attachment  
P/N. 90890-06629



- ②⑨ Bearing/oil seal attachment  
P/N. 90890-06637
- ③⑩ Bearing/oil seal attachment  
P/N. 90890-06659, 90890-06660,  
90890-06661, 90890-06662
- ③① Slide hammer attachment  
P/N. YB-06335  
90890-06514
- ③② End screw wrench  
P/N. YB-06548  
90890-06548
- ③③ End screw wrench  
P/N. YB-06175-1A
- ③④ Universal holder  
P/N. YU-01235  
90890-01235
- ③⑤ Sheave holder  
P/N. YS-1880-A  
90890-01701
- ③⑥ Universal puller  
P/N. YB-06540  
90890-06540



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## **CHAPTER 2 SPECIFICATIONS**

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**GENERAL SPECIFICATIONS**

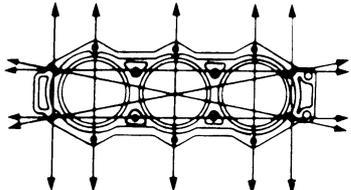
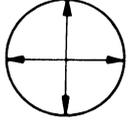
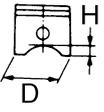
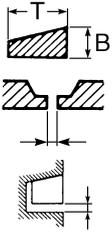
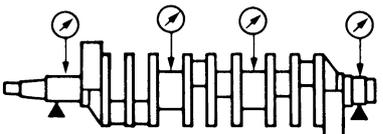
Item	<table border="1"> <tr><td>Worldwide</td></tr> <tr><td>USA</td></tr> <tr><td>Canada</td></tr> </table>		Worldwide	USA	Canada	Unit	Model	
			Worldwide					
			USA					
			Canada					
Z200NETO	LZ200NETO							
Z200TR	LZ200TR							
Z200TR	—							
<b>DIMENSION</b>								
Overall length			mm (in)	792 (31.2)				
Overall width			mm (in)	554 (21.8)				
Overall height (X)			mm (in)	1,782 (70.2)				
Boat transom height (X)			mm (in)	635 (25.0)				
<b>WEIGHT</b>								
(with aluminum propeller) (X)			kg (lb)	218 (480.6)				
(with stainless steel propeller) (X)			kg (lb)	222 (489.4)				
<b>PERFORMANCE</b>								
Maximum output (ISO)			kW (hp) @ 5,000 r/min	147.1 (200)				
Full throttle operating range			r/min	4,500 - 5,500				
Maximum fuel consumption			L (US gal, Imp gal)/hr @ 5,500 r/min	68 (18.0, 15.0)				
<b>POWER UNIT</b>								
Type				2 stroke - V				
Number of cylinders				6				
Displacement			cm <sup>3</sup> (cu. in)	2,596 (158.4)				
Bore × stroke			mm (in)	90.0 × 68.0 (3.54 × 2.68)				
Compression ratio				Cylinders #1 - #4: 6.4 Cylinders #5 - #6: 6.1				
Fuel system				Electronic fuel injection				
Fuel injection system				Sequential injection				
Intake system				Reed valve				
Induction system				Loop charge				
Starting system				Electric				
Ignition control system				Microcomputer				
Alternator output			V - A	12 - 45				
Spark plugs (NGK)				BKR7ES-11				
Cooling system				Water				
Exhaust system				Through propeller boss				
Lubrication system				Oil injection				



Item			Unit	Model	
				Z200NETO	LZ200NETO
				Z200TR	LZ200TR
				Z200TR	—
<b>FUEL AND OIL</b>					
Fuel type			Unleaded regular gasoline		
Fuel rating			86		
			91		
Engine oil type			2-stroke outboard engine oil		
Engine oil grade			TC-W3		
Engine oil capacity (engine oil tank)	L (US qt, Imp qt)		0.9 (0.95, 0.79)		
(sub-oil tank)	L (US qt, Imp qt)		10.5 (11.1, 9.2)		
Gear oil type			Hypoid gear oil SAE 90		
Gear oil total quantity	cm <sup>3</sup> (US oz, Imp oz)		980 (33.1, 34.5)	870 (29.4, 30.6)	
<b>BRACKET</b>					
Trim angle (at 12° boat transom)	Degree		-4 - 16		
Tilt-up angle	Degree		70		
Steering angle	Degree		32 + 32		
<b>DRIVE UNIT</b>					
Gear shift positions			F-N-R		
Gear ratio			1.86 (26/14)		
Reduction gear type			Spiral bevel gear		
Clutch type			Dog clutch		
Propeller shaft type			Spline		
Propeller direction (rear view)			Clockwise	Counterclockwise	
Propeller mark			M	ML	
<b>ELECTRICAL</b>					
Battery capacity	Ah (kC)		100 (360)		
Minimum cold cranking performance	A		512		

\* PON: Pump Octane Number (Research octane + Motor octane)/2  
 RON: Research Octane Number

**MAINTENANCE SPECIFICATIONS  
POWER UNIT**

Item	<table border="1"> <tr><td>Worldwide</td></tr> <tr><td>USA</td></tr> <tr><td>Canada</td></tr> </table>		Worldwide	USA	Canada	Unit	Model	
			Worldwide					
			USA					
			Canada					
Z200NETO	LZ200NETO							
Z200TR	LZ200TR							
Z200TR	—							
<b>CYLINDER HEADS</b>								
Warpage limit			mm (in)	0.1 (0.004)				
 <p>(lines indicate straightedge position)</p>								
<b>CYLINDERS</b>								
Bore size				mm (in)	90.00 - 90.02 (3.543 - 3.544)			
Wear limit				mm (in)	90.1 (3.55)			
Taper limit				mm (in)	0.08 (0.003)			
Out-of-round limit				mm (in)	0.05 (0.002)			
<b>PISTONS</b>								
Piston diameter (D)				mm (in)	89.845 - 89.869 (3.5372 - 3.5381)			
Measuring point (H)				mm (in)	10 (0.4)			
Piston-to-cylinder clearance <Limit>				mm (in)	0.150 - 0.156 (0.0059 - 0.0061)			
Oversize piston diameter				mm (in)	0.206 (0.0081)			
1st			mm (in)	90.11 (3.548)				
2nd			mm (in)	90.36 (3.557)				
<b>PISTON RINGS</b>								
Type				mm (in)	Keystone			
(B)				mm (in)	2.0 (0.079)			
(T)				mm (in)	2.8 (0.110)			
End gap (installed) <Limit>				mm (in)	0.30 - 0.40 (0.012 - 0.016)			
Side clearance			mm (in)	0.60 (0.024)				
0.02 - 0.06 (0.001 - 0.002)			mm (in)	0.02 - 0.06 (0.001 - 0.002)				
<b>CRANKSHAFT</b>								
Runout limit			mm (in)	0.05 (0.002)				
								



Item	Worldwide USA Canada		Unit	Model	
				Z200NETO	LZ200NETO
				Z200TR	LZ200TR
				Z200TR	—
<b>CONNECTING RODS</b>					
Small-end axial play limit (F)		mm (in)	2.0 (0.08)		
Big-end side clearance (E)		mm (in)	0.12 - 0.26 (0.005 - 0.010)		
<b>OIL INJECTION PUMP</b>					
ID mark			68F00		
Bleeding			Screw type		
<b>REED VALVES</b>					
Reed valve stopper height (a)		mm (in)	9.0 ± 0.35 (0.35 ± 0.01)		
Warpage limit (b)		mm (in)	0.2 (0.008)		
<b>THERMOSTATS</b>					
Opening temperature			°C (°F)	48 - 52 (118 - 126)	
Full-open temperature			°C (°F)	60 (140)	
Valve open lower limit			mm (in)	3 (0.12)	
<b>ENGINE SPEED</b>					
Idling speed			r/min	700 ± 30	

**LOWER UNIT**

Item	Model		Unit	
	Worldwide	Z200NETO		LZ200NETO
	USA	Z200TR		LZ200TR
Canada	Z200TR	—		
<b>GEAR BACKLASH</b>				
Pinion - forward gear	mm (in)	0.25 - 0.46 (0.010 - 0.018)	0.21 - 0.43 (0.008 - 0.017)	
Pinion - reverse gear	mm (in)	0.74 - 1.29 (0.029 - 0.051)	0.97 - 1.29 (0.038 - 0.051)	
Pinion 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**

Item	Model		Unit	
	Worldwide	Z200NETO		LZ200NETO
	USA	Z200TR		LZ200TR
Canada	Z200TR	—		
<b>IGNITION SYSTEM</b>				
Ignition timing (#1)	Degree	ATDC 3 - BTDC 17		
Fuse 1	V-A	12-80		
Fuse 2	V-A	12-30		
Fuse 3	V-A	12-20		
Control unit (B/O, B/Y, B/L, B/Br, B/G, B/W – R/Y)				
Output peak voltage lower limit				
@ cranking 1	V	—		
@ cranking 2	V	140		
@ 1,500 r/min	V	205		
@ 3,500 r/min	V	220		
Pulser coil (W/R, W/Y, W/G, W/B, W/L, W/Br – B)				
Output peak voltage lower limit				
@ cranking 1	V	5.0		
@ cranking 2	V	5.0		
@ 1,500 r/min	V	20		
@ 3,500 r/min	V	35		

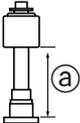
\* Cranking 1: Open circuit voltage.  
Cranking 2: Loaded circuit voltage.



Item	Unit		Model			
			Z200NETO	LZ200NETO		
			Z200TR	LZ200TR		
			Z200TR	—		
<b>IGNITION CONTROL SYSTEM</b>						
Crank position sensor (G/L)	mm (in)	$1.0 \pm 0.5$ ( $0.04 \pm 0.02$ )				
Crank-position-sensor-to-flywheel gap						
Output peak voltage lower limit						
@ cranking 1					V	4.5
@ cranking 2					V	4.0
		V	13			
		V	20			
Engine cooling water temperature sensor						
Resistance (B/Y – B/Y)						
@ 5°C (41°F)	kΩ	128				
@ 20°C (68°F)	kΩ	54 - 69				
@ 100°C (212°F)	kΩ	3.02 - 3.48				
Throttle position sensor						
Input voltage (O – R)	V	4.75 - 5.25				
Output voltage (P – O)	V	$0.50 \pm 0.02$				
Thermo switch (P – B)						
OFF → ON	°C (°F)	84 - 90 (183 - 194)				
ON → OFF	°C (°F)	60 - 74 (140 - 165)				
<b>FUEL CONTROL SYSTEM</b>						
Oxygen density sensor						
Heater resistance (R/W – B)	Ω	2 - 100				
Output voltage (Gy – B/W)	V	0.0 - 1.0				
Atmospheric pressure sensor						
Output voltage (at 101.32 kPa) (P – B)	V	3.2 - 4.6				
Intake air temperature sensor						
Resistance (B/Y – B/Y)	kΩ	1.5 - 4.0				
Injector driver (O/R – Pu/R, O/B – Pu/B, O/Y – Pu/Y, O/G – Pu/G, O/L – Pu/L, O/W – Pu/W)						
Output peak voltage lower limit						
@ cranking 1	V	65				
@ cranking 2	V	60				
@ 1,500 r/min	V	65				
@ 3,500 r/min	V	65				

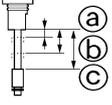
\* Cranking 1: Open circuit voltage.  
 Cranking 2: Loaded circuit voltage.



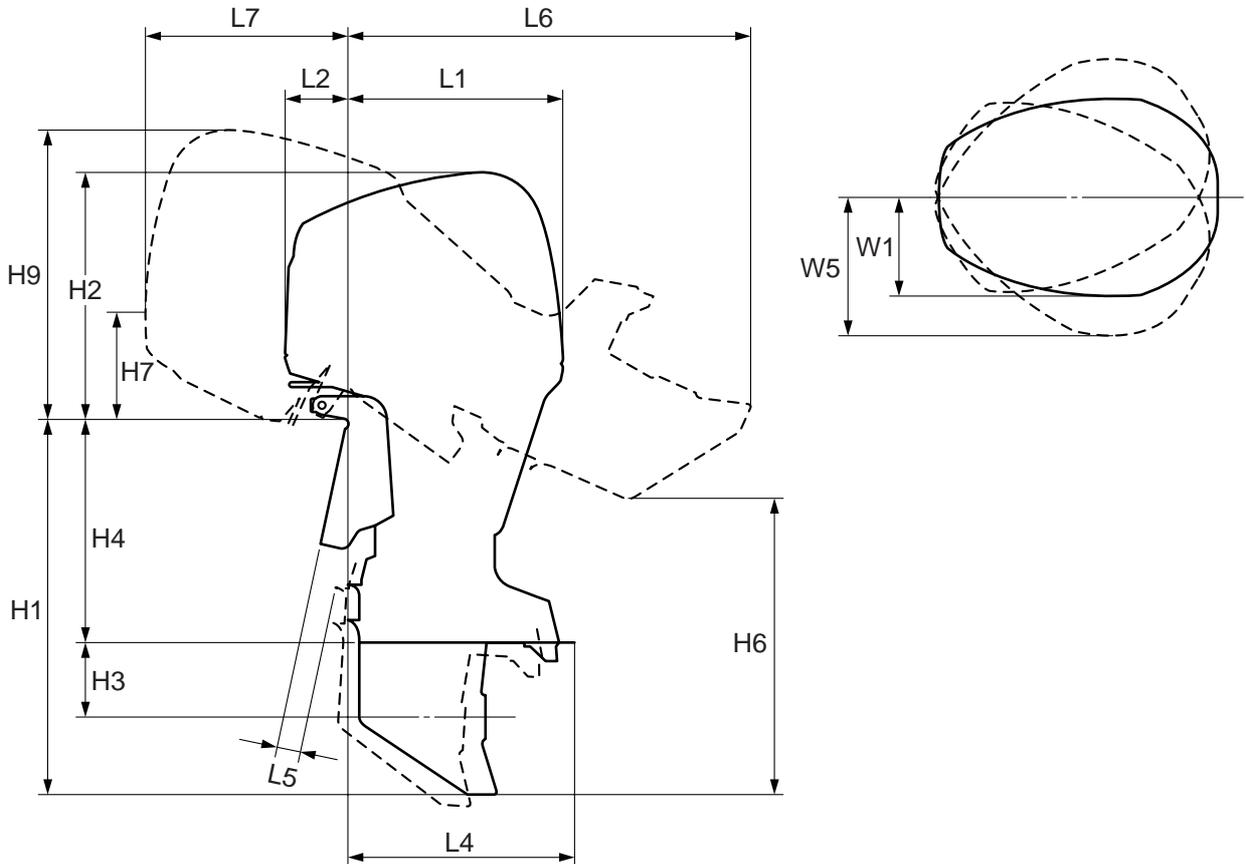
Item			Unit	Model	
				Z200NETO	LZ200NETO
				Z200TR	LZ200TR
				Z200TR	—
Fuel pressure sensor Output voltage (P – B)		V	2.8 - 3.2		
Water detection switch Float position ① "ON"		mm (in)	47		
<b>STARTER MOTOR</b>					
Type			Sliding gear		
Output		kW	1.4		
Cranking time limit		Second	30		
Brushes					
Standard length		mm (in)	15.5 (0.61)		
Wear limit		mm (in)	9.5 (0.37)		
Commutator					
Standard diameter		mm (in)	29.0 (1.14)		
Wear limit		mm (in)	28.0 (1.10)		
Mica					
Standard undercut		mm (in)	0.5 - 0.8 (0.02 - 0.03)		
Wear limit		mm (in)	0.2 (0.01)		
<b>CHARGING SYSTEM</b>					
Rectifier/regulator (R – B)					
Output peak voltage lower limit					
@ cranking 1		V	—		
@ cranking 2		V	7.5		
@ 1,500 r/min		V	12.7		
@ 3,500 r/min		V	12.7		
Lighting coil (G – G)					
Output peak voltage lower limit					
@ cranking 1		V	7.5		
@ cranking 2		V	8.0		
@ 1,500 r/min		V	12		
@ 3,500 r/min		V	12		

\* Cranking 1: Open circuit voltage.  
Cranking 2: Loaded circuit voltage.

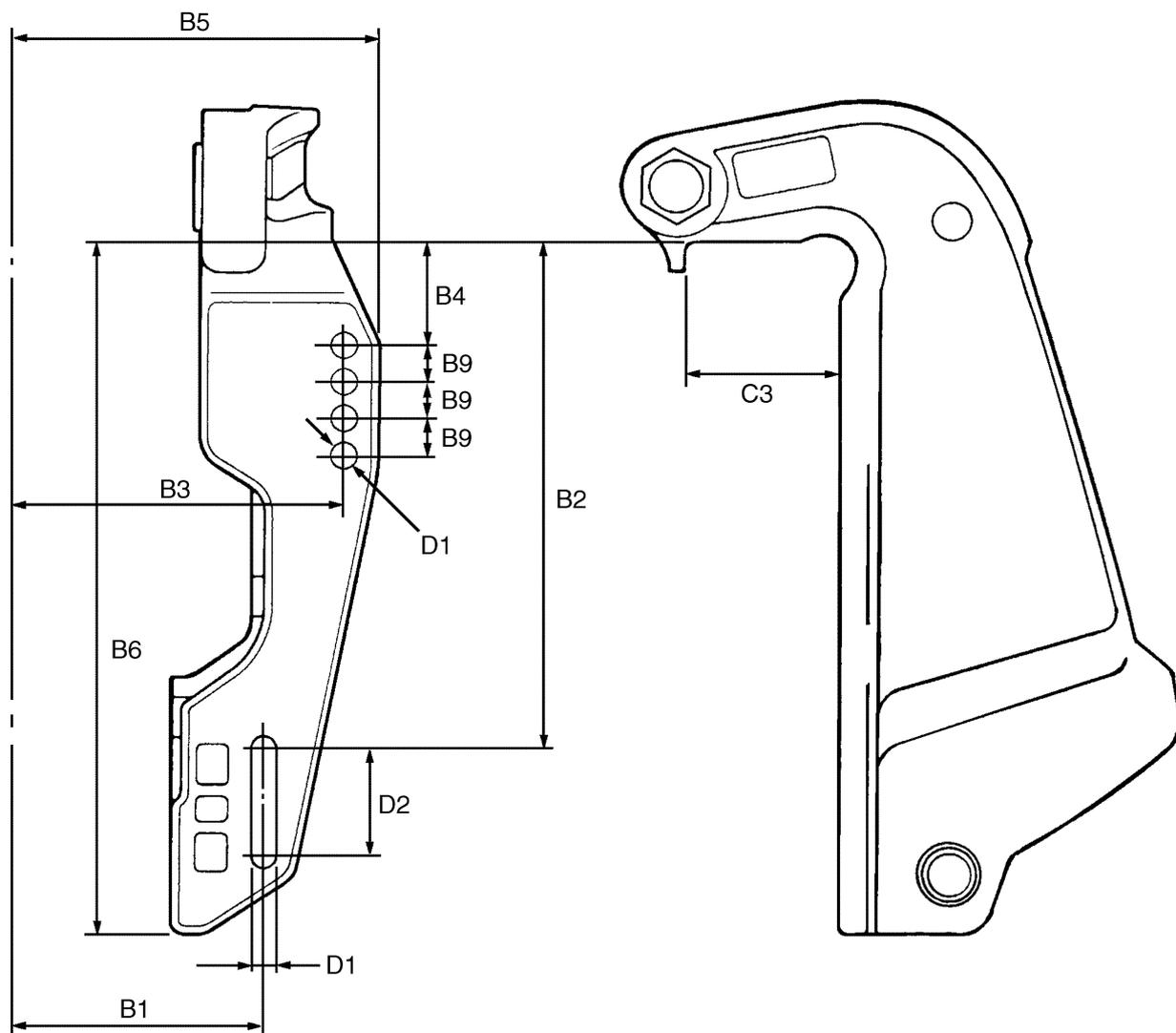


Item	Unit		Model	
			Z200NETO	LZ200NETO
			Z200TR	LZ200TR
			Z200TR	—
<b>OIL FEED PUMP CONTROL SYSTEM</b>				
Oil level sensor (engine oil tank)				
Float position ① "OFF"	mm (in)		3 - 6 (0.12 - 0.24)	
Float position ② "ON"	mm (in)		33 - 36 (1.30 - 1.42)	
Float position ③ "ON"	mm (in)		53 - 56 (2.09 - 2.20)	
Oil level switch (sub-oil tank)				
Float position ④ "ON"	mm (in)		150 - 153 (5.91 - 6.02)	
<b>POWER TRIM AND TILT SYSTEM</b>				
Trim sensor				
Setting resistance		Ω		80 ± 12
Resistance (P - B)		Ω		582 - 873
Resistance (O - B)		Ω		800 - 1,200
<b>POWER TRIM AND TILT MOTOR</b>				
Fluid type				ATF Dexron II
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)
Mica				
Standard undercut		mm (in)		1.35 (0.05)
Wear limit		mm (in)		0.85 (0.03)

**DIMENSIONS**



Symbol	Models		
	Worldwide	Unit	
	USA	Z200NETO	
	Canada	LZ200NETO	
		Z200TR	LZ200TR
		Z200TR	—
L1	mm (in)	613 (24.1)	
L2	mm (in)	180 (7.1)	
L4	mm (in)	646 (25.4)	
L5	mm (in)	69 (2.7)	
L6	mm (in)	1,150 (45.3)	
L7	mm (in)	574 (22.6)	
H1	mm (in)	1,074 (42.3)	
H2	mm (in)	708 (27.9)	
H3	mm (in)	211 (8.3)	
H4	mm (in)	643 (25.3)	
H6	mm (in)	850 (33.4)	
H7	mm (in)	308 (12.1)	
H9	mm (in)	835 (32.9)	
W1	mm (in)	277 (10.9)	
W5	mm (in)	396 (15.6)	



Symbol	Unit	Models	
		Z200NETO	LZ200NETO
		Z200TR	LZ200TR
		Z200TR	—
B1	mm (in)	125.4 (4.9)	
B2	mm (in)	254 (10.0)	
B3	mm (in)	163.5 (6.4)	
B4	mm (in)	50.8 (2.0)	
B5	mm (in)	180 (7.1)	
B6	mm (in)	367 (14.4)	
B9	mm (in)	18.5 (0.7)	
C3	mm (in)	82 (3.2)	
D1	mm (in)	13 (0.5)	
D2	mm (in)	55.5 (2.2)	

## TIGHTENING TORQUES SPECIFIED TORQUES

Part to be tightened		Thread size	Tightening torques		
			Nm	m•kgf	ft•lb
<b>POWER UNIT</b>					
Intake silencer		M6	3	0.3	2.2
Electric oil pump		M6	8	0.8	5.8
Fuel injection unit		M6	10	1.0	7.2
Atmospheric pressure sensor		M6	4	0.4	2.9
Electric oil pump bracket		M6	8	0.8	5.8
Throttle position sensor		M5	4	0.4	2.9
Intake air temperature sensor		M12	8	0.8	5.8
Drive belt tensioner		M10	40	4.0	29
Mechanical fuel pump		M8	23	2.3	17
Fuel rail		M8	23	2.3	17
Fuel injector cap		M8	26	2.6	19
Fuel filter nut holder		M6	8	0.8	5.8
Oil pump		M6	7	0.7	5.1
Emergency switch		—	4	0.4	2.9
Flywheel magnet assembly		M20	190	19	137
Negative battery lead		M8	9	0.9	6.5
Positive battery lead		M8	9	0.9	6.5
Apron		M6	8	0.8	5.8
Power unit mount		M8	21	2.1	15
Starter relay holder		M5	3	0.3	2.2
Oxygen density sensor cover		M6	9	0.9	6.5
Oxygen density sensor bracket		M6	14	1.4	10
Oxygen density sensor		M18	49	4.9	35
Reed valve assembly		M6	10	1.0	7.2
Reed valve		M5	3	0.3	2.2
Reed valve stopper		M3	1	0.1	0.7
Shift position switch		M4	3	0.3	2.2
Spark plug		M14	25	2.5	18
Thermostat cover	1st	M6	5	0.5	3.6
	2nd		11	1.1	8.0
Cylinder head cover	1st	M6	5	0.5	3.6
	2nd		11	1.1	8.0
Engine cooling water temperature sensor		—	15	1.5	11
Cylinder head	1st	M8	15	1.5	11
	2nd		30	3.0	22
Cooling water pressure control valve cover	1st	M6	4	0.4	2.9
	2nd		8	0.8	5.8
Exhaust port outer cover	1st	M6	4	0.4	2.9
	2nd		8	0.8	5.8



Part to be tightened		Thread size	Tightening torques		
			Nm	m•kgf	ft•lb
Crankcase	1st	M8	10	1.0	7.2
	2nd		18	1.8	13
	1st	M10	20	2.0	14
	2nd		40	4.0	29
Connecting rod	1st	M8	19	1.9	14
	2nd		37	3.7	27
	3rd		*		
	4th		19	1.9	14
	5th		37	3.7	27
<b>LOWER UNIT</b>					
Propeller		M18	55	5.5	40
Lower unit		M10	40	4.0	29
Ring nut		—	145	14.5	105
Pinion nut		M22	95	9.5	68
Gear oil drain screw		—	7	0.7	5.1
Gear oil level check screw		—	7	0.7	5.1
<b>BRACKET UNIT</b>					
Flushing hose		M5	5	0.5	3.6
Shift rod detent mechanism screw		—	24	2.4	17
Upper mount		M12	53	5.3	38
Lower mount		M14	73	7.3	53
Exhaust manifold assembly		M8	21	2.1	15
Muffler		M8	18	1.8	13
Exhaust manifold		M8	18	1.8	13
Lower exhaust manifold guide		M8	18	1.8	13
Clamp bracket		M22	15	1.5	11
Trim sensor stopper		M6	2	0.2	1.4
Trim stopper		—	37	3.7	27
<b>POWER TRIM AND TILT UNIT</b>					
Power trim and tilt reservoir cap		—	8	0.8	5.8
Power trim and tilt reservoir		1/4"	5	0.5	3.6
Power trim and tilt motor		1/4"	5	0.5	3.6
Manual valve		—	4	0.4	2.9
Tilt ram end screw		—	130	13	94
Gear pump unit		5/16"	9	0.9	6.5
Gear pump		—	6	0.6	4.3
Trim ram end screw		—	80	8.0	52

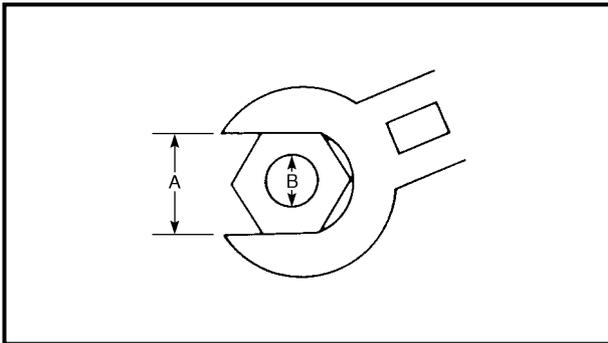
\*: Loosen



Nut (A)	Bolt (B)	General torque specifications		
		Nm	m•kgf	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	25
17 mm	M12	43	4.3	31

**GENERAL TORQUES**

This chart specifies tightening torques for standard fasteners with a standard ISO thread pitch. Tightening torque specifications for special components or assemblies are provided in applicable sections of this manual. To avoid warpage, tighten multi-fastener assemblies in a crisscross fashion and progressive stages until the specified tightening torque is reached. Unless otherwise specified, tightening torque specifications require clean, dry threads. Components should be at room temperature.





## CHAPTER 3

### PERIODIC INSPECTIONS AND ADJUSTMENTS

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## MAINTENANCE INTERVAL CHART

Use the following chart as a guide to general maintenance intervals.

Dependant on operating conditions, adjust the maintenance intervals accordingly.

Item	Remarks	Initial		Every		Refer to page
		10 hours (Break-in)	50 hours (3 months)	100 hours (6 months)	200 hours (1 year)	
<b>TOP COWLING</b>						
Top cowling fit	Check				○	3-3
<b>FUEL SYSTEM</b>						
Fuel line	Check	○	○	○		3-3
Fuel filter	Clean/check	○	○	○		3-4
Mechanical fuel pump oil	Change				○	3-6
Fuel tank	Clean				○	—
<b>POWER UNIT</b>						
Water leakage	Check	○	○	○		—
Motor exterior	Check	○	○	○		—
Exhaust leakage	Check	○	○	○		—
Cooling water passage <sup>(*1)</sup>	Clean		○	○		—
<b>CONTROL SYSTEM</b>						
Throttle valve synchronization	Check/adjust				○	3-7
Engine idling speed	Check/adjust	○		○		3-9
Throttle position sensor	Check/adjust				○	3-8
Remote control shift cable	Check/adjust				○	3-10
Remote control throttle cable	Check/adjust				○	3-10
Drive belt <sup>(*2)</sup>	Check/adjust				○	3-11
<b>OIL INJECTION SYSTEM</b>						
Oil tank water drain	Clean	○	○	○		—
Oil pump lever	Check/adjust	○				3-13
<b>POWER TRIM AND TILT UNIT</b>						
Power trim and tilt fluid	Check	○	○	○		3-15
<b>LOWER UNIT</b>						
Gear oil	Change	○		○		3-16
Lower unit leakage	Check				○	3-18
Propeller and cotter pin	Check/replace	○	○	○		6-3, 6-30

(\*1) When operating in salt water, turbid or muddy water, the engine should be flushed with clean water after each use.

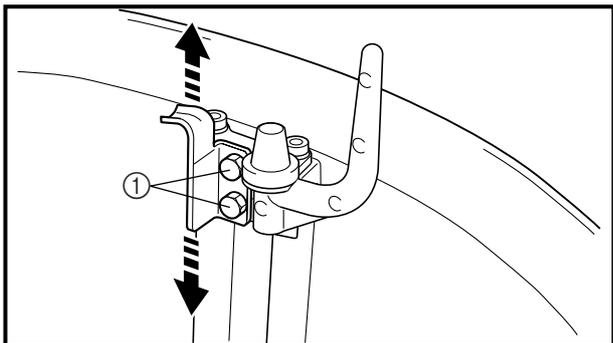
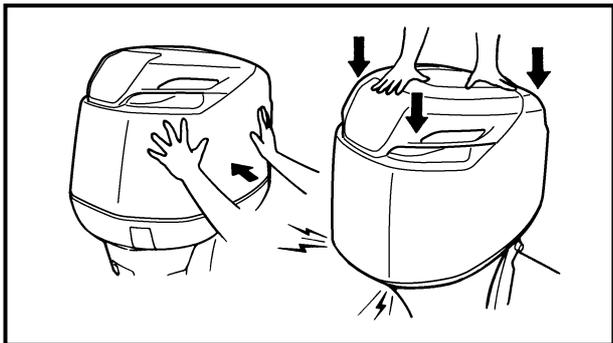
(\*2) Be sure to replace the drive belt after every 1,000 hours (5 years) of operation.



# MAINTENANCE INTERVAL CHART

E

Item	Remarks	Initial		Every		Refer to page
		10 hours (Break-in)	50 hours (3 months)	100 hours (6 months)	200 hours (1 year)	
<b>GENERAL</b>						
Anodes	Check/replace		○	○		3-18
Battery	Check/charge	(every month)				3-19
Spark plugs	Clean/adjust/ replace	○	○	○		3-20
Wiring and connectors	Adjust/reconnect	○	○	○		—
Bolts and nuts	Tighten	○	○	○		—
Lubrication points	Grease			○		3-22



**TOP COWLING**  
**CHECKING THE TOP COWLING FIT**

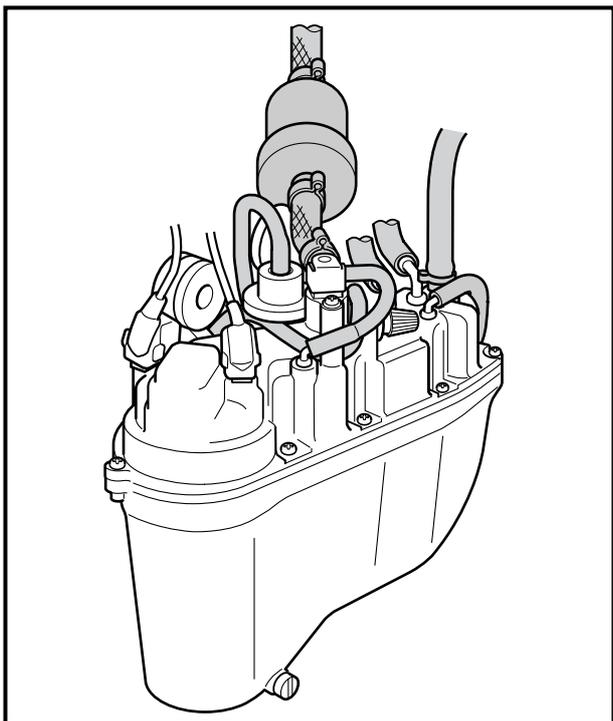
1. Check:
  - Top cowling fitting  
Loose/unlatched → Adjust the top cowling hook.
  
2. Adjust:
  - Top cowling hook position

**Adjustment steps**

- (1) Loosen the bolts ① approximately 1/4 of a turn.
- (2) Move the top cowling hook either up or down slightly.
- (3) Secure the bolts.
- (4) Check the top cowling fitting and repeat the adjustment if necessary.

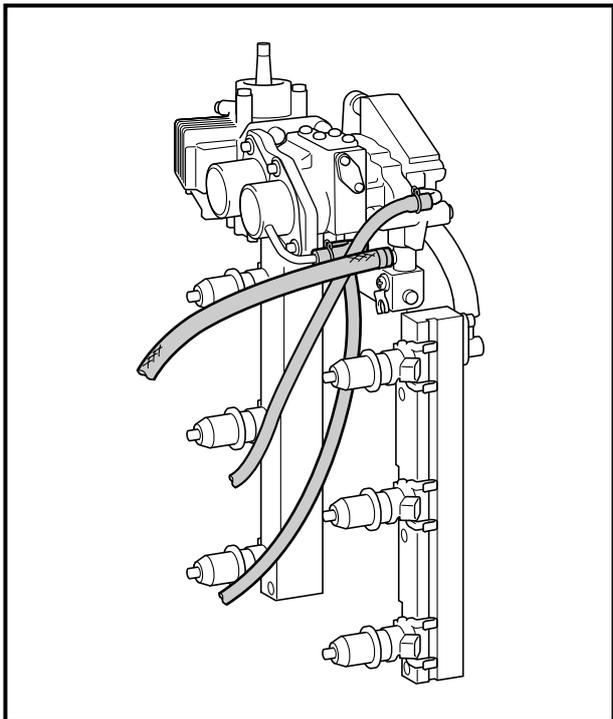
**NOTE:** \_\_\_\_\_

- Moving the latch towards the seal will loosen the top cowling.
- Moving the latch away from the seal will tighten the top cowling.



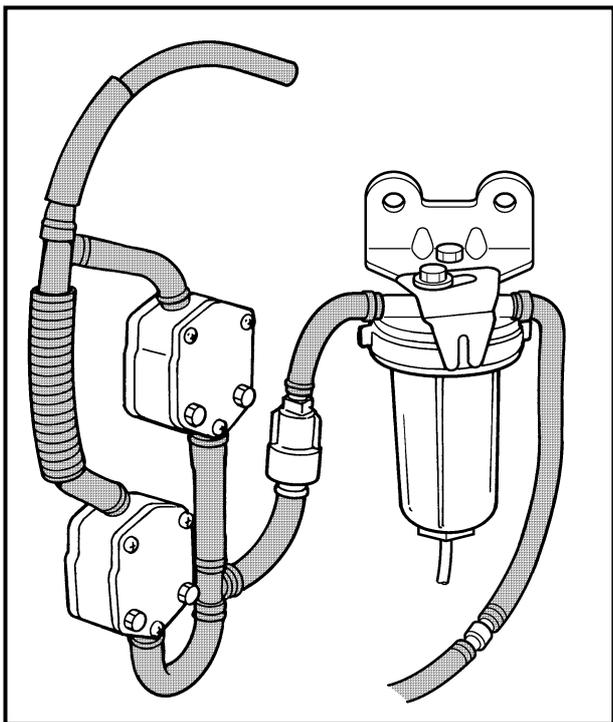
**FUEL SYSTEM**  
**CHECKING THE FUEL LINE**

1. Check:
  - Medium-pressure fuel line  
Cracks/damage/leaks → Replace.  
Refer to "MEDIUM-PRESSURE FUEL LINE" on page 4-2.



**2. Check:**

- High-pressure fuel line  
Cracks/damage/leaks → Replace.  
Refer to "HIGH-PRESSURE FUEL LINE ASSEMBLY" on page 4-30.

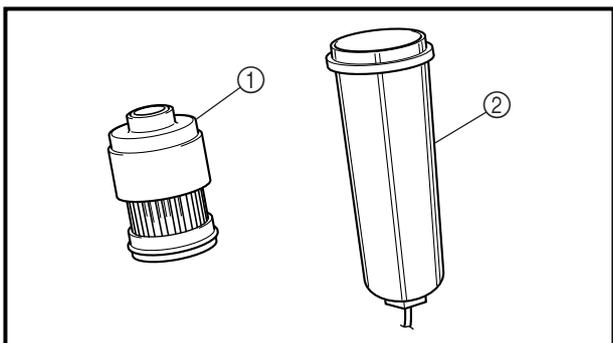


**3. Check:**

- Plastic locking ties  
Loosen → Retighten or replace.

**4. Check:**

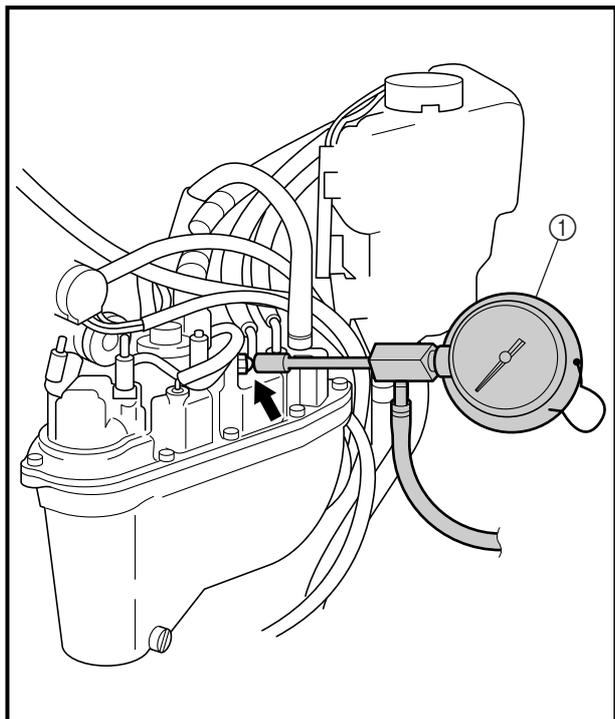
- Low-pressure fuel line  
Cracks/damage/leaks → Replace.  
Refer to "LOW-PRESSURE FUEL LINE" on page 4-43.



**CHECKING THE FUEL FILTER**

**Check:**

- Fuel filter element ①
- Fuel filter cup ②  
Clogs/cracks/leaks → Replace.  
Foreign matter → Clean.  
Refer to "FUEL FILTER" on page 4-46.



**MEASURING THE FUEL PRESSURE  
(MEDIUM-PRESSURE FUEL LINE)**

Measure:

- Fuel pressure (medium-pressure fuel line)
- Out of specification → Check the medium-pressure fuel line.



**Fuel pressure  
(medium-pressure fuel line)**  
280 - 360 kPa  
(2.8 - 3.6 kgf/cm<sup>2</sup>, 39.8 - 51.2 psi)

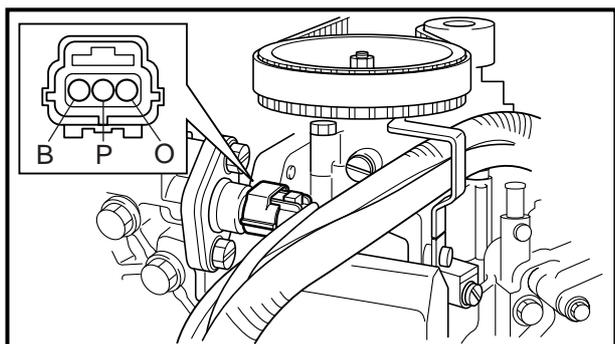
**Measuring steps**

- (1) Install the fuel pressure gauge onto the pressure check valve.



**Fuel pressure gauge** ..... ①  
**YB-06766 / 90890-06786**

- (2) Start the engine, run it at idle speed for 1 minute, and then measure the fuel pressure.



**CHECKING THE FUEL PRESSURE  
(MECHANICAL FUEL PUMP)**

Measure:

- Fuel pressure sensor output voltage
- Out of specification → Check the high-pressure fuel line.



**Fuel pressure sensor output  
voltage**  
Pink (P) – Black (B)  
2.8 - 3.2 V

**Measuring steps**

- (1) Connect the test harness between the fuel pressure sensor and the wire harness as shown.



**Test harness (3-pin)**  
**YB-06769 / 90890-06769**

- (2) Start the engine.
- (3) Measure the fuel pressure sensor output voltage.



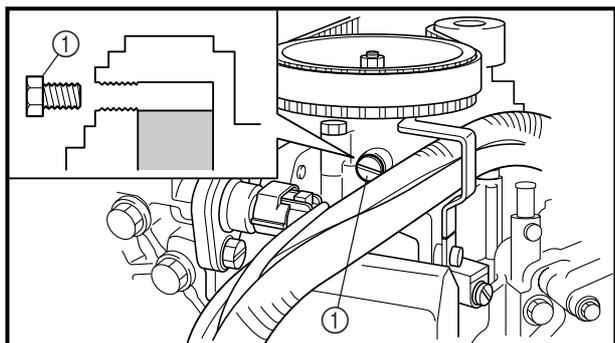
**CHECKING THE MECHANICAL FUEL PUMP OIL LEVEL**

Check:

- Mechanical fuel pump oil level  
Level is low → Add to the proper level.



**Recommended gear oil**  
**GEAR CASE LUBE (USA) or**  
**Hypoid gear oil SAE 90**



**Checking steps**

- (1) Remove the gear oil level check screw ① and check the oil level.
- (2) Add gear oil if needed, and then install the gear oil level check screw.

**CHANGING THE MECHANICAL FUEL PUMP OIL**

1. Place:

- Container

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

Place a container under the gear oil drain screw.

2. Remove:

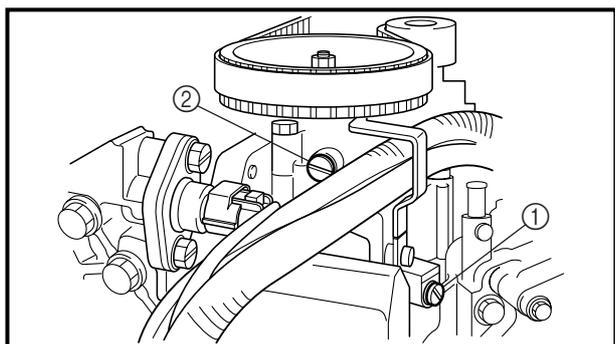
- Gear oil drain screw ①
  - Gear oil level check screw ②
- Drain the gear oil.

3. Fill:

- Gear oil

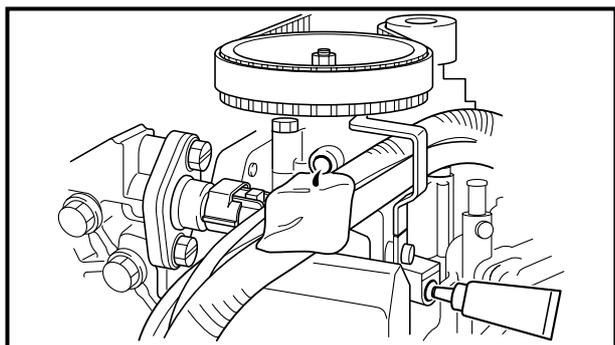


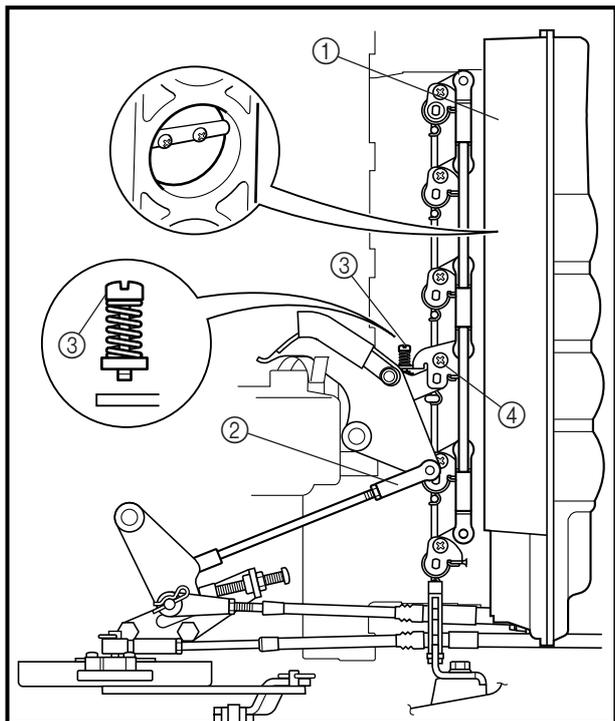
**Recommended gear oil**  
**GEAR CASE LUBE (USA) or**  
**Hypoid gear oil SAE 90**



**Filling steps**

- (1) Insert the gear oil tube into the drain hole and slowly fill the gear oil until oil flows out of the check hole.
- (2) Install the gear oil level check screw and then quickly install the gear oil drain screw.



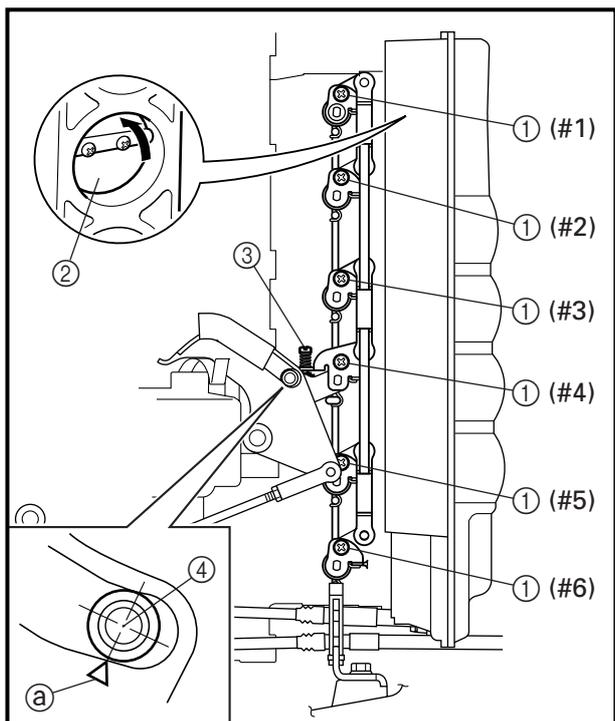


**CONTROL SYSTEM  
SYNCHRONIZING THE THROTTLE  
VALVES**

1. Check:
- Throttle valve synchronization  
Uneven opening → Adjust.

**Checking steps**

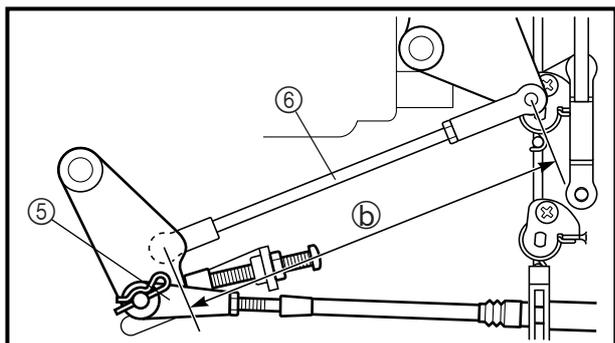
- (1) Remove the intake silencer ①.
- (2) Disconnect the throttle lever rod ② and oil pump link rod.
- (3) Turn the throttle stop screw ③ until it does not touch the stopper.
- (4) Turn the screw ④ clockwise.
- (5) Verify that all the throttle valves are fully closed.
- (6) If correct, proceed with adjustment steps 3-5, 8, and 9 below.



2. Adjust:
- Throttle valve opening

**Adjustment steps**

- (1) Proceed with checking steps 1 to 2.
- (2) Turn the screws ① clockwise for all of the cylinders.
- (3) Close the valves ② and turn the screws ① for cylinder #1, #2, #3, #5, and #6 counterclockwise.
- (4) Connect the oil pump link rod.
- (5) Turn in the throttle stop screw ③ until the throttle valve #4 starts opening and then turn it 1-1/2 turns in.
- (6) Align the center of the throttle control lever cam roller ④ with the mark ⑤ and turn screw #4 ① counterclockwise.
- (7) Disconnect the throttle cable joint ⑤.
- (8) Adjust the throttle lever rod ⑥ length and connect it.



**Throttle lever rod length ⑥  
163 mm (6.4 in)**

- (9) Install the intake silencer.
- (10) Adjust the throttle position sensor and engine idling speed. Refer to "ADJUSTING THE THROTTLE POSITION SENSOR" and "ADJUSTING THE ENGINE IDLING SPEED" on page 3-8 and 3-9.

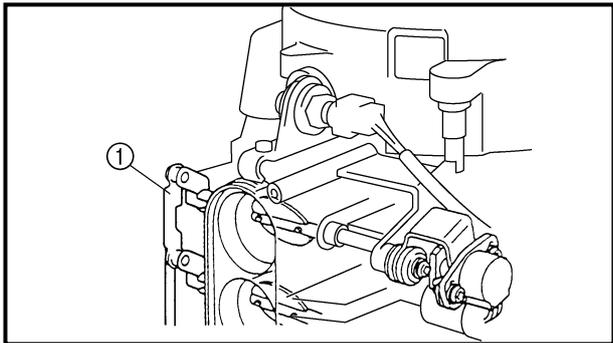
**ADJUSTING THE THROTTLE POSITION SENSOR**

1. Measure:

- Throttle position sensor output voltage (with the throttle valves fully closed)

Out of specification → Adjust.

	<p><b>Throttle position sensor output voltage (pink (P) – orange (O))</b> <b>0.50 ± 0.02 V</b></p>
---	--



**NOTE:**

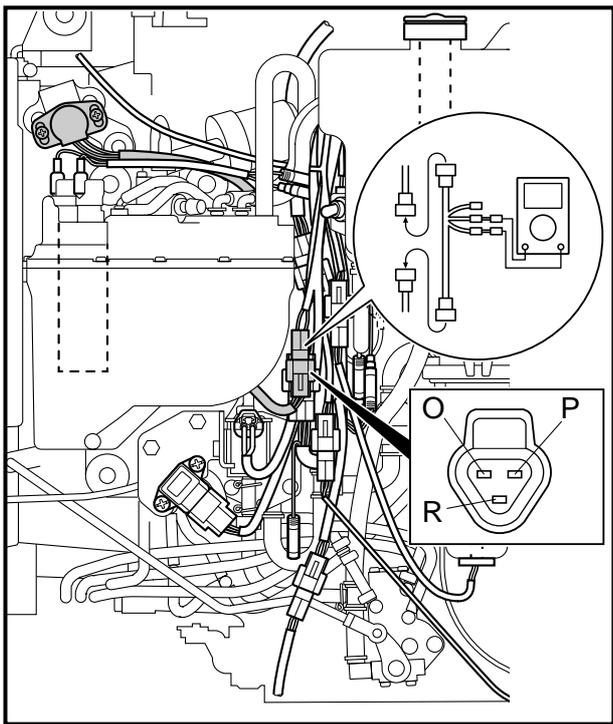
- Be sure to adjust the throttle valve's opening before measuring the throttle position sensor output voltage.
- When measuring the throttle position sensor output voltage, set the digital tester to the manual range.

**Measuring steps**

- (1) Disconnect the throttle link rod ① at the #1 throttle valve.
- (2) Connect the test harness (3-pin) as shown.

	<p><b>Test harness (3-pin)</b> <b>YB-06443 / 90890-06757</b></p>
---	--

- (3) Connect the digital tester probes to the test harness (3-pin) as shown.
- (4) Turn the engine start switch on.
- (5) Measure the output voltage (with the throttle valves fully closed).

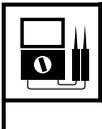


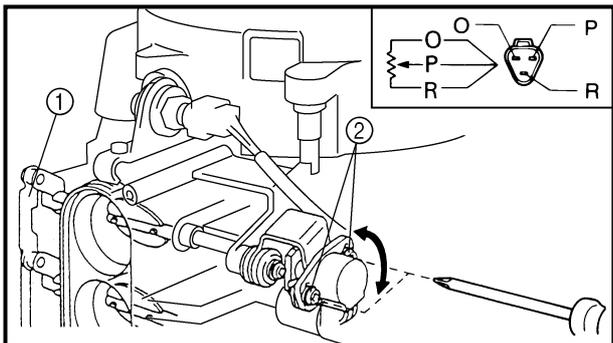
2. Adjust:

- Throttle position sensor

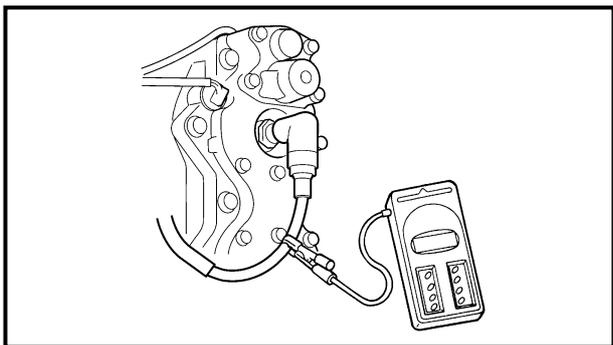
**Adjustment steps**

- (1) Loosen the screws ②.
- (2) Adjust the position of the throttle position sensor until the specified output voltage is obtained.

	<p><b>Throttle position sensor output voltage (pink (P) – orange (O))</b> <b>0.50 ± 0.02 V</b></p>
---	--



- (3) Tighten the screws.
- (4) Connect the throttle link rod.



**ADJUSTING THE ENGINE IDLING SPEED**

1. Measure:
- Engine idling speed
- Out of specification → Adjust.

	<b>Engine idling speed</b> <b>700 ± 30 r/min</b>
--	---

**Measuring steps**

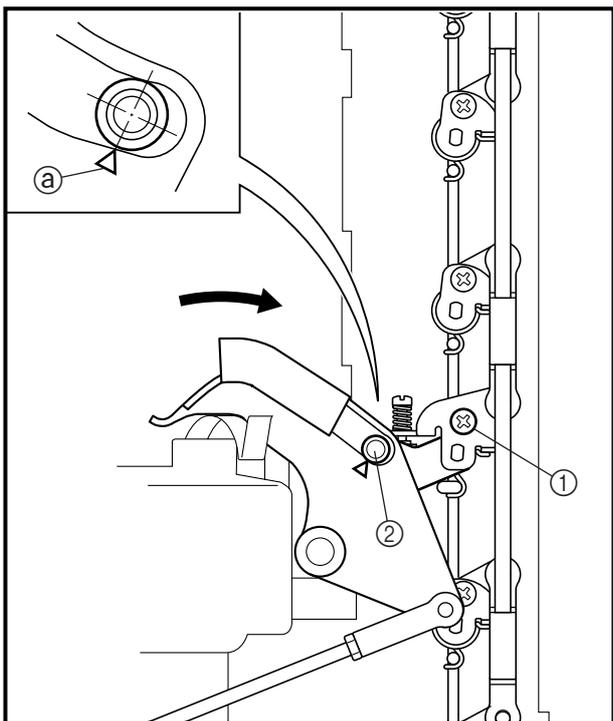
- (1) Start the engine and allow it to warm up for a few minutes.
- (2) Install the tachometer onto the spark plug lead of cylinder #1.

	<b>Tachometer</b> <b>YU-08036-A / 90890-06760</b>
--	--

2. Adjust:
- Engine idling speed

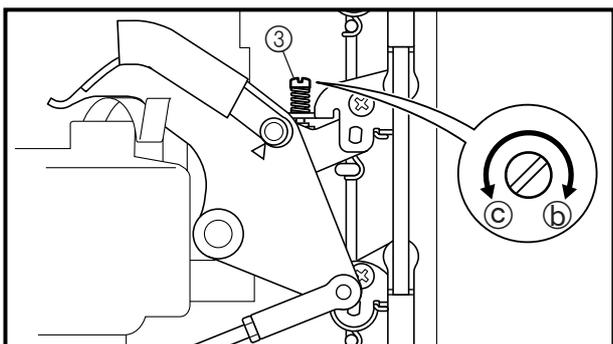
**Adjustment steps**

- (1) Loosen the adjustment screw ①.
- (2) Align the center of the throttle control lever cam roller ② with the mark ③.



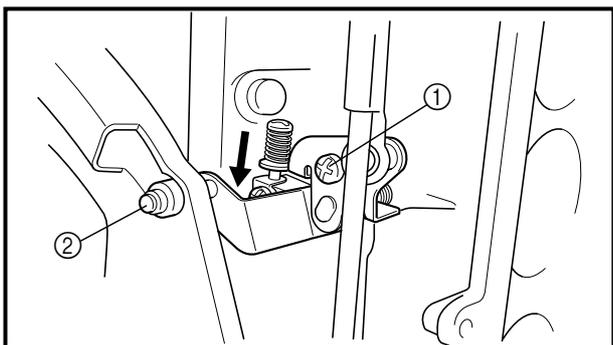
- (3) Turn the throttle stop screw ③ in direction ⑥ or ⑦ until the specified engine idling speed is obtained.

<b>Direction ⑥</b>	<b>Engine idling speed increases.</b>
<b>Direction ⑦</b>	<b>Engine idling speed decreases.</b>



- (4) Tighten the adjustment screw ① while pressing down on the throttle control lever cam roller ②.

**NOTE:** \_\_\_\_\_  
Turn the adjustment screw ① counterclockwise to tighten it.  
\_\_\_\_\_



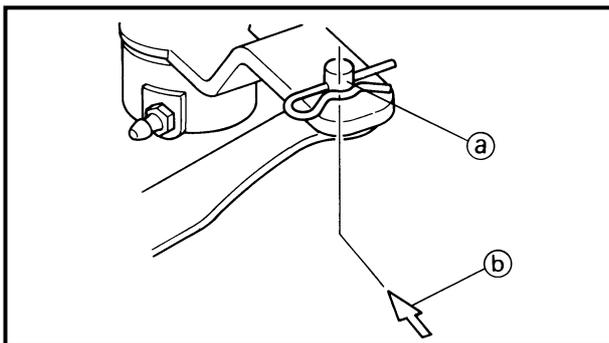
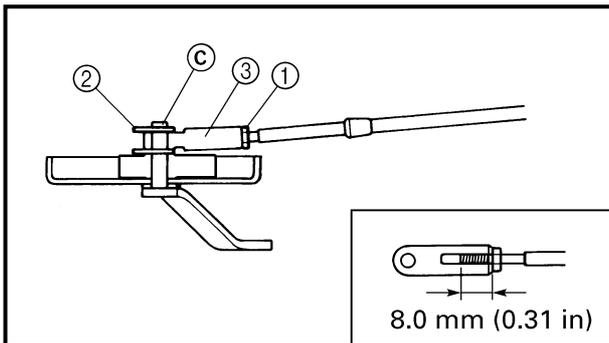


## ADJUSTING THE REMOTE CONTROL SHIFT CABLE

1. Check:
  - Shift operation  
Incorrect → Adjust.
2. Adjust:
  - Remote control shift cable length

### Adjustment steps

- (1) Loosen the locknut ①.
- (2) Remove the clip ②.
- (3) Disconnect the shift cable joint ③.
- (4) Set the remote control lever to the neutral position.
- (5) Align the center of the set pin ③ with the mark ④ on the bottom cowling.
- (6) Adjust the position of the shift cable joint until its hole aligns with the set pin ⑤.
- (7) Install the clip and tighten the locknut.



### CAUTION:

The remote control cable joint must be screwed in more than 8 mm (0.31 in).

## ADJUSTING THE REMOTE CONTROL THROTTLE CABLE

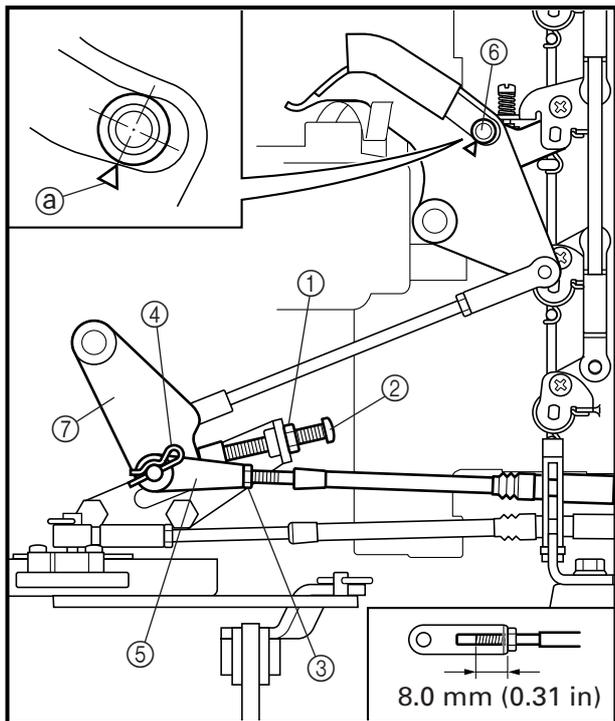
### NOTE:

Before adjusting the remote control throttle cable, be sure to adjust the throttle valves' opening and engine idling speed.

1. Check:
  - Throttle operation  
Incorrect → Adjust.

### NOTE:

Make sure the throttle valves are fully closed when the remote control lever is fully closed position.



**2. Adjust:**

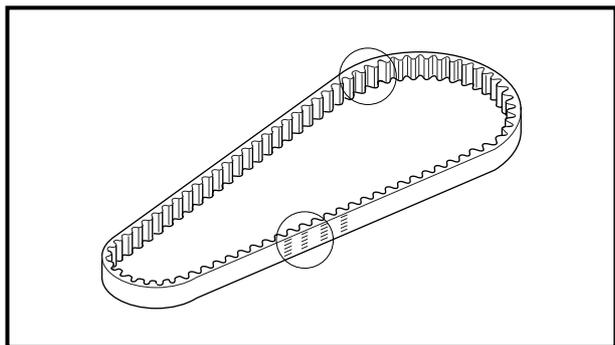
- Remote control throttle cable length

**Adjustment steps**

- (1) Loosen the locknut ① and stopper screw ②.
- (2) Loosen the locknut ③.
- (3) Remove the clip ④.
- (4) Disconnect the throttle cable joint ⑤.
- (5) Set the remote control lever to the fully closed position.
- (6) Align the center of the throttle control lever cam roller ⑥ with the mark ③.
- (7) Tighten the stopper screw ② until it contacts the throttle control lever ⑦.
- (8) Tighten the locknut ①.
- (9) Adjust the position of the throttle cable joint until its hole aligns with the set pin on the throttle control lever ⑦.
- (10) Install the clip ④ and tighten the locknut ③.

**CAUTION:**

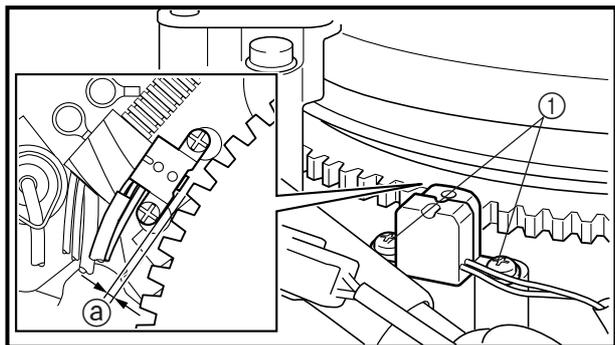
**The remote control cable joint must be screwed in more than 8 mm (0.31 in).**



**CHECKING THE DRIVE BELT**

**Check:**

- Drive belt  
Wear/damage → Replace.  
Refer to "DRIVE BELT" on page 4-22.



**ADJUSTING THE CRANK POSITION SENSOR**

1. Measure:
- Crank position sensor-to-flywheel magnet assembly clearance ②
- Out of specification → Adjust.

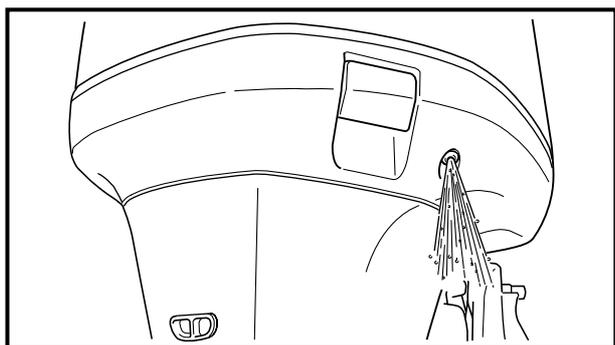


**Crank position sensor-to-flywheel magnet assembly clearance**  
**1.0 ± 0.5 mm (0.04 ± 0.02 in)**

2. Adjust:
- Crank position sensor

**Adjustment steps**

- (1) Loosen the screws ①.
- (2) Adjust the position of the crank position sensor until the specified clearance is obtained.
- (3) Tighten the screws.

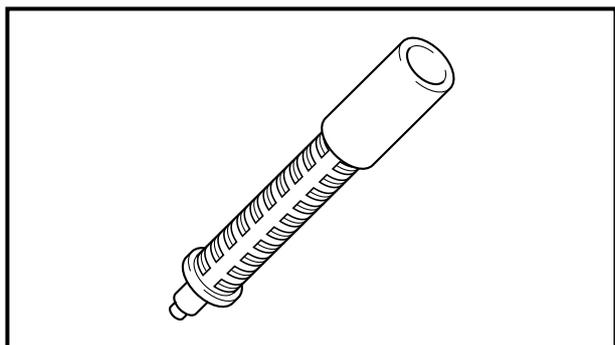


**COOLING SYSTEM  
CHECKING THE COOLING WATER DISCHARGE**

- Check:
- Cooling water discharge
- No discharge → Clean and check the cooling water passage.

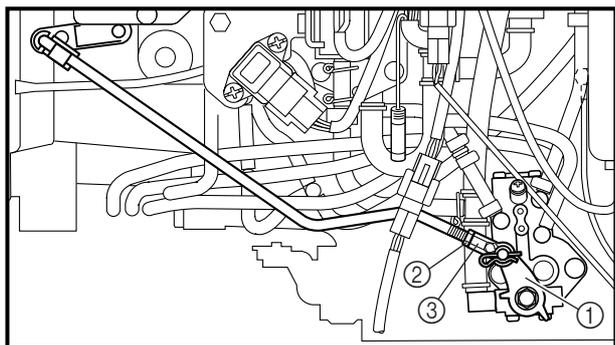
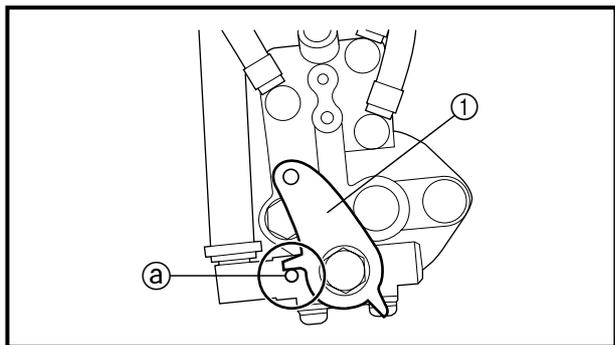
**Checking steps**

- (1) Place the lower unit in water.
- (2) Start the engine.
- (3) Check that water flows from the cooling water outlet.



**OIL INJECTION SYSTEM  
CHECKING THE OIL STRAINER**

- Check:
- Oil strainer
- Clogs/cracks/leaks → Replace.  
Foreign matter → Clean.  
Refer to "OIL TANK" on page 4-56.



**SYNCHRONIZING THE OIL PUMP**

1. Check:
  - Oil pump lever position
  - Incorrect → Adjust.

**NOTE:** \_\_\_\_\_  
 Make sure the oil pump lever ① touches the stopper ① (fully closed position) when the throttle valves are closed.

2. Adjust:
  - Oil pump lever position

**Adjustment steps**

- (1) Loosen the locknut ②.
- (2) Remove the clip and washer.
- (3) Disconnect the oil pump link rod joint ③.
- (4) Fully close the throttle valves.
- (5) Turn the oil pump lever ① so it contacts the stopper ① (fully closed position).
- (6) Adjust the position of the oil pump link rod joint until its hole aligns with the set pin on the oil pump lever ①.
- (7) Install the washer and clip.
- (8) Tighten the locknut.

**CAUTION:** \_\_\_\_\_  
 After adjustment, make sure the oil pump lever operates properly.

**AIR BLEEDING THE OIL INJECTION SYSTEM**

**CAUTION:**

- **DO NOT USE GASOLINE MIXED WITH OIL (PREMIX).**
- **USE UNLEADED STRAIGHT GASOLINE ONLY.**

Bleed:

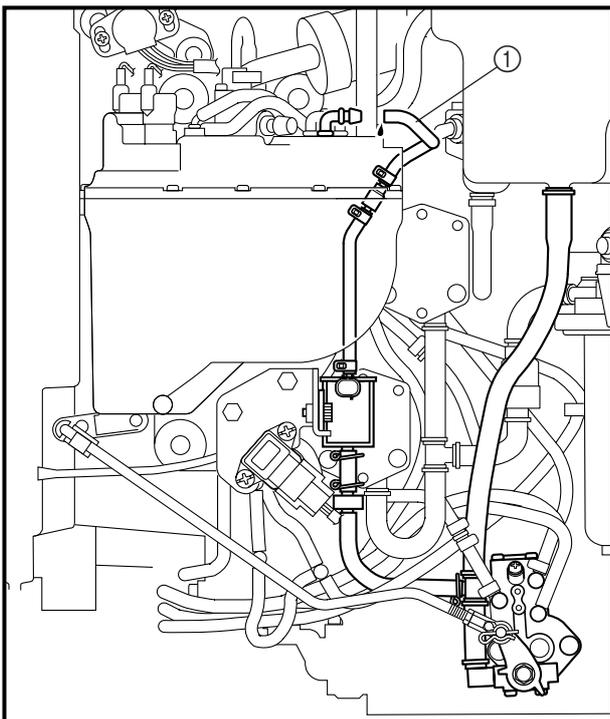
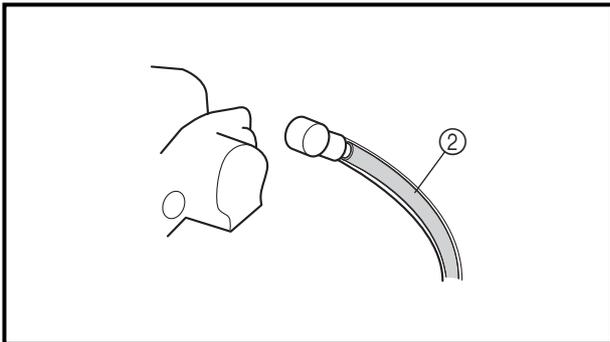
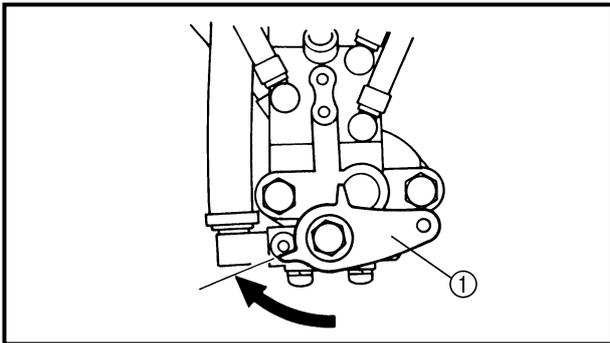
- Air bubbles  
(from the oil injection system)

**Bleeding steps**

- (1) Fill the oil tank with the engine oil.

	<p><b>Recommended engine oil</b>  <b>Engine oil type</b>                  2-stroke outboard engine oil  <b>Engine oil grade</b>                  TC-W3</p>
---	--

- (2) Disconnect the oil pump link rod joint from the oil pump lever.
- (3) Start the engine.
- (4) Turn the oil pump lever ① and keep it in the fully-opened position until the oil flows out of the oil pump feed hoses ②.



**CHECKING THE ELECTRIC OIL PUMP**

**CAUTION:**

- **DO NOT USE GASOLINE MIXED WITH OIL (PREMIX).**
- **USE UNLEADED STRAIGHT GASOLINE ONLY.**

Check:

- Electric oil pump operation  
Incorrect → Replace.

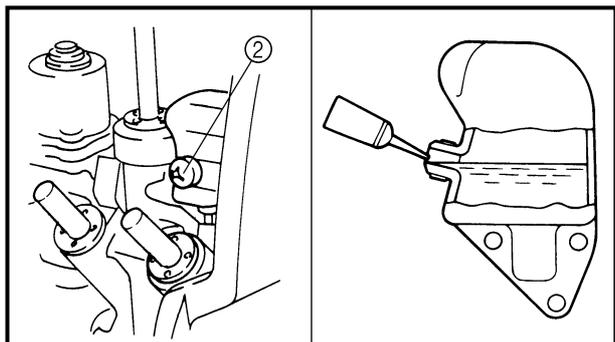
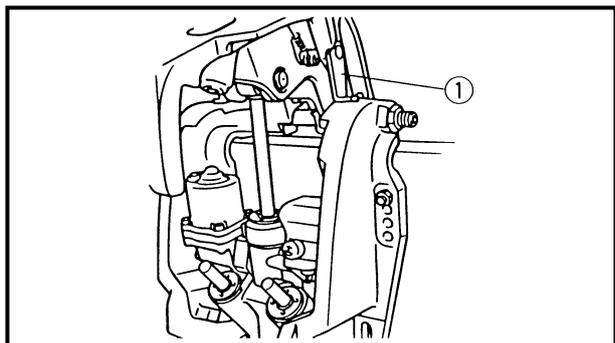
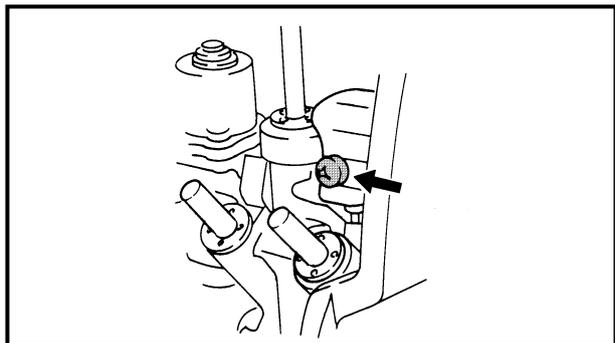
**Checking steps**

- (1) Disconnect the electric oil pump hose ① from the vapor separator.
- (2) Start the engine.
- (3) Check the oil flows from the electric oil pump hose end.
- (4) Connect the electric oil pump hose.

**POWER TRIM AND TILT SYSTEM  
CHECKING THE POWER TRIM AND  
TILT FLUID LEVEL**

Check:

- Power trim and tilt fluid level  
Level is low → Add power trim and tilt fluid to the proper level.



**Recommended power trim and tilt fluid  
ATF Dexron II**

**⚠ WARNING**

When removing the power trim and tilt reservoir cap, the power trim and tilt fluid may spurt out due to internal pressure. Highly pressurized fluid could spray out causing serious injury. Therefore, fully tilt up the outboard (the tilt ram assembly fully extended) and then slowly remove the power trim and tilt reservoir cap.

**Checking steps**

- (1) Tilt the outboard all the way up and lock it with the tilt stop levers ①.

**⚠ WARNING**

After tilting up the outboard, be sure to support it with the tilt stop levers. Otherwise, the outboard could suddenly lower if the power trim and tilt unit should lose fluid pressure.

- (2) Remove the reservoir cap ② and check the fluid level.

**NOTE:**

The fluid level should be directly below the check hole as shown.

- (3) Add power trim and tilt fluid if needed, and then install the reservoir cap.



**Reservoir cap  
8 Nm (0.8 m · kgf, 5.8 ft · lb)**

**ADJUSTING THE TRIM SENSOR CAM**

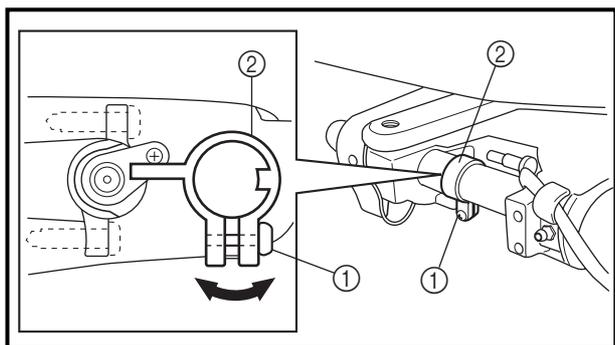
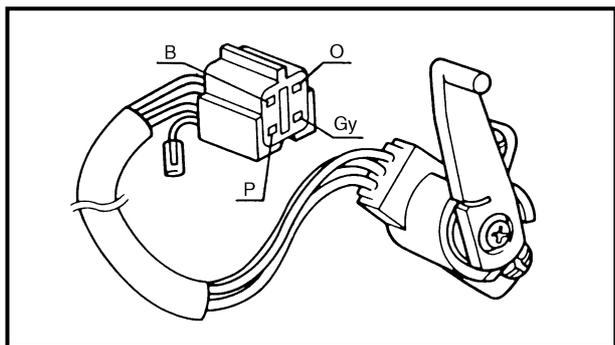
1. Measure:

- Trim sensor setting resistance  
Out of specification → Adjust.

	<b>Trim sensor setting resistance</b>
	<b>Pink (P) – Black (B)</b>
	<b>80 ± 12 Ω at 20 °C (68 °F)</b>

**Measuring steps**

- (1) Fully tilt the outboard down.
- (2) Measure the trim sensor resistance.



2. Adjust:

Trim sensor cam position

**Adjusting steps**

- (1) Fully tilt the outboard down.
- (2) Loosen the screw ①.
- (3) Adjust the position of the trim sensor cam ② until the specified resistance is obtained.

	<b>Trim sensor resistance</b>
	<b>Pink (P) – Black (B)</b>
	<b>80 ± 12 Ω at 20 °C (68 °F)</b>

- (4) Tighten the screw.

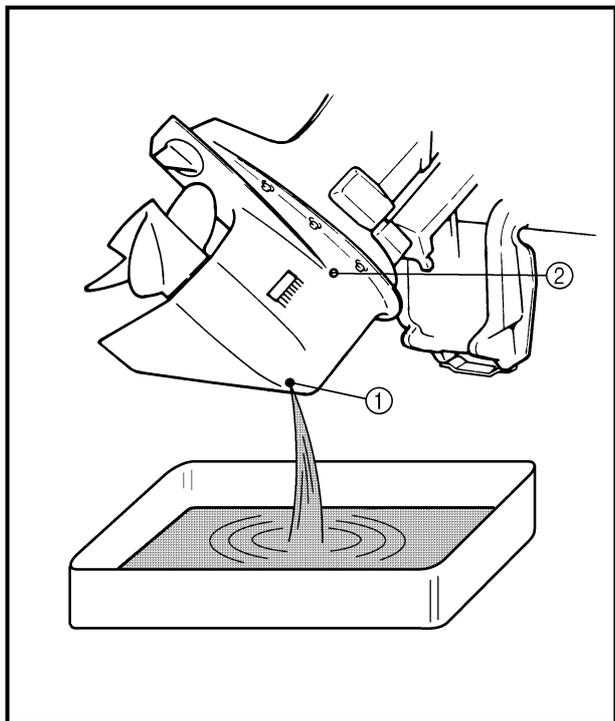
	<b>Trim sensor cam screw</b>
	<b>2 Nm (0.2 m • kgf, 1.4 ft • lb)</b>

**LOWER UNIT**

**CHECKING THE GEAR OIL LEVEL**

Check:

- Gear oil level  
Level is low → Add gear oil to the proper level.



**CHANGING AND CHECKING THE GEAR OIL**

1. Check:

- Gear oil
  - Milky oil → Replace the oil seal.
  - Slag oil → Check the gears, bearings, and clutch dog.

**Checking steps**

- (1) Tilt up the outboard slightly.
- (2) Place a container under the gear oil drain screw ①.
- (3) Remove the gear oil drain screw and gear oil level check screw ②.

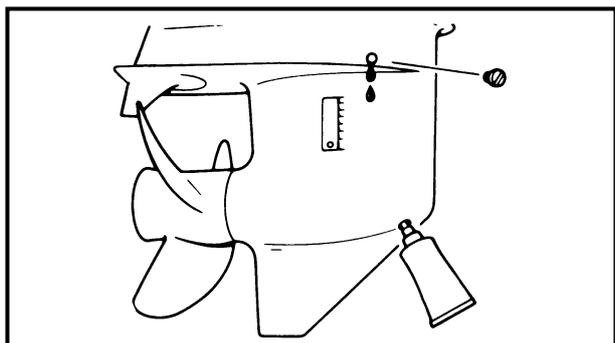
2. Fill:

- Gear oil  
(with the specified amount of the recommended gear oil)

	<p><b>Recommended gear oil</b> <b>GEAR CASE LUBE (USA) or</b> <b>Hypoid gear oil, SAE 90</b></p> <p><b>Total amount</b></p> <p><b>Regular rotation models</b> <b>980 cm<sup>3</sup></b> <b>(33.1 US oz, 34.5 Imp oz)</b></p> <p><b>Counter rotation models</b> <b>870 cm<sup>3</sup></b> <b>(29.4 US oz, 30.6 Imp oz)</b></p>
--	---

**Filling steps**

- (1) Place the outboard in an upright position.
- (2) Insert the gear oil tube into the drain hole and slowly fill the gear oil until oil flows out of the check hole and no air bubbles are visible.
- (3) Install the gear oil level check screw and then quickly install the gear oil drain screw.



	<p><b>Gear oil level check screw</b> <b>7 Nm (0.7 m • kgf, 5.1 ft • lb)</b></p> <p><b>Gear oil drain screw</b> <b>7 Nm (0.7 m • kgf, 5.1 ft • lb)</b></p>
--	---



**CHECKING THE LOWER UNIT  
(FOR AIR LEAKS)**

Check:

- Lower unit holding pressure  
Pressure drops → Check the seals and components.



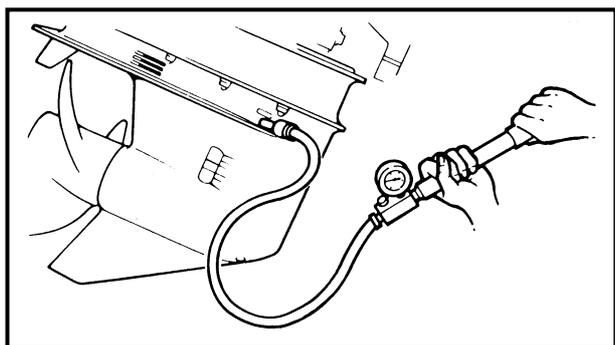
**Lower unit holding pressure**  
**100 kPa (1.0 kg/cm<sup>2</sup>, 14.2 psi)**

**Checking steps**

**CAUTION:**

**Do not overpressurize the lower unit. Excessive pressure may damage the oil seals.**

- (1) Remove the gear oil level check screw.
- (2) Install the pressure tester into the check hole.

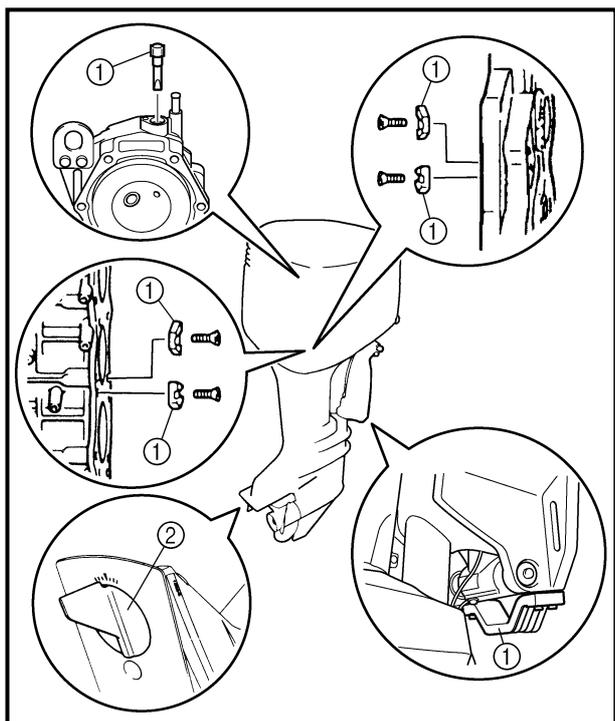


**Pressure tester**  
**YB-35956 / 90890-06762**

- (3) Apply the specified pressure.

**NOTE:**

The lower unit should hold the specified pressure for 10 seconds.



**GENERAL  
CHECKING THE ANODES**

Check:

- Anodes ①
  - Trim tab ②
- Scales → Clean.  
Grease/oil → Clean.  
Excessive wear → Replace.

**CAUTION:**

**Do not oil, grease or paint the anode, or it will not operate properly.**

---

**CHECKING THE BATTERY****⚠ WARNING**

Battery electrolytic fluid is dangerous; it contains sulfuric acid and therefore is poisonous and highly caustic.

Always follow these preventive measures:

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

Antidote (EXTERNAL):

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

Antidote (INTERNAL):

- Drink large quantities of water or milk followed by milk of magnesia, beaten egg, or vegetable oil. Get immediate medical attention.

Batteries also generate explosive hydrogen gas; therefore, you should always follow these preventive measures:

- Charge batteries in a well-ventilated area.
- Keep batteries away from fire, sparks, or open flames (e.g., welding equipment, lighted cigarettes, etc.).
- DO NOT SMOKE when charging or handling batteries.

**KEEP BATTERIES AND ELECTROLYTIC FLUID OUT OF REACH OF CHILDREN.**

---

**NOTE:**

- Batteries vary among manufacturers. Therefore, the following procedures may not always apply. Consult your battery manufacturer's instructions.
  - First, disconnect the negative lead, then the positive lead.
-

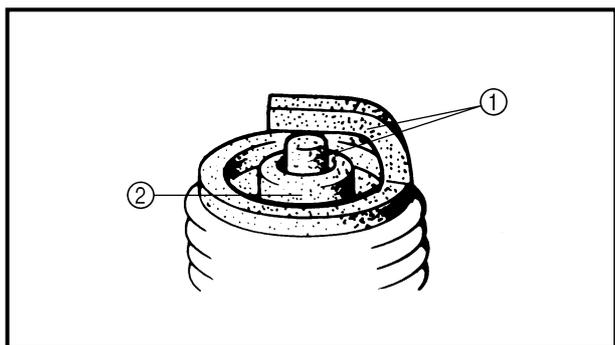


**Check:**

- Electrolyte level  
Below the minimum level mark → Add distilled water to the proper level.
- Electrolyte specific gravity  
Less than specification → Recharge the battery.



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



**CHECKING THE SPARK PLUGS**

**1. Check:**

- Electrodes ①  
Cracks/excessive wear → Replace.
- Insulator color ②  
Distinctly different color → Check the engine condition.



**Color guide**  
**Medium to light tan color**  
**Normal**  
**Whitish color**

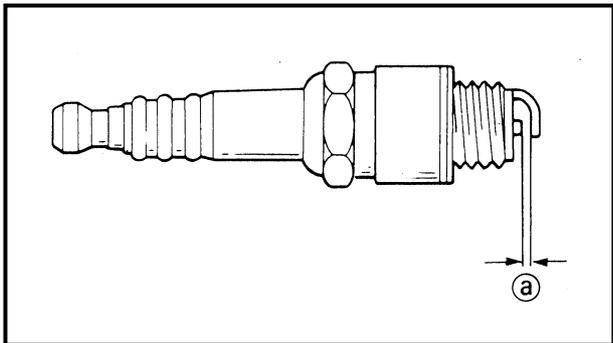
- Lean fuel mixture
- Plugged jet(-s)
- Air leak
- Wrong setting

**Blackish color**

- Rich mixture
- Excessive oil usage
- Defective ignition system
- Defective spark plug

**2. Clean:**

- Spark plugs  
(with a spark plug cleaner or wire brush.)

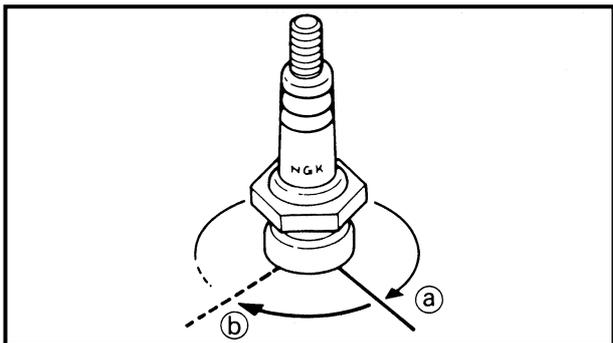


3. Measure:

- Spark plug gap ①
- Out of specification → Regap.



**Spark plug gap**  
**1.0 - 1.1 mm (0.039 - 0.043 in)**



4. Tighten:

- Spark plugs



**Spark plug**  
**25 Nm (2.5 m • kgf, 18 ft • lb)**

**NOTE:**

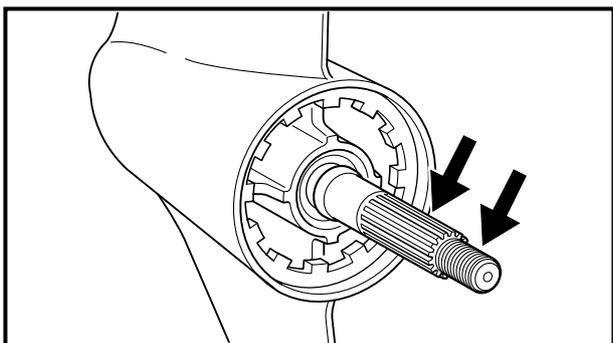
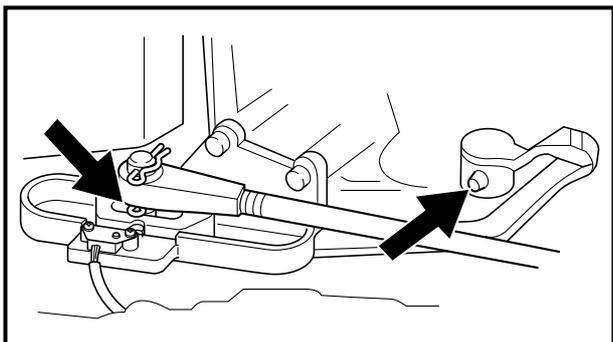
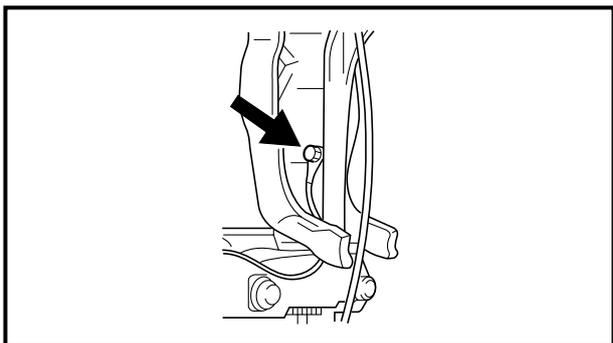
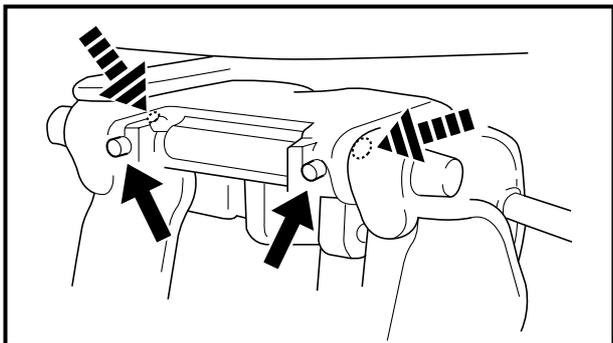
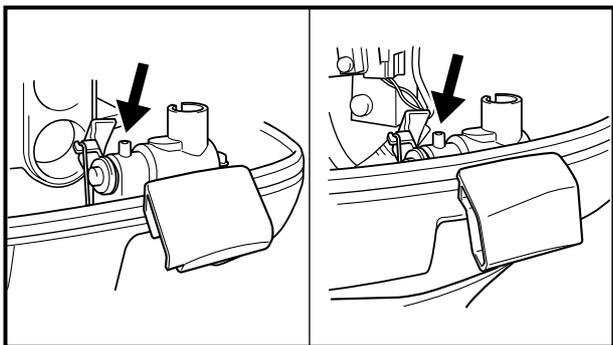
- Before installing the spark plug, clean the gasket surface and spark plug surface. Also, it is suggested to apply a thin film of anti-seize compound to the spark plug threads to prevent thread seizure.
- If a torque wrench is not available, a good estimate of the correct tightening torque is to finger tighten ① the spark plug and then tighten it another 1/4 to 1/2 of a turn ②.



**LUBRICATION POINTS**

Apply:

- Yamaha marine grease (for USA and Canada)
- Yamaha grease A (for worldwide)



## CHAPTER 4 FUEL SYSTEM

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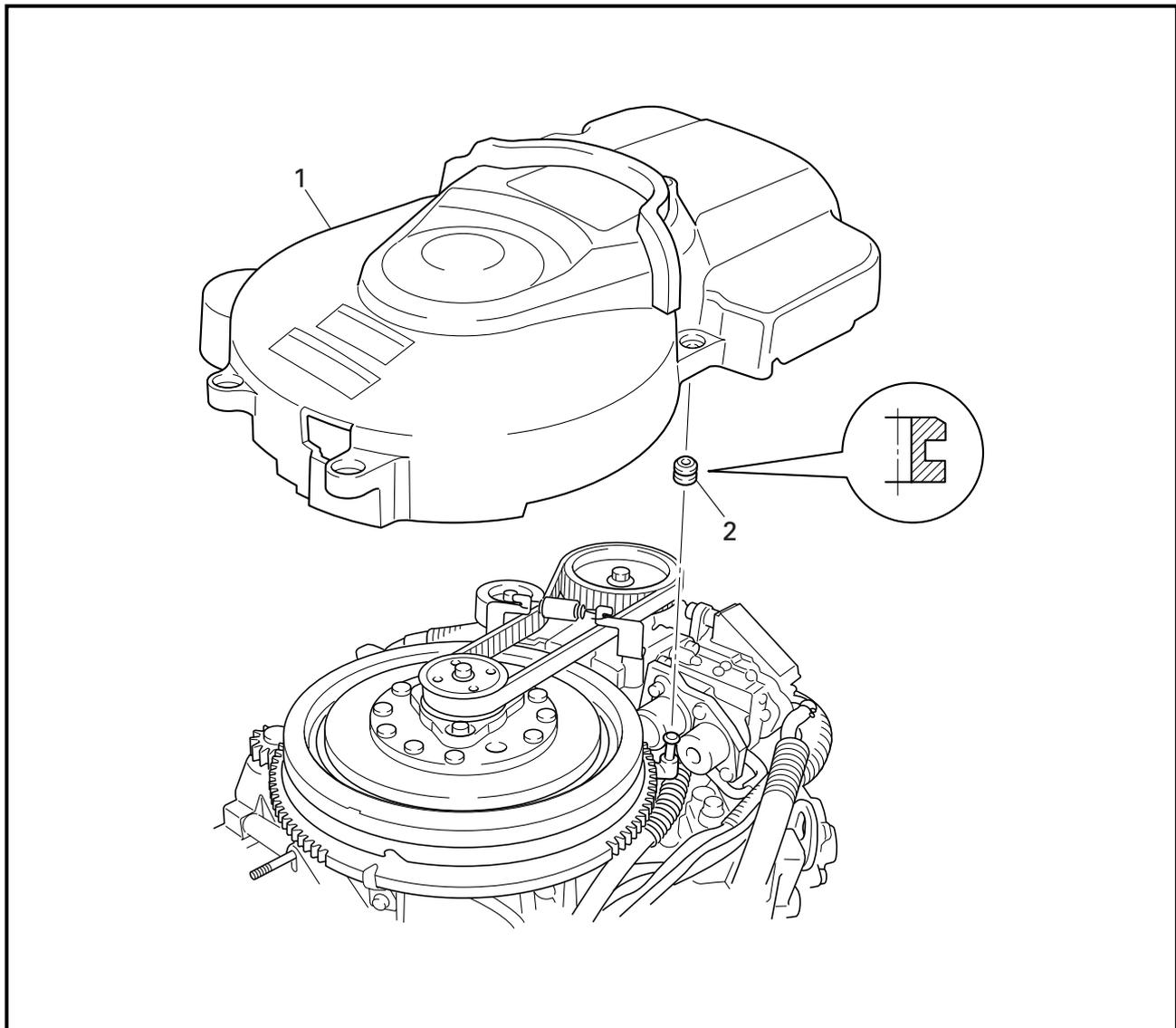
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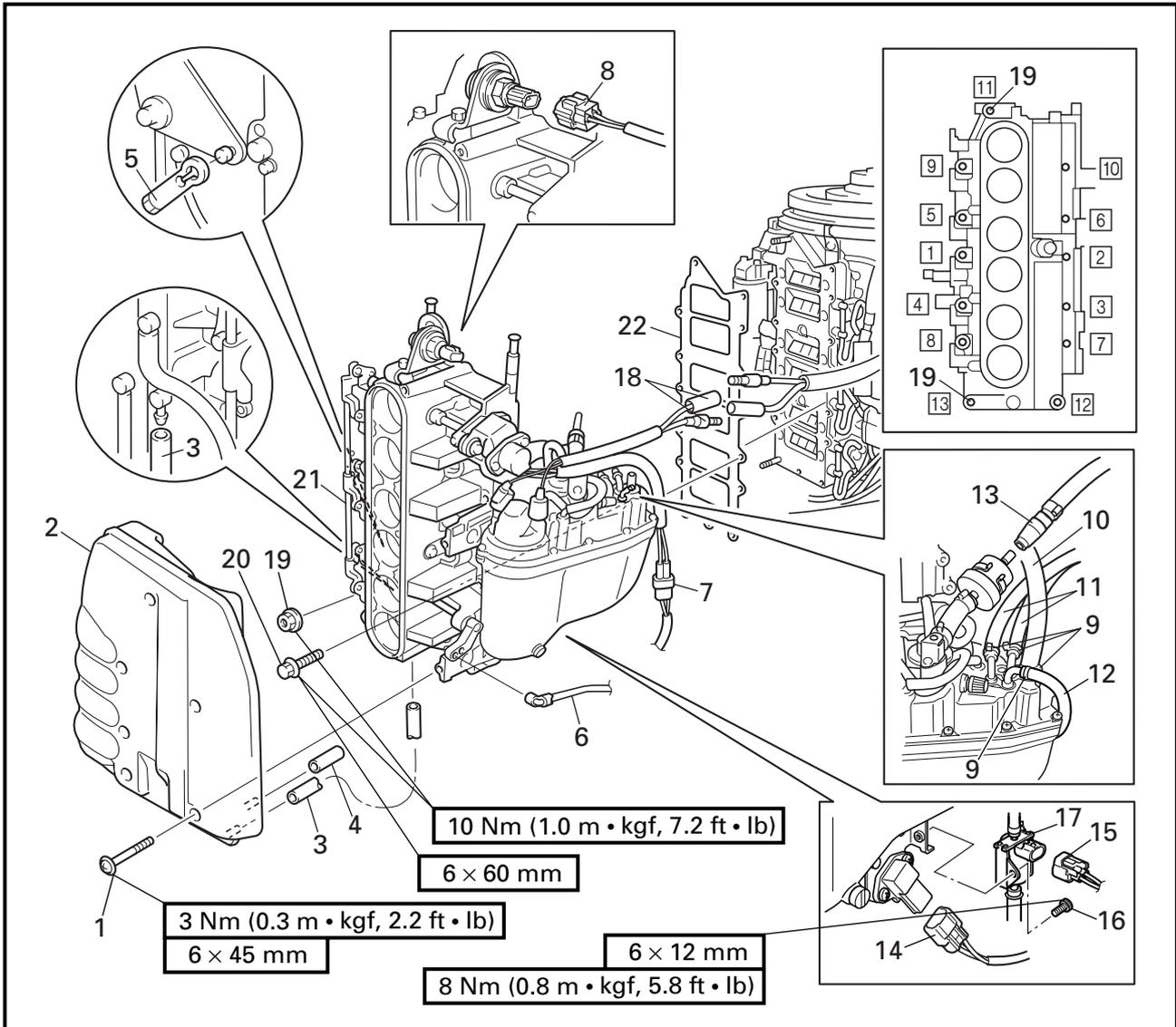


**FLYWHEEL MAGNET ASSEMBLY COVER  
REMOVING/INSTALLING THE FLYWHEEL MAGNET ASSEMBLY COVER**



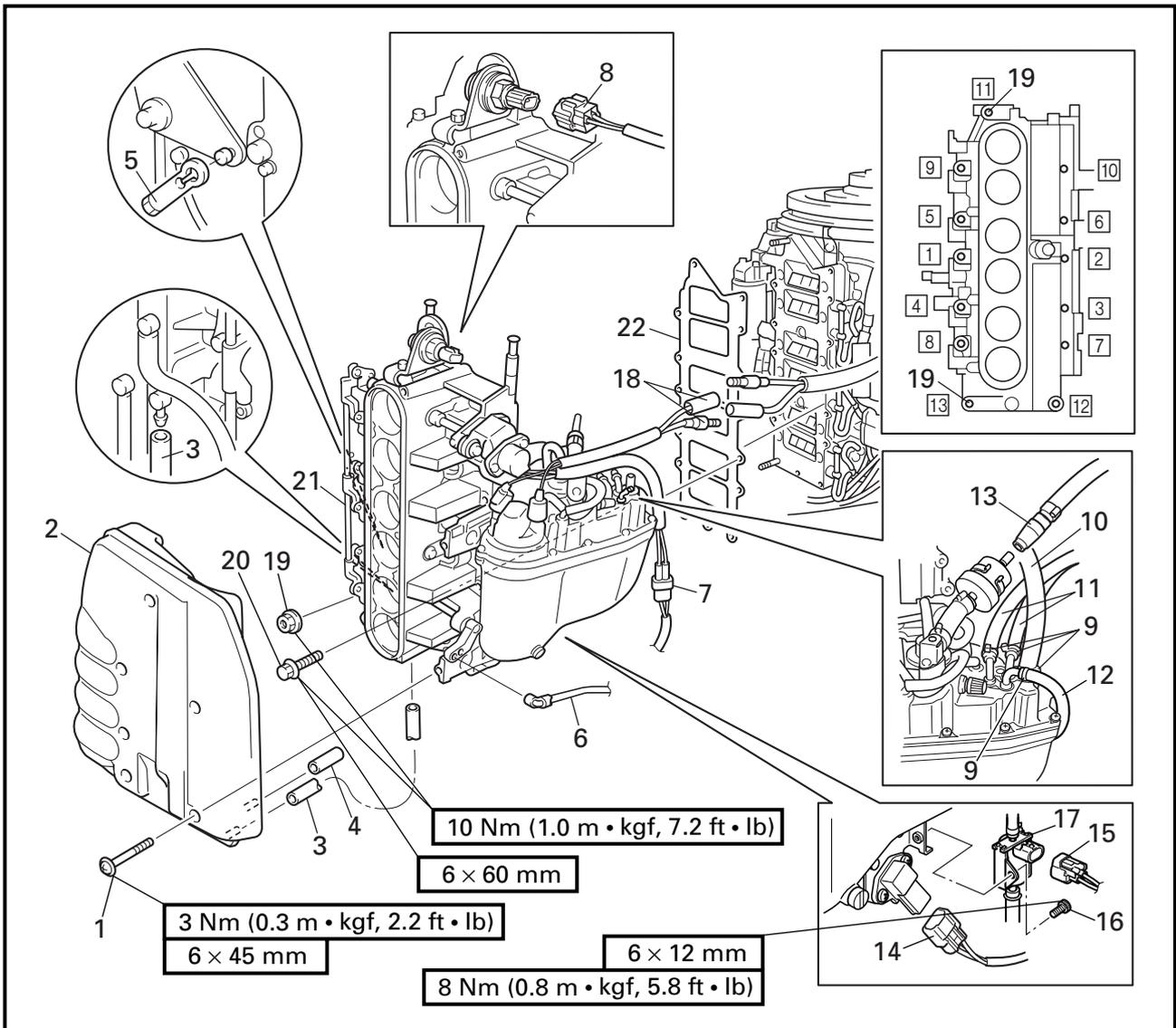
Order	Job/Part	Q'ty	Remarks
1	Flywheel magnet assembly cover	1	For installation, reverse the removal procedure.
2	Grommet	4	

**MEDIUM-PRESSURE FUEL LINE  
REMOVING/INSTALLING THE MEDIUM-PRESSURE FUEL LINE**



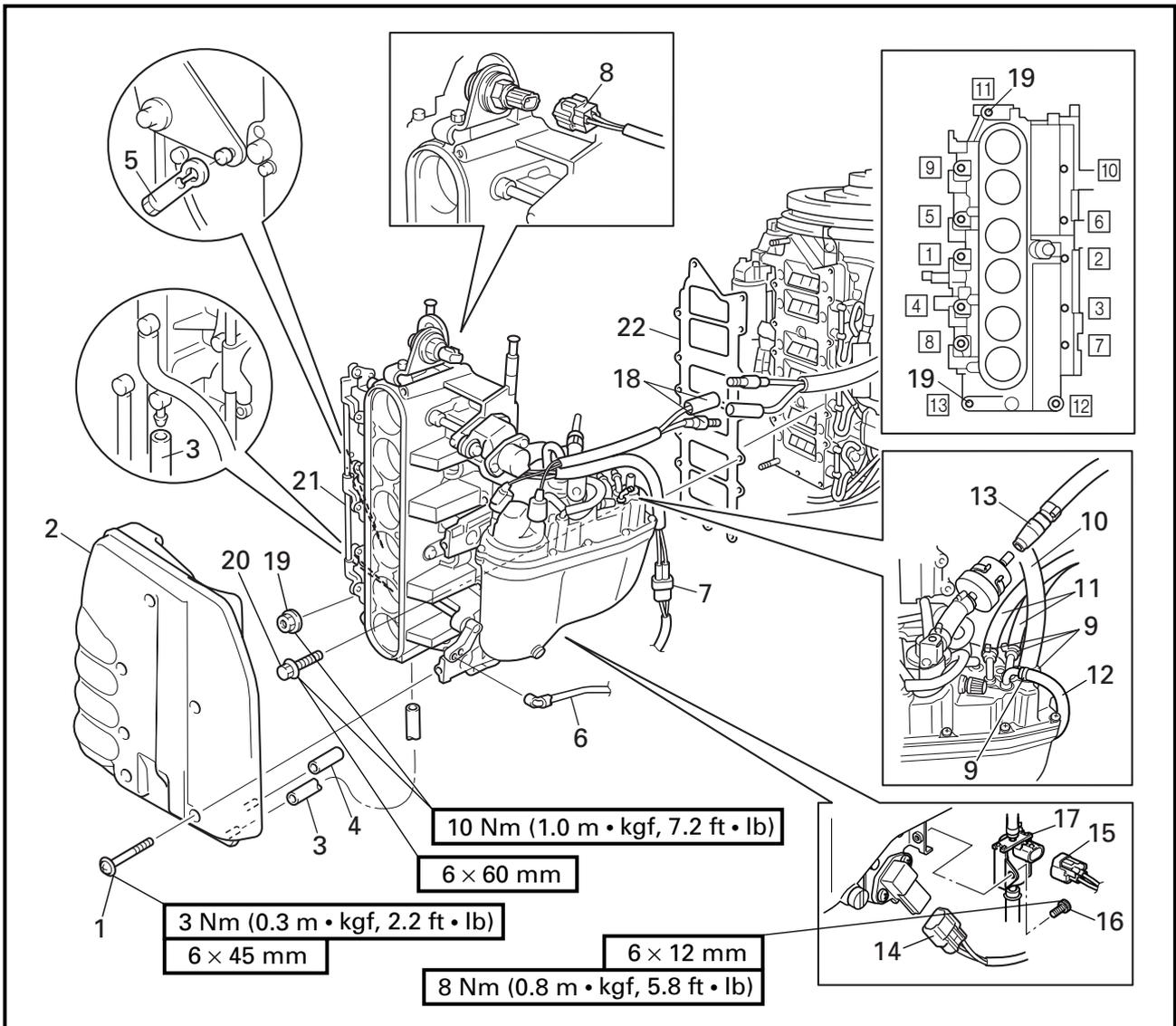
Order	Job/Part	Q'ty	Remarks
	Flywheel magnet assembly cover		Refer to "FLYWHEEL MAGNET ASSEMBLY COVER" on page 4-1.
1	Drain fuel Screw	6	
2	Intake silencer	1	
3	Suction hose	1	(intake silencer-to-throttle body)
4	Oil tank air vent hose	1	(intake silencer-to-oil tank)
5	Throttle link rod	1	
6	Oil pump link rod	1	
7	Throttle position sensor coupler	1	

Continued on next page.



Order	Job/Part	Q'ty	Remarks
8	Intake air temperature sensor	1	
9	Plastic locking tie, clamp	3, 1	<b>Not reusable</b>
10	Fuel inlet hose	1	(fuel pump-to-vapor separator)
11	Fuel return hose	2	(high-pressure fuel line assembly-to-vapor separator)
12	Electric oil pump hose	1	(electric oil pump-to-vapor separator)
13	Fuel feed hose	1	(high-pressure fuel line assembly-to-vapor separator)
14	Atmospheric pressure sensor coupler	1	

Continued on next page.

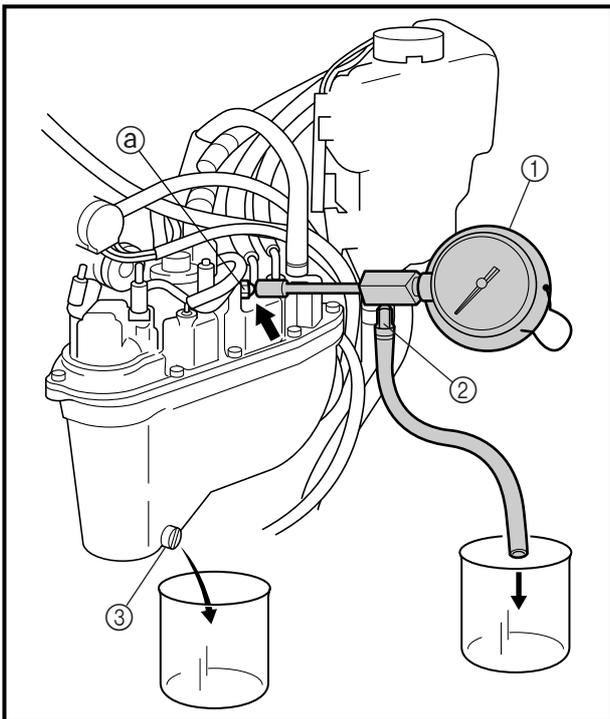


Order	Job/Part	Q'ty	Remarks
15	Electric oil pump coupler	1	
16	Bolt	1	
17	Electric oil pump assembly	1	
18	Electric fuel pump connector	2	
19	Nut	2	
20	Bolt	11	
21	Fuel injection unit	1	
22	Gasket	1	<b>Not reusable</b> For installation, reverse the removal procedure.

**REDUCING THE FUEL PRESSURE  
(MEDIUM-PRESSURE FUEL LINE)**

**⚠ WARNING**

Always reduce the fuel pressure in the medium-pressure fuel line before servicing the line or the vapor separator. If the fuel pressure is not released, pressurized fuel may spray out.



1. Reduce:

- Fuel pressure (medium-pressure fuel line)

**Reducing steps**

- (1) Install the fuel pressure gauge onto the pressure check valve (a).

	<b>Fuel pressure gauge</b> ..... ① <b>YB-06766 / 90890-06786</b>
---	---

- (2) Place the drain hose into a container.  
(3) Open the valve (2) and release the pressure.

2. Drain:

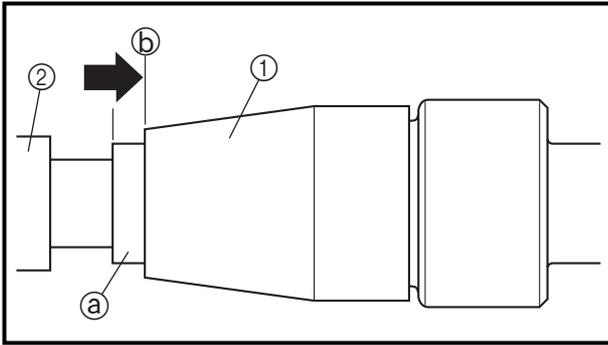
- Fuel

**⚠ WARNING**

Reduce the fuel pressure before removing the vapor separator drain screw, or pressurized fuel will spray out and may result in serious injury.

**NOTE:**

Remove the drain screw (3) and drain the vapor separator of any fuel.



**DISCONNECTING THE FUEL HOSE JOINT**

Disconnect:

- Fuel hose joint ①

**NOTE:**

Disconnect from the fuel strainer ② the fuel hose with the collar ③ slid to the end ④ of the joint.

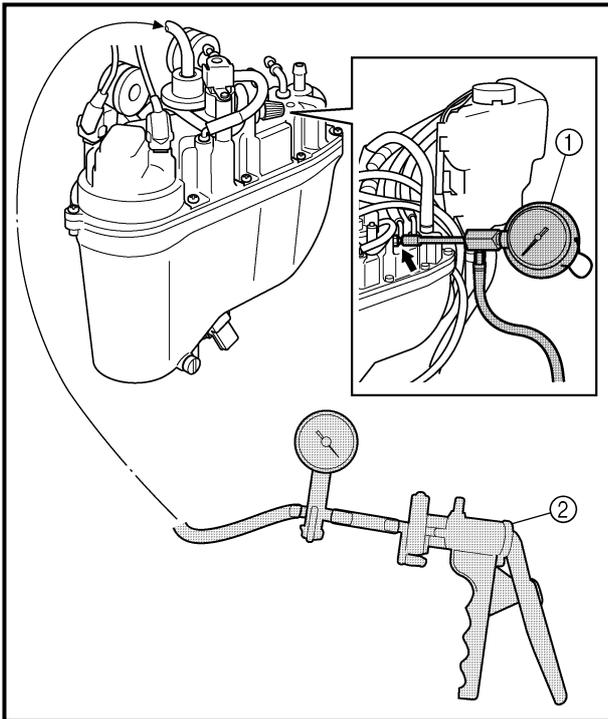
**CHECKING THE PRESSURE REGULATOR**

Check:

- Fuel pressure displacement  
Faulty → Replace the pressure regulator.

**Checking steps**

- (1) Install the fuel pressure gauge onto the pressure check valve and then install the Mity vac onto the pressure regulator vacuum hose.



	<b>Fuel pressure gauge</b> ..... ① <b>YB-06786 / 90890-06786</b>
	<b>Mity vac</b> ..... ② <b>YB-35956 / 90890-06756</b>

- (2) Start the engine.
- (3) Apply vacuum pressure with the Mity vac.

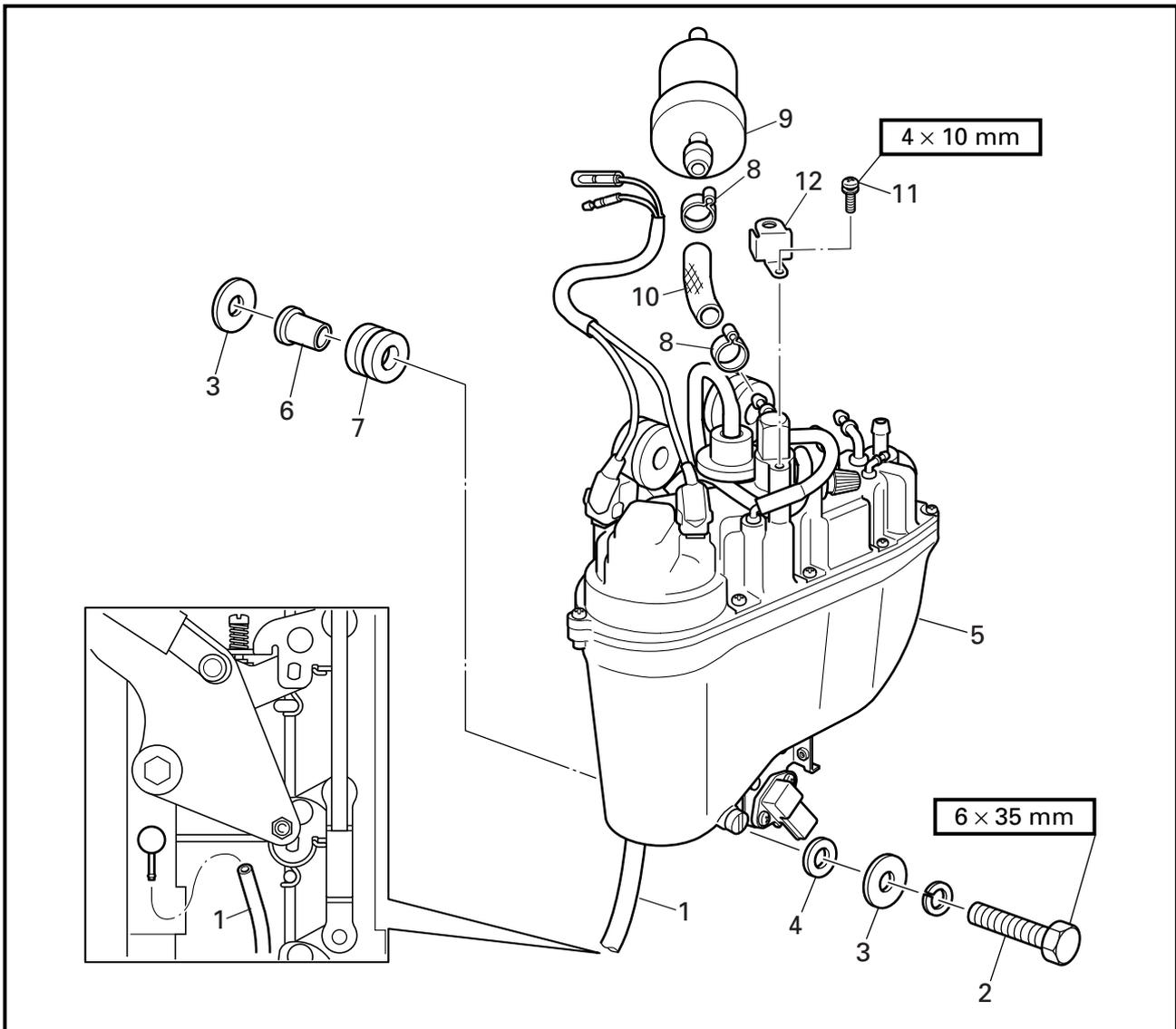
	<b>Vacuum pressure</b> <b>Approx.</b> <b>35 kPa (0.35 kg/cm<sup>2</sup>, 4.98 psi)</b>
--	--

- (4) Check the fuel pressure displacement.

**NOTE:**

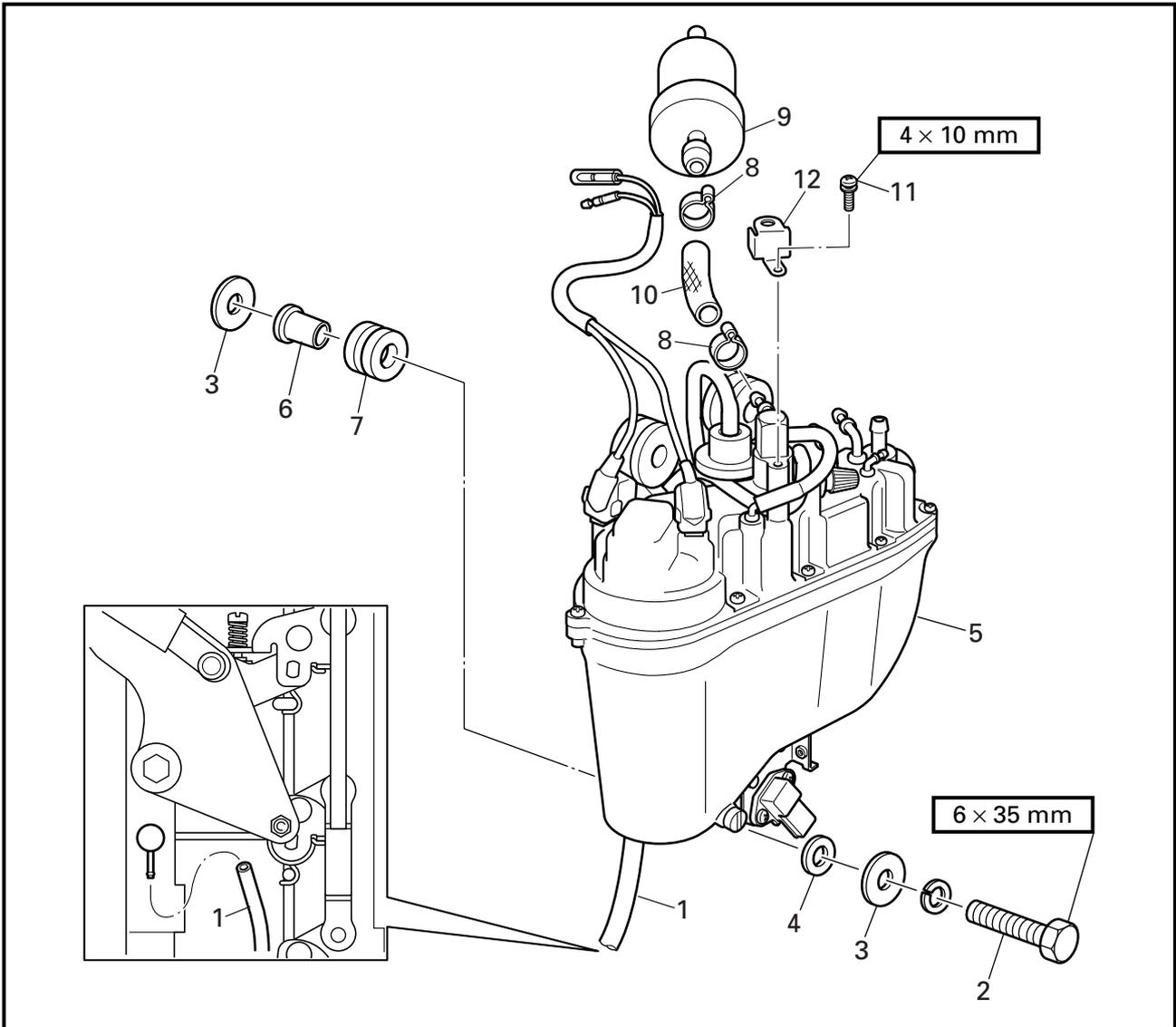
Make sure the fuel pressure in the medium-pressure fuel line lowers conversely in relation to the amount of pressure that is applied to the pressure regulator.

**VAPOR SEPARATOR  
REMOVING/INSTALLING THE VAPOR SEPARATOR**

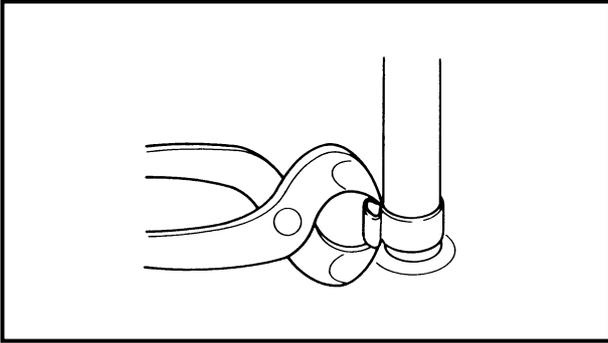


Order	Job/Part	Q'ty	Remarks
	Atmospheric pressure sensor coupler, electric oil pump coupler, fuel inlet hose, fuel return hoses, electric oil pump hose, electric oil pump assembly, fuel feed hose and electric fuel pump connector		Refer to "MEDIUM-PRESSURE FUEL LINE" on page 4-2. Before performing the following procedure, reduce the fuel pressure (medium-pressure fuel line).
1	Hose	1	(vapor separator and pressure regulator-to-throttle body)
2	Bolt	3	
3	Large washer	6	

Continued on next page.



Order	Job/Part	Q'ty	Remarks
4	Small washer	3	
5	Vapor separator	1	
6	Collar	3	
7	Grommet	3	
8	Hose clamp	2	<b>Not reusable</b>
9	Fuel strainer	1	
10	Fuel hose	1	
11	Screw	1	
12	Fuel hose joint holder	1	
			For installation, reverse the removal procedure.

**REMOVING THE HOSE CLAMPS**

Remove:

- Hose clamps

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

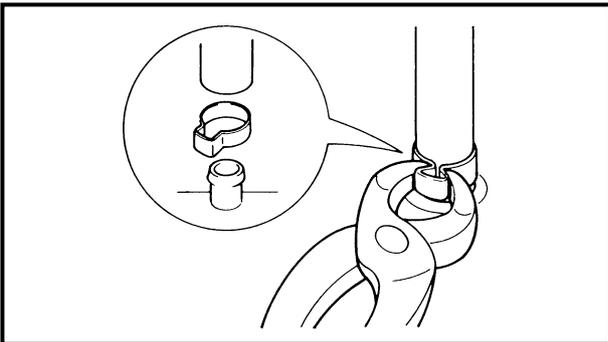
Remove the hose clamps by cutting its joint.

---

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

The fuel hose will be damaged if a hose clamps are removed without cutting the joint.

---

**INSTALLING THE HOSE CLAMPS**

Install:

- Hose clamps

**⚠ WARNING** \_\_\_\_\_

Do not reuse hose clamps, only use new ones.

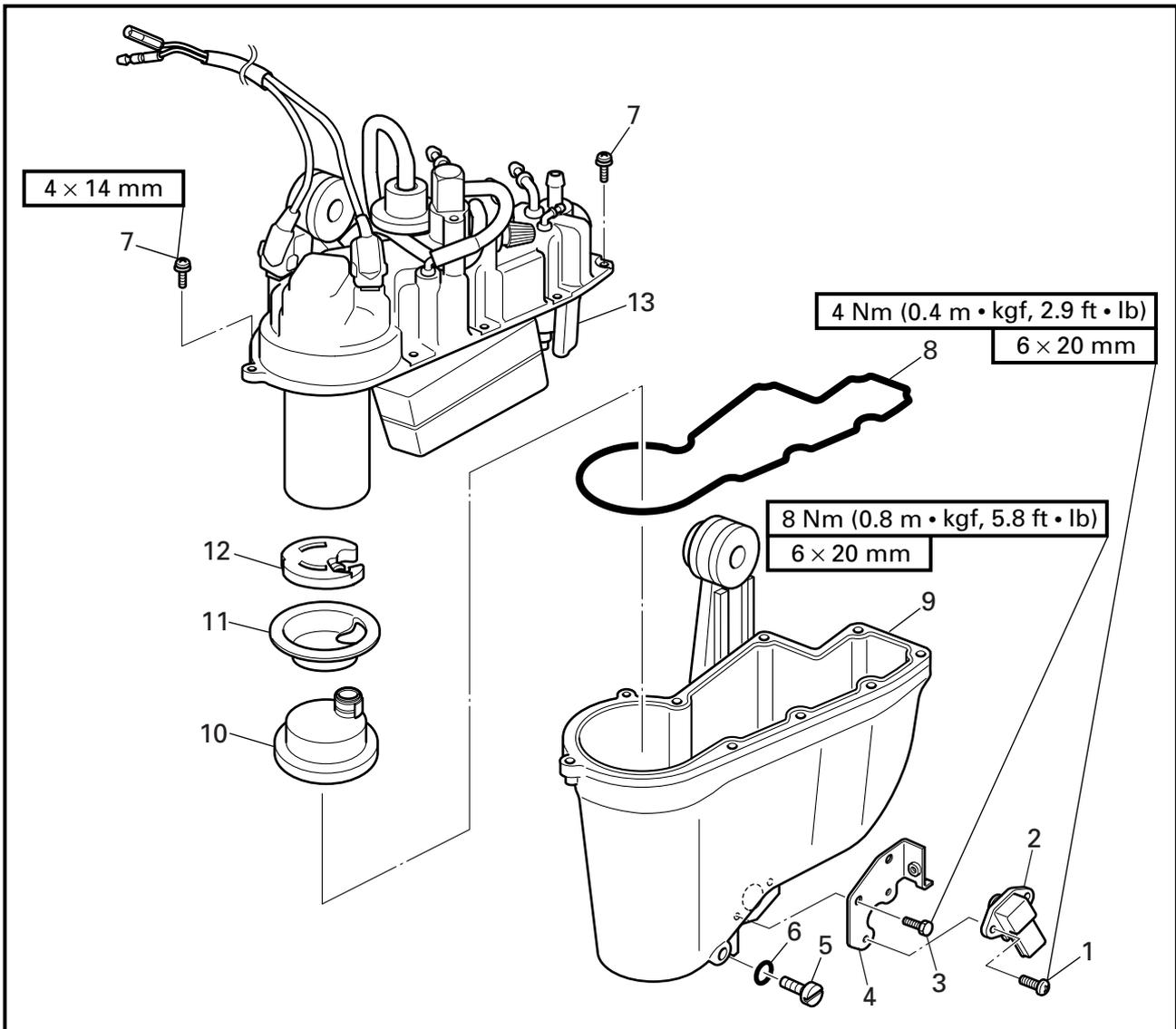
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**NOTE:** \_\_\_\_\_

Properly crimp the hose clamps so it is securely fastened.

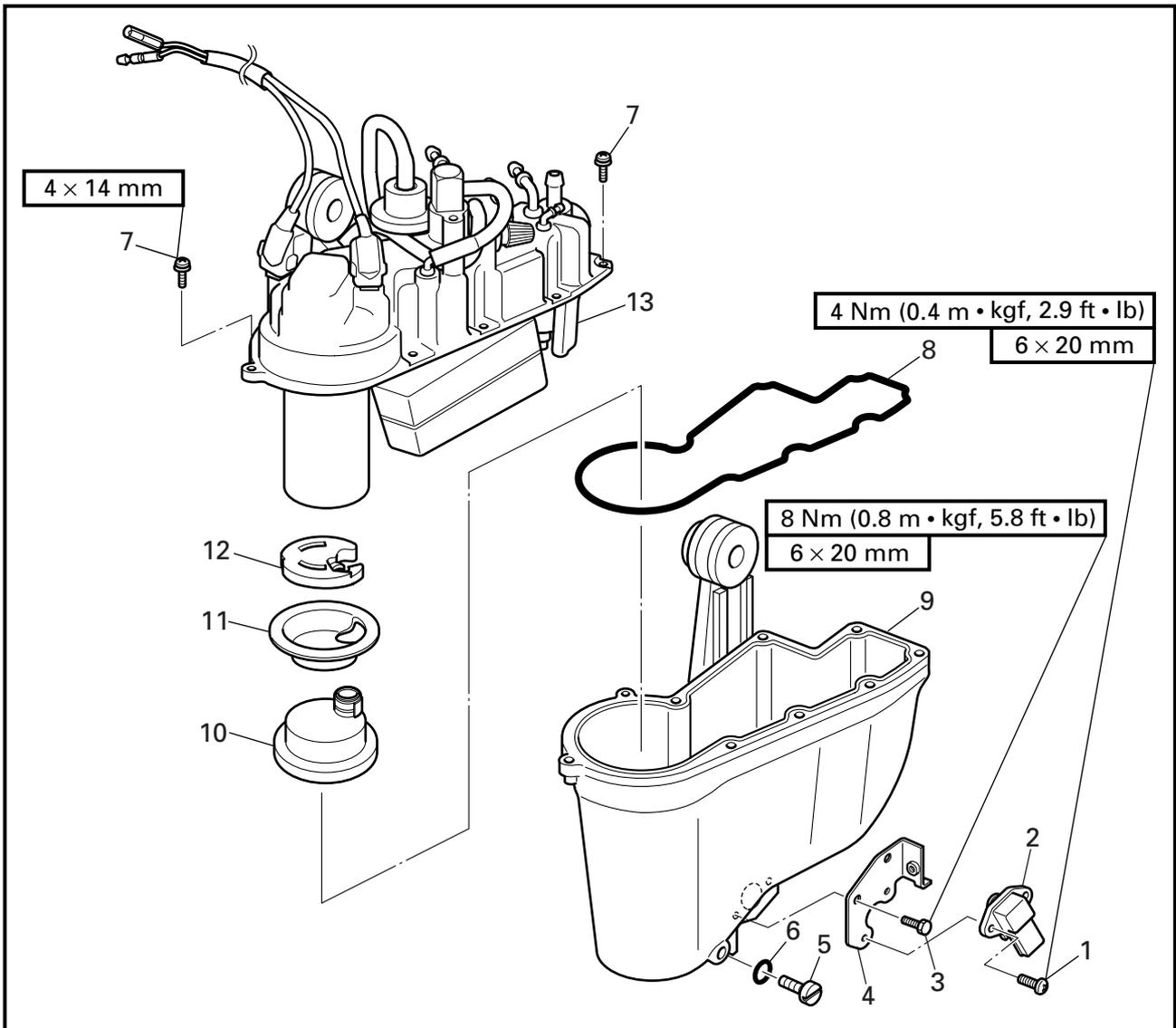
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**DISASSEMBLING/ASSEMBLING THE VAPOR SEPARATOR**

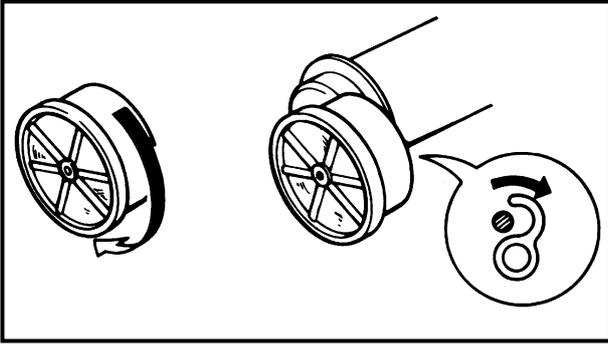


Order	Job/Part	Q'ty	Remarks
1	Screw	2	
2	Atmospheric pressure sensor	1	
3	Bolt	2	
4	Electric oil pump bracket	1	
5	Drain screw	1	
6	O-ring	1	4.8 x 1.9 mm
7	Screw	9	

Continued on next page.



Order	Job/Part	Q'ty	Remarks
8	O-ring	1	
9	Float chamber	1	
10	Electric fuel pump filter	1	
11	Rubber damper holder	1	
12	Rubber damper	1	
13	Vapor separator body	1	
			For assembly, reverse the disassembly procedure.



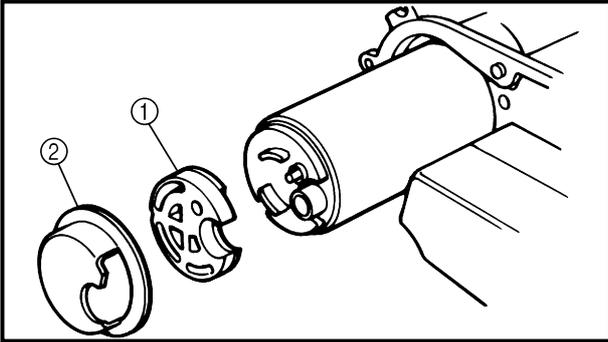
### REMOVING THE ELECTRIC FUEL PUMP FILTER

Remove:

- Electric fuel pump filter

#### NOTE:

To remove the electric fuel pump filter, turn it clockwise.



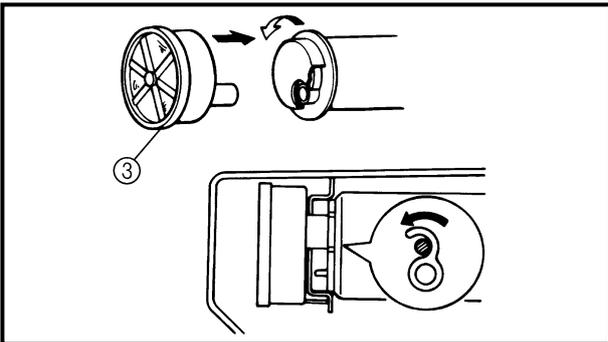
### INSTALLING THE ELECTRIC FUEL PUMP FILTER

Install:

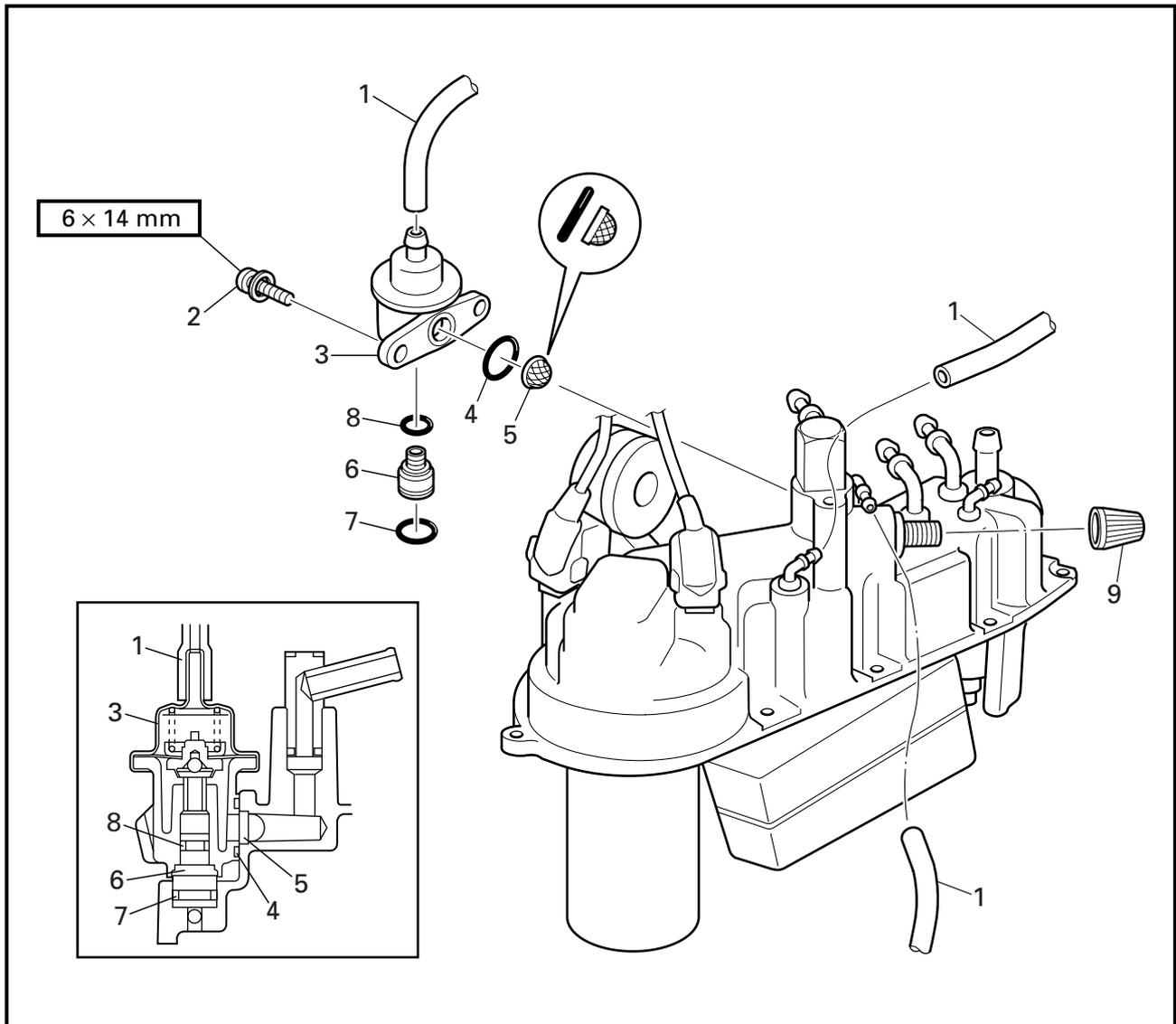
- Rubber damper ①
- Rubber damper holder ②
- Electric fuel pump filter ③

#### NOTE:

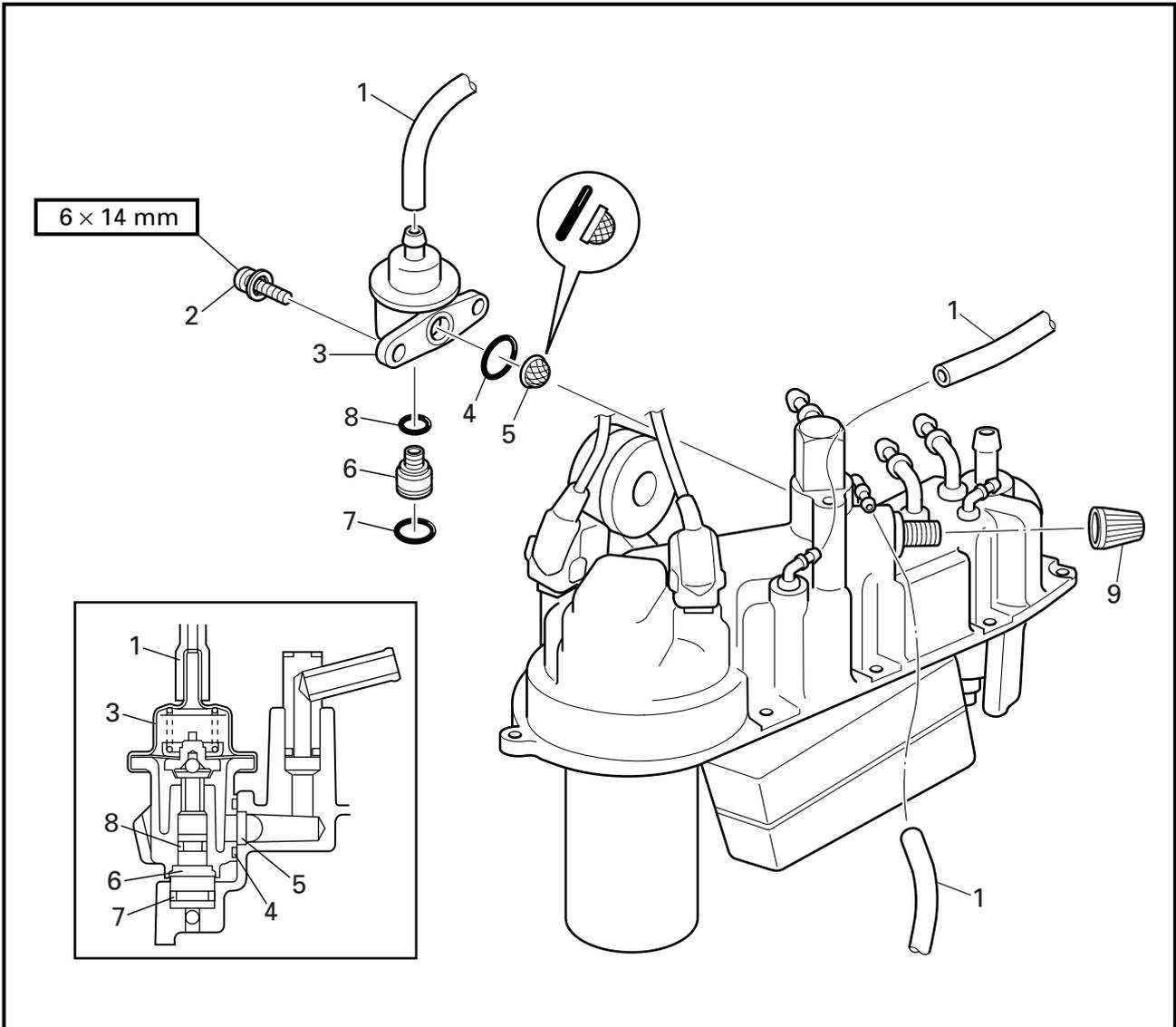
- Make sure the rubber damper is correctly installed in its holder.
- Firmly push the electric fuel pump filter into the bottom of the electric fuel pump and then turn the filter counterclockwise until it clicks.



**REMOVING/INSTALLING THE PRESSURE REGULATOR**



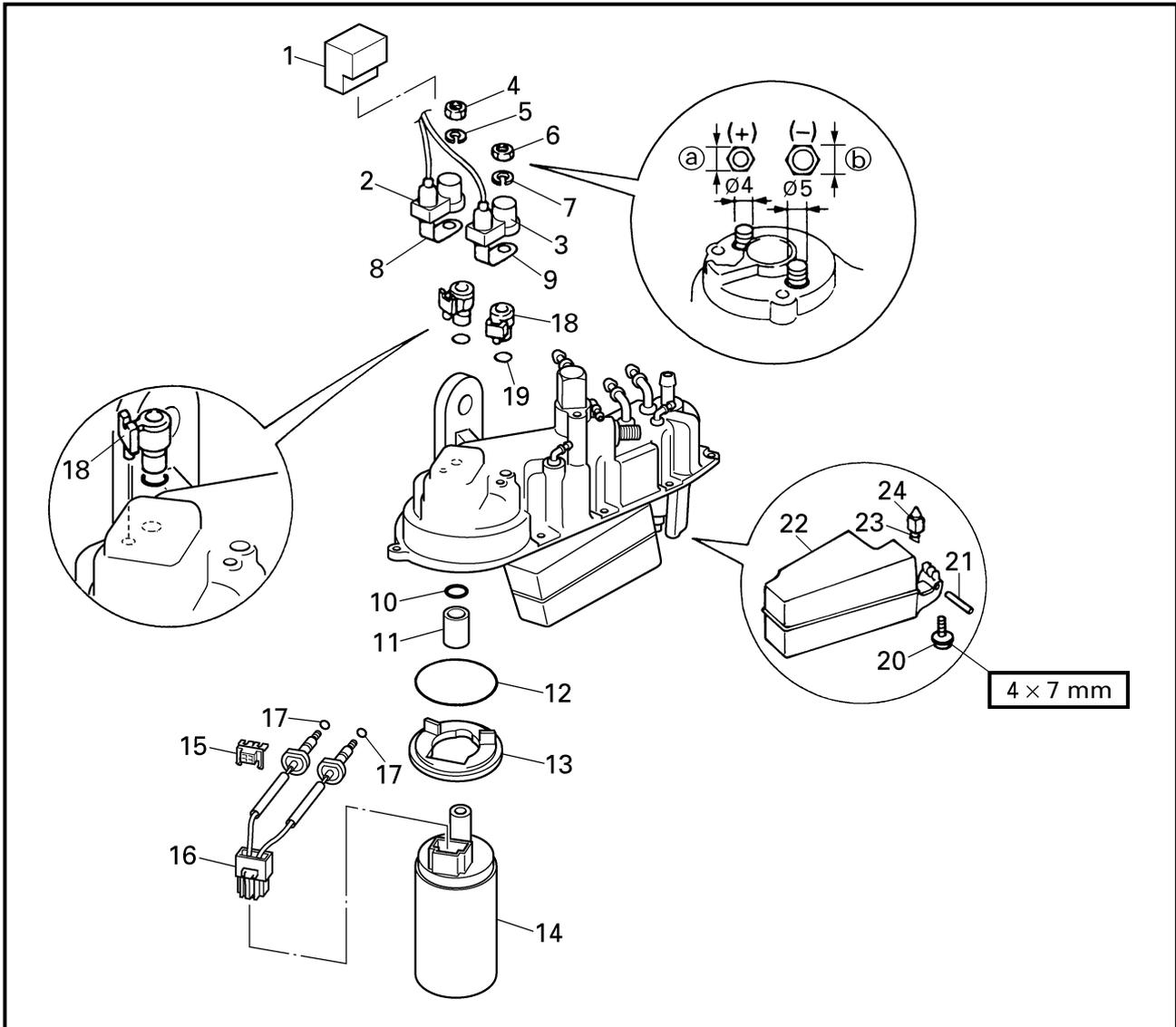
Order	Job/Part	Q'ty	Remarks
	Float chamber		Refer to "DISASSEMBLING/ASSEMBLING THE VAPOR SEPARATOR" on page 4-10.
1	Hose	3	(vapor separator and pressure regulator-to-throttle body)
2	Screw	2	
3	Pressure regulator	1	
4	O-ring	1	
			Continued on next page.



Order	Job/Part	Q'ty	Remarks
5	Filter	1	For installation, reverse the removal procedure.
6	Fuel return joint	1	
7	O-ring	1	
8	O-ring	1	
9	Cap	1	

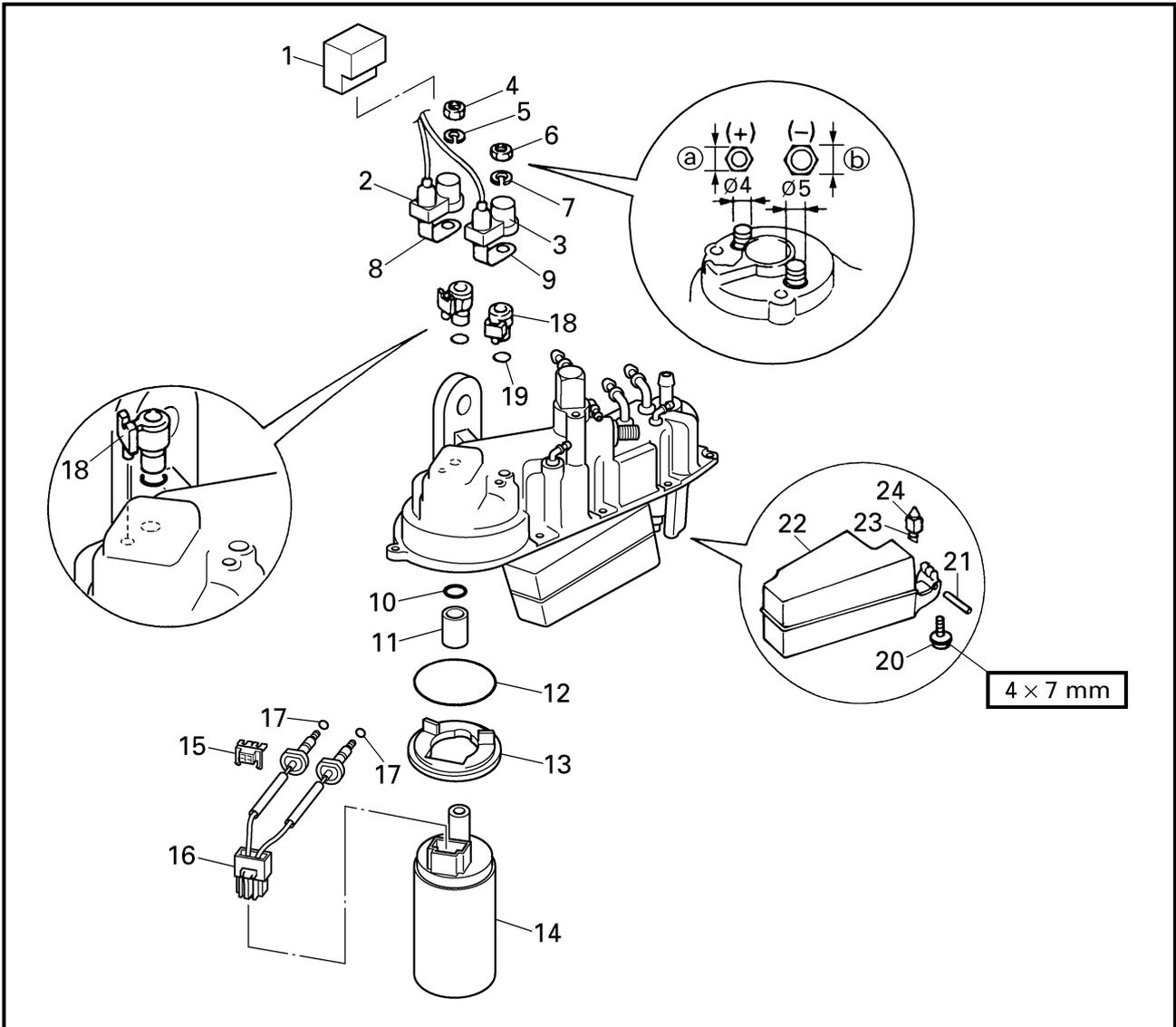
**ELECTRIC FUEL PUMP**

**DISASSEMBLING/ASSEMBLING THE ELECTRIC FUEL PUMP**



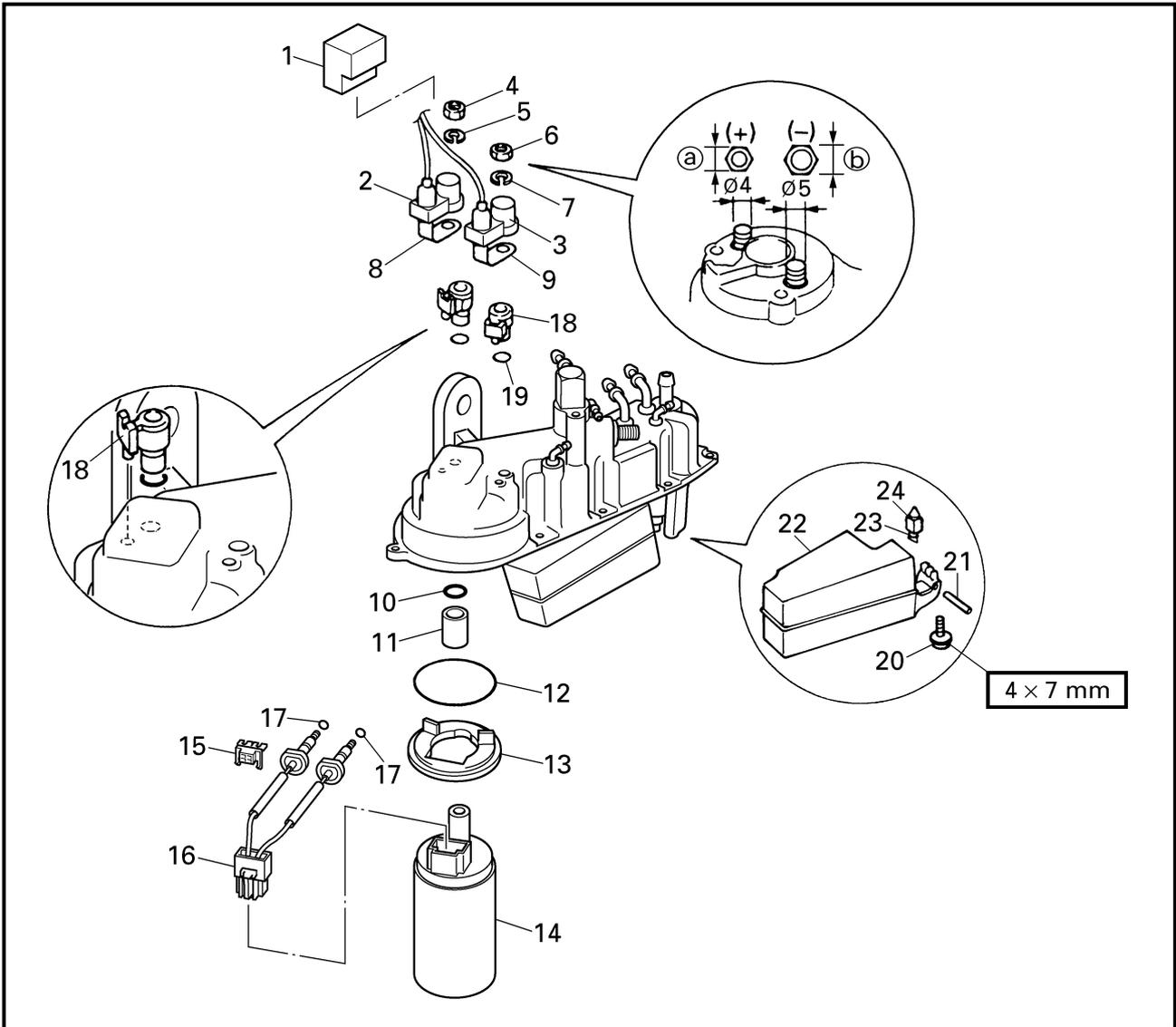
Order	Job/Part	Q'ty	Remarks
1	Terminal cover	1	
2	Positive electric fuel pump terminal cap	1	(red lead)
3	Negative electric fuel pump terminal cap	1	(blue lead)
4	Nut	1	(M4) Ⓐ = 7 mm
5	Spring washer	1	
6	Nut	1	(M5) Ⓑ = 8 mm
7	Spring washer	1	
8	Positive electric fuel pump terminal	1	

Continued on next page.



Order	Job/Part	Q'ty	Remarks
9	Negative electric fuel pump terminal	1	
10	O-ring	1	
11	Collar	1	
12	O-ring	1	
13	Electric fuel pump guide plate	1	
14	Electric fuel pump	1	
15	Coupler holder	1	
16	Terminal assembly	1	

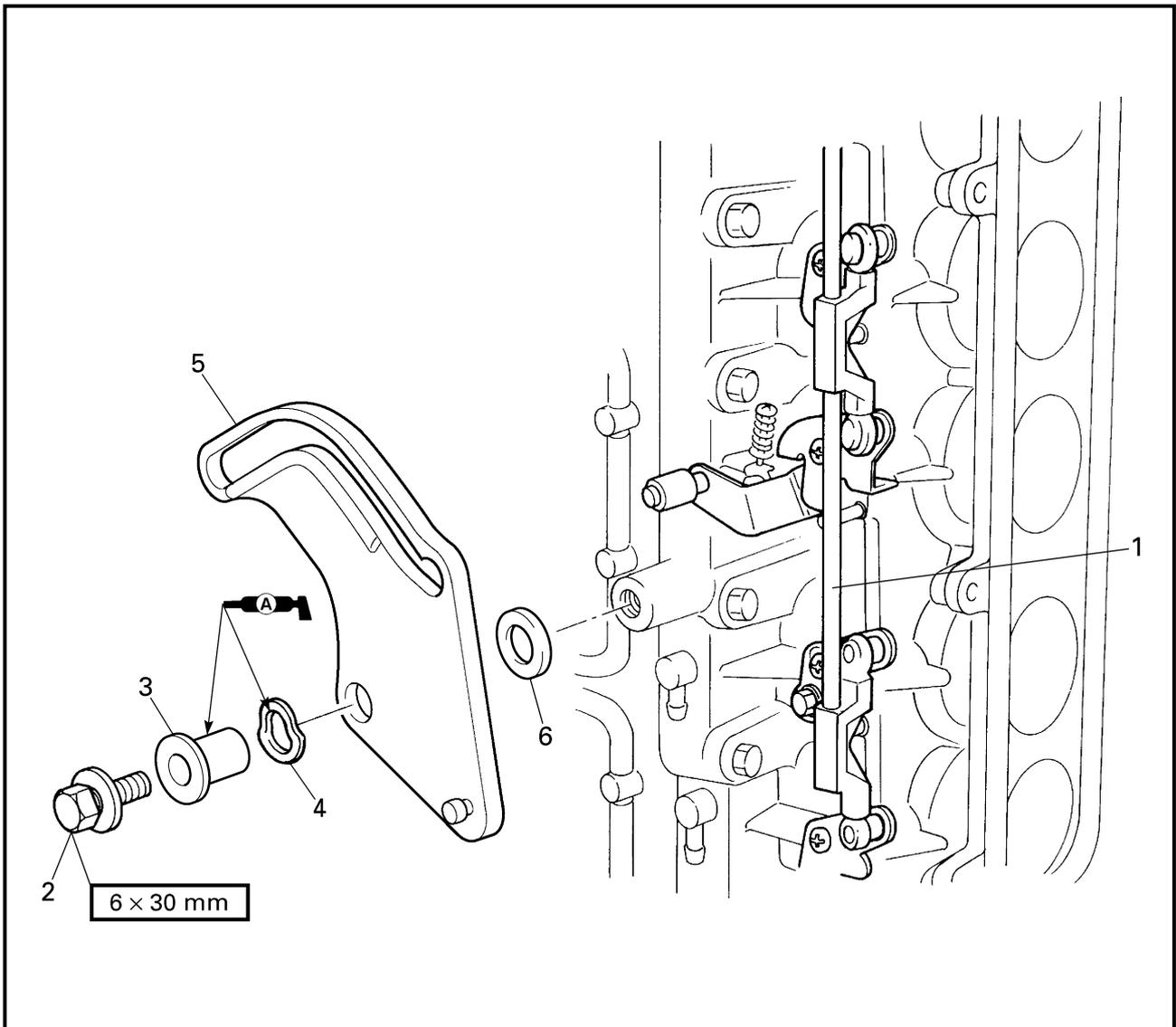
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Order	Job/Part	Q'ty	Remarks
17	O-ring	2	
18	Insulator	2	
19	O-ring	2	
20	Screw	1	
21	Float pin	1	
22	Float	1	
23	Clip	1	
24	Needle valve	1	
			For assembly, reverse the disassembly procedure.

**THROTTLE CONTROL LEVER CAM**

**REMOVING/INSTALLING THE THROTTLE CONTROL LEVER CAM**



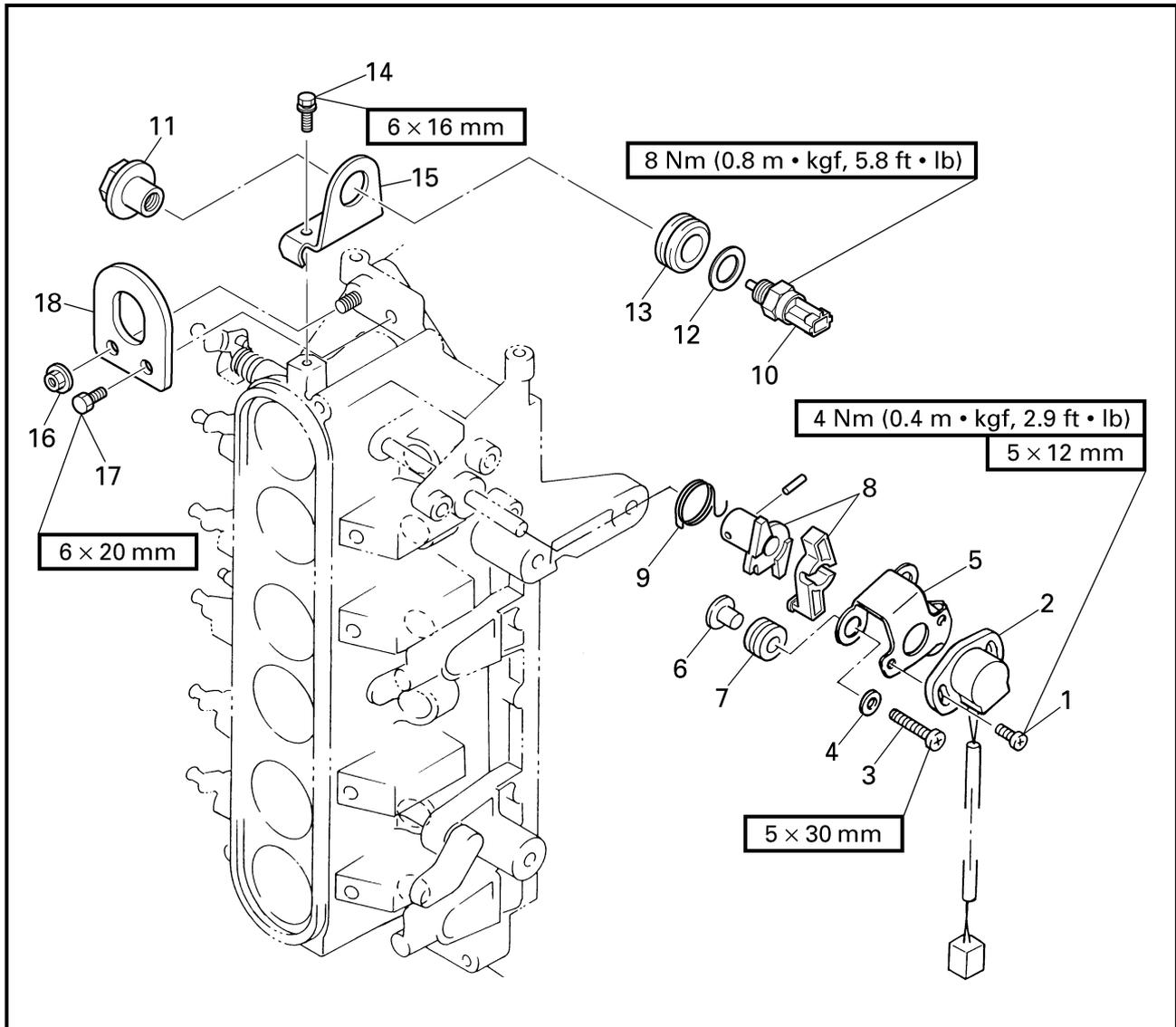
Order	Job/Part	Q'ty	Remarks
	Throttle link rod		Refer to "MEDIUM-PRESSURE FUEL LINE" on page 4-2.
1	Throttle link	1	
2	Bolt	1	
3	Collar	1	
4	Wave washer	1	
5	Throttle control lever cam	1	
6	Washer	1	
			For installation, reverse the removal procedure.



# THROTTLE POSITION SENSOR AND AIR TEMPERATURE SENSOR

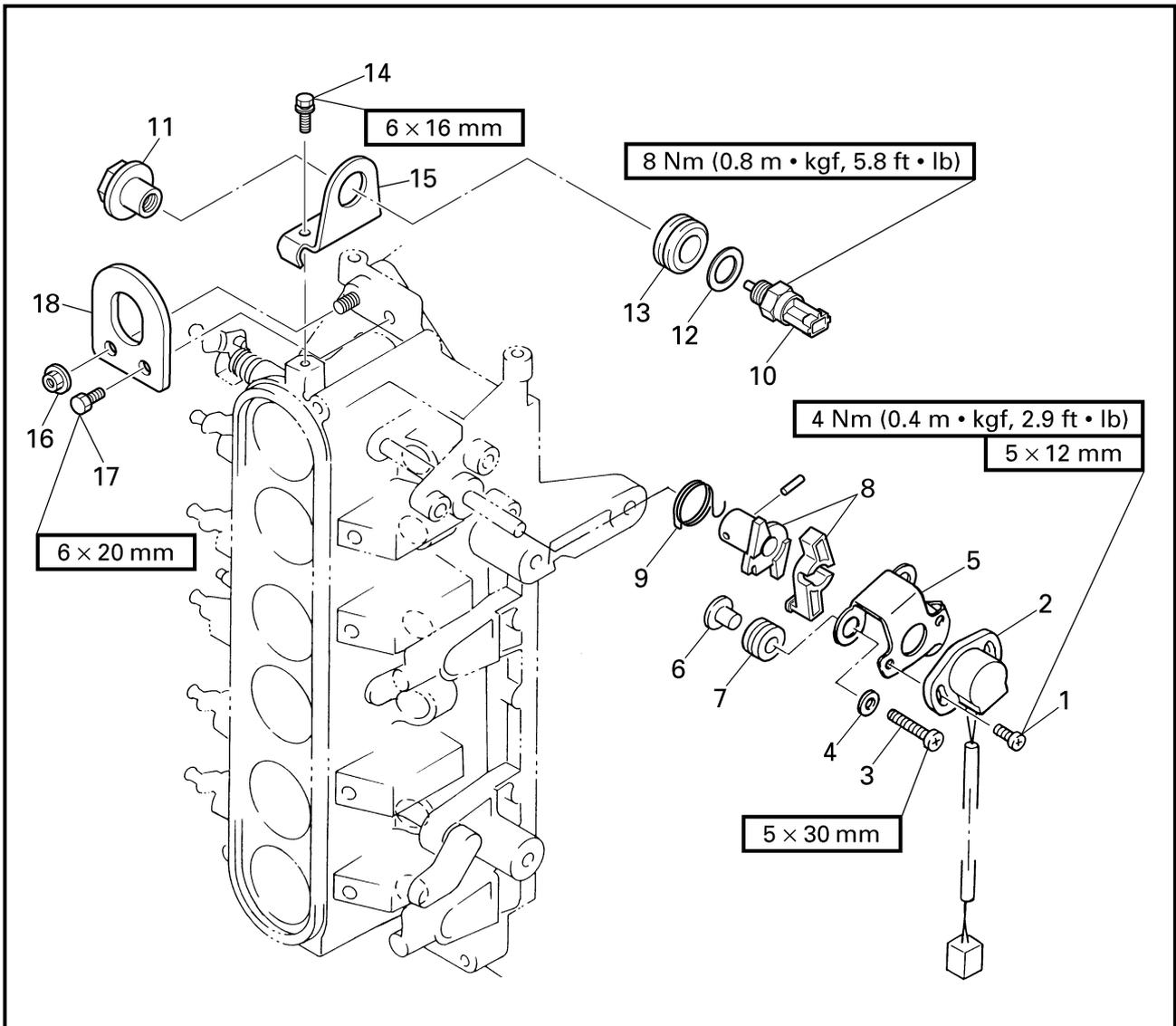
E

## THROTTLE POSITION SENSOR AND AIR TEMPERATURE SENSOR REMOVING/INSTALLING THE THROTTLE POSITION SENSOR AND AIR TEMPERATURE SENSOR



Order	Job/Part	Q'ty	Remarks
1	Screw	2	
2	Throttle position sensor	1	
3	Screw	3	
4	Washer	3	
5	Throttle position sensor bracket	1	
6	Collar	3	
7	Grommet	3	
8	Throttle position sensor cam	1	
9	Spring	1	
10	Intake air temperature sensor	1	

Continued on next page.



Order	Job/Part	Q'ty	Remarks
11	Nut	1	
12	Washer	1	
13	Grommet	1	
14	Bolt	1	
15	Intake air temperature sensor bracket	1	
16	Nut	1	
17	Bolt	1	
18	Engine hanger	1	
			For installation, reverse the removal procedure.



## THROTTLE POSITION SENSOR AND AIR TEMPERATURE SENSOR

E

### INSTALLING THE THROTTLE POSITION SENSOR

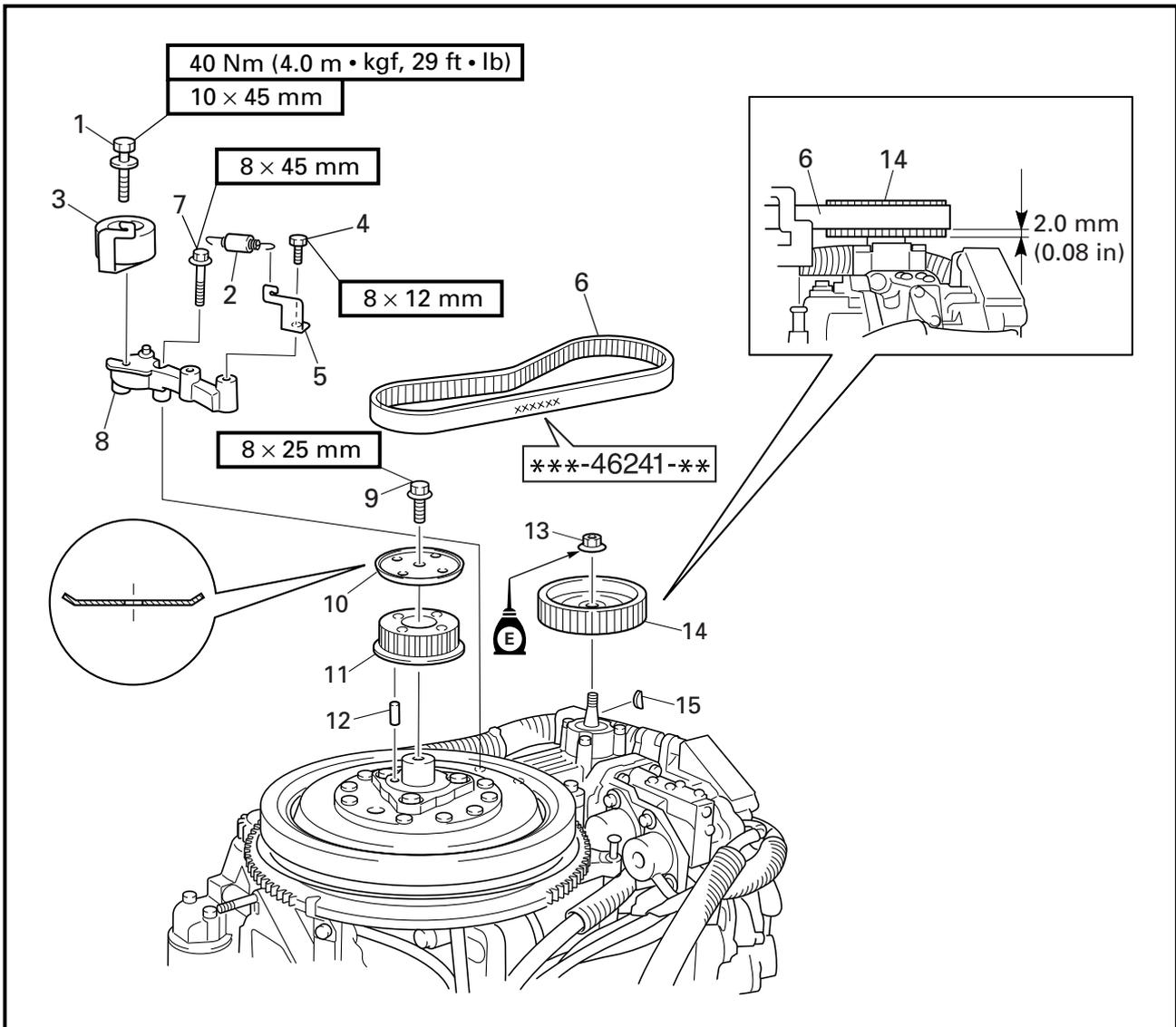
**NOTE:** \_\_\_\_\_  
During installation, make sure the throttle position sensor is properly adjusted.

---

Install:

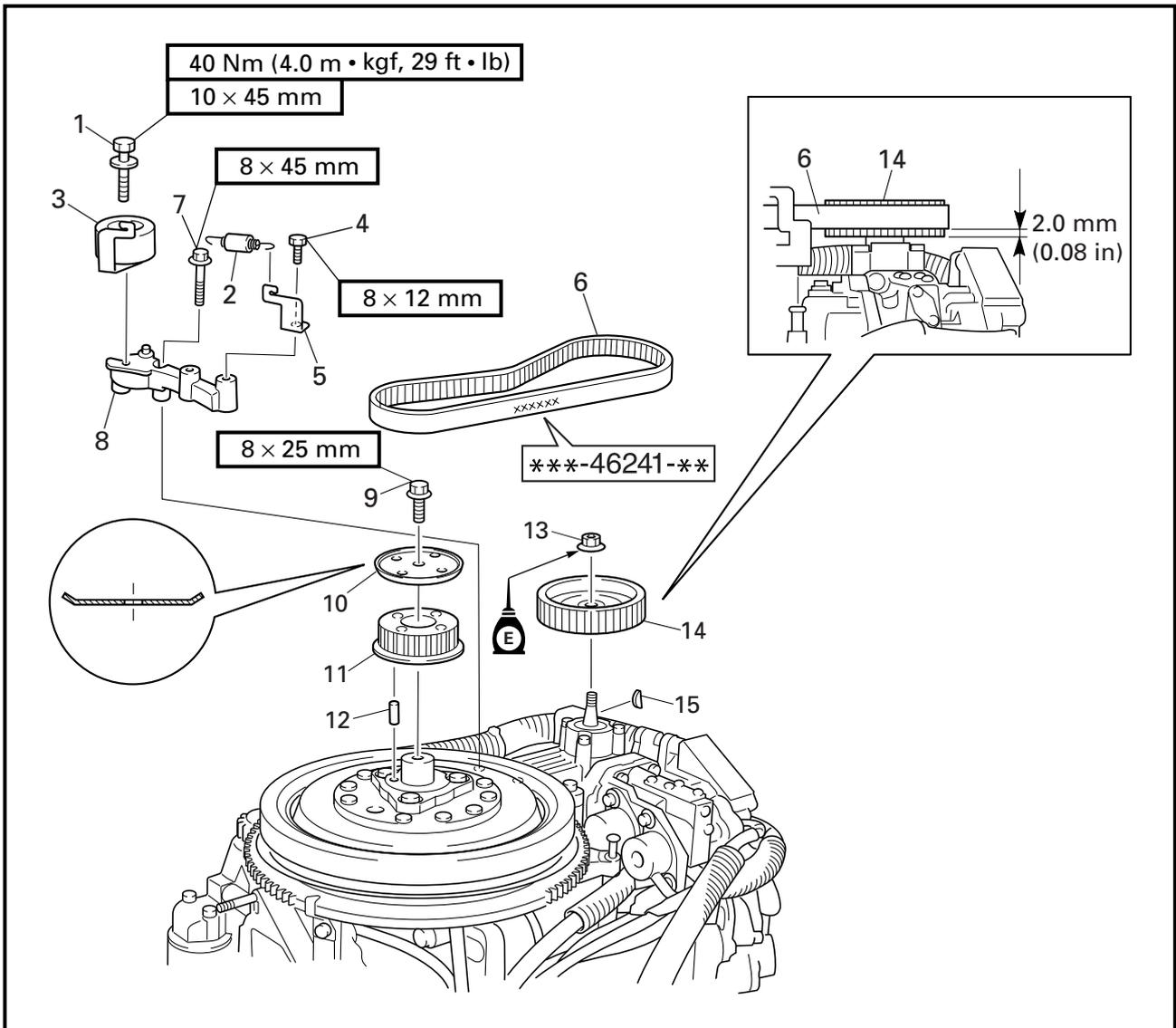
- Throttle position sensor  
Refer to "ADJUSTING THE THROTTLE POSITION SENSOR" on page 3-8.

**DRIVE BELT  
REMOVING/INSTALLING THE DRIVE BELT**



Order	Job/Part	Q'ty	Remarks
	Flywheel magnet assembly cover		Refer to "FLYWHEEL MAGNET ASSEMBLY COVER" on page 4-1.
1	Bolt	1	
2	Spring	1	
3	Drive belt tensioner	1	
4	Bolt	1	
5	Spring holder	1	
6	Drive belt	1	
7	Bolt	2	

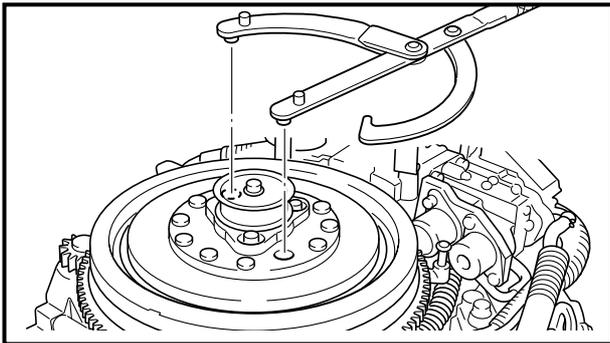
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Order	Job/Part	Q'ty	Remarks
8	Tensioner bracket	1	
9	Bolt	1	
10	Drive sprocket plate	1	
11	Drive sprocket	1	
12	Dowel pin	1	
13	Nut	1	
14	Driven sprocket	1	
15	Woodruff key	1	
			For installation, reverse the removal procedure.

**CAUTION:**

Do not loosen or tighten the drive sprocket bolt and driven sprocket nut when the drive belt is installed.

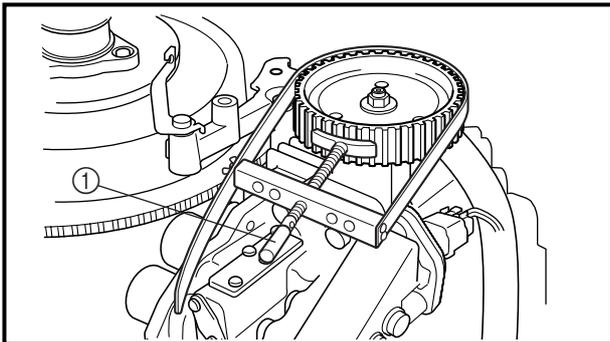


**REMOVING THE DRIVE SPROCKET**

Remove:

- Drive sprocket

	<b>Universal holder</b> <b>YU-01235 / 90890-01235</b>
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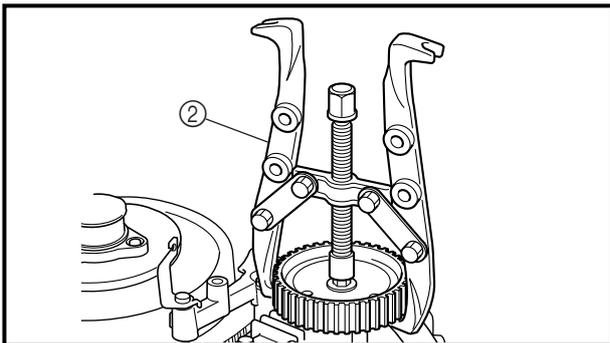


**REMOVING THE DRIVEN SPROCKET**

Remove:

- Driven sprocket

	<b>Sheave holder</b> ..... ① <b>YS-1880-A / 90890-01701</b> <b>Universal puller</b> ..... ② <b>YB-06540 / 90890-06540</b>
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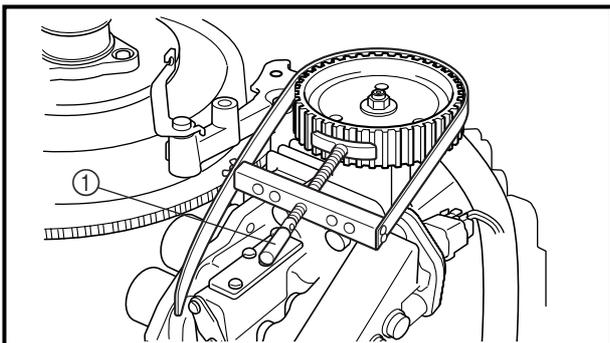


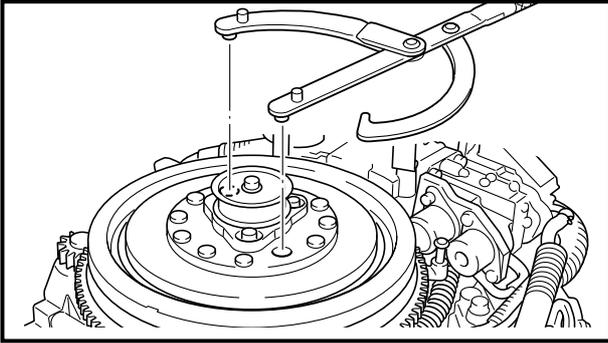
**INSTALLING THE DRIVEN SPROCKET**

Install:

- Driven sprocket

	<b>Sheave holder</b> ..... ① <b>YS-1880-A / 90890-01701</b>
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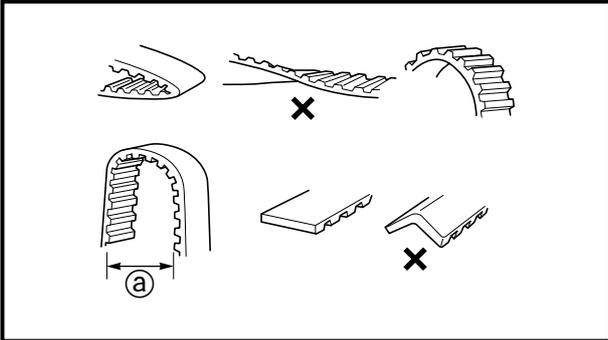
**INSTALLING THE DRIVE SPROCKET**

Install:

- Drive sprocket



**Universal holder**  
YU-01235 / 90890-01235



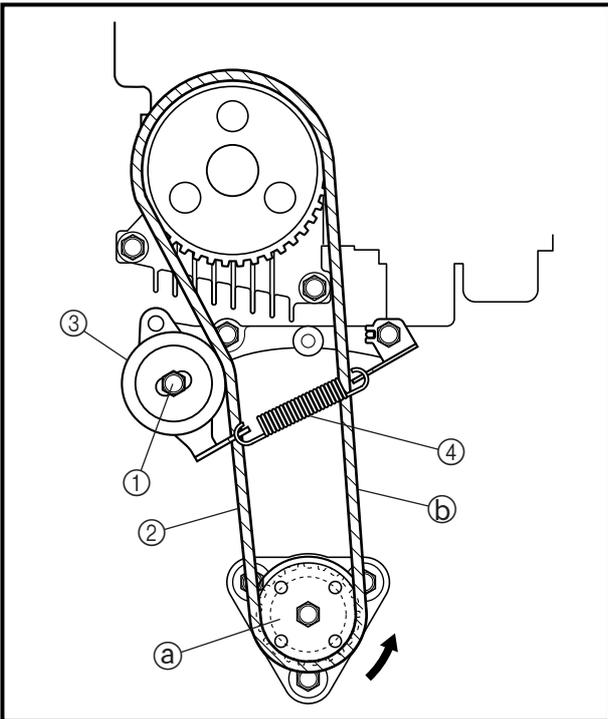
**INSTALLING THE DRIVE BELT**

Install:

- Drive belt

**CAUTION:**

- Never forcefully twist, turn inside out, or bend the drive belt.
- Do not let oil or grease get onto the drive belt.
- Minimum 25 mm (1.0 in) <sup>a</sup>.



**Installation steps**

- (1) Finger tighten the drive belt tensioner bolt ①, and then loosen it 90°.
- (2) Install the drive belt ② by pushing the drive belt tensioner ③ to the loosest point on the belt.

**NOTE:**

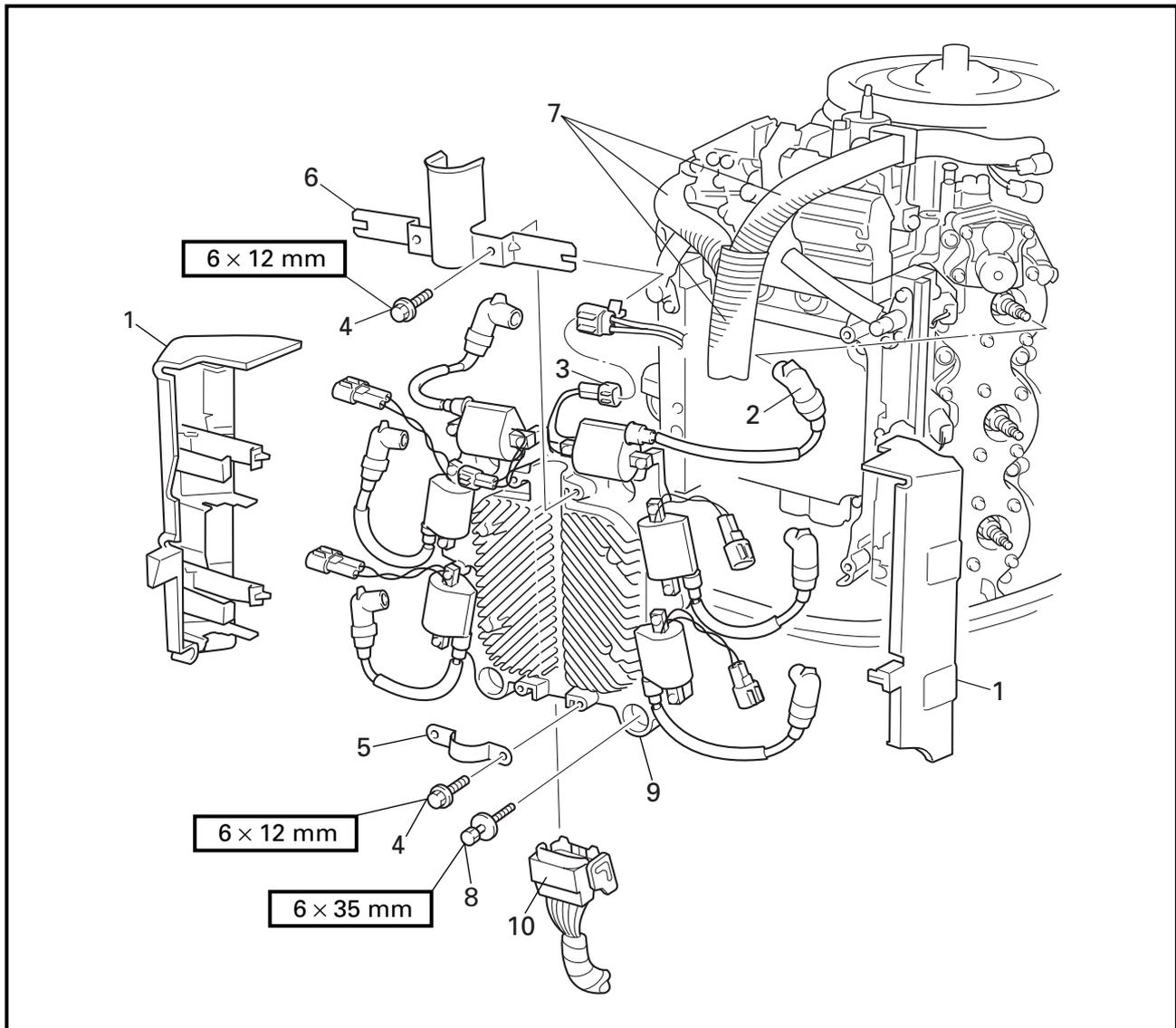
Install the drive belt from the drive sprocket side <sup>a</sup> and working it counterclockwise.

- (3) Install the spring ④.
- (4) Loosen the drive belt tensioner bolt and stretch the drive belt with the force of the spring.
- (5) Adjust the drive belt tension so that side <sup>b</sup> of the drive belt has no slack, and then tighten the drive belt tensioner bolt.



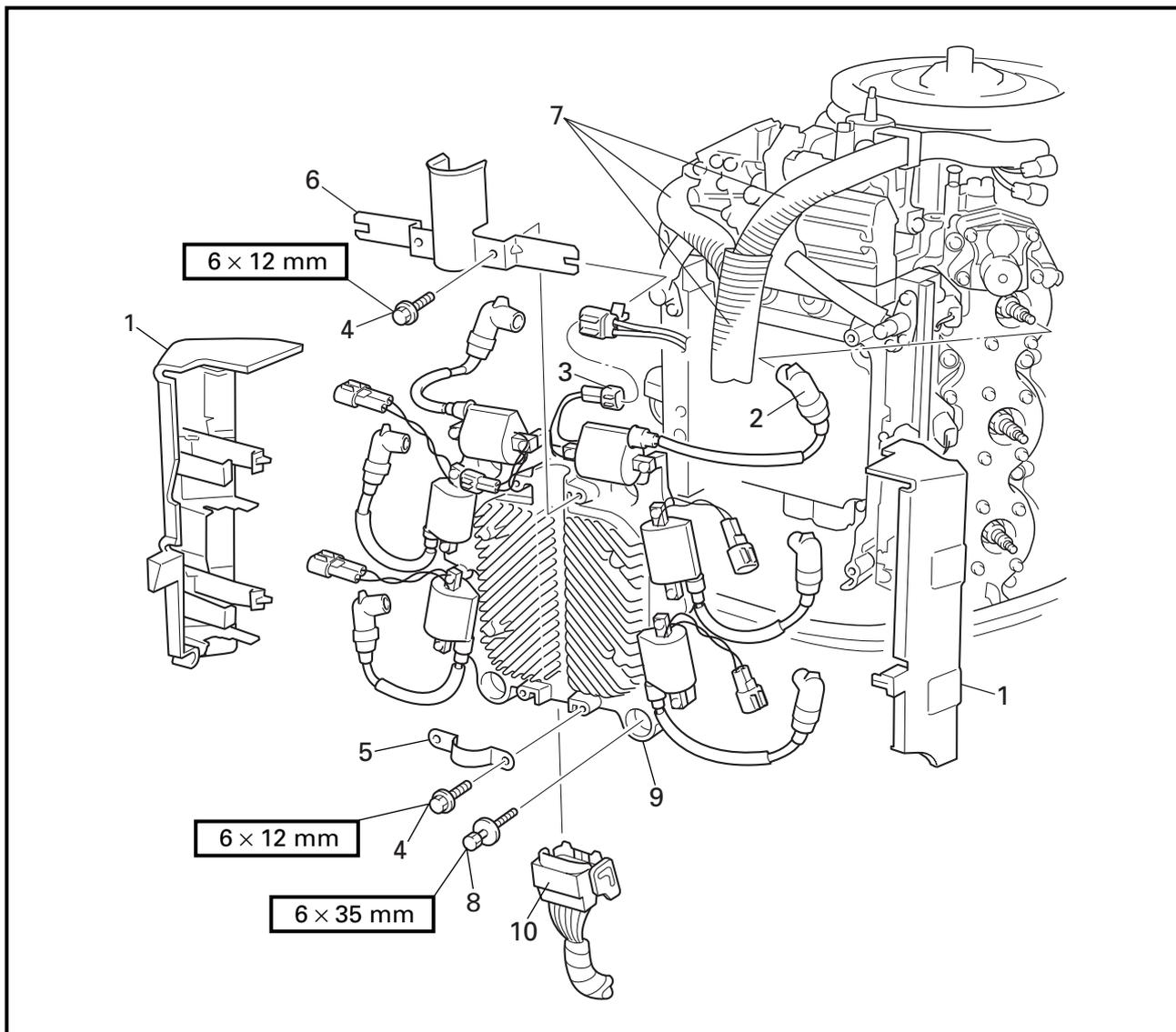
**Drive belt tensioner bolt**  
40 Nm (4.0 m • kgf, 29 ft • lb)

**INJECTOR DRIVER  
REMOVING/INSTALLING THE INJECTOR DRIVER**

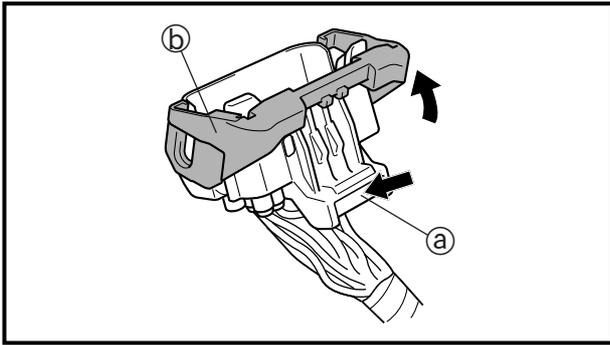


Order	Job/Part	Q'ty	Remarks
	Flywheel magnet assembly cover		Refer to "FLYWHEEL MAGNET ASSEMBLY COVER" on page 4-1.
1	Fuel rail cover	2	
2	Spark plug cap	6	
3	Ignition coil coupler	6	
4	Bolt	4	
5	Lower wire harness holder	1	

Continued on next page.



Order	Job/Part	Q'ty	Remarks
6	Upper wire harness holder	1	For installation, reverse the removal procedure.
7	Wire harness cover	3	
8	Bolt	4	
9	Injector driver assembly	1	
10	Injector driver coupler	1	



## REMOVING THE INJECTOR DRIVER COUPLER

Remove:

- Injector driver coupler

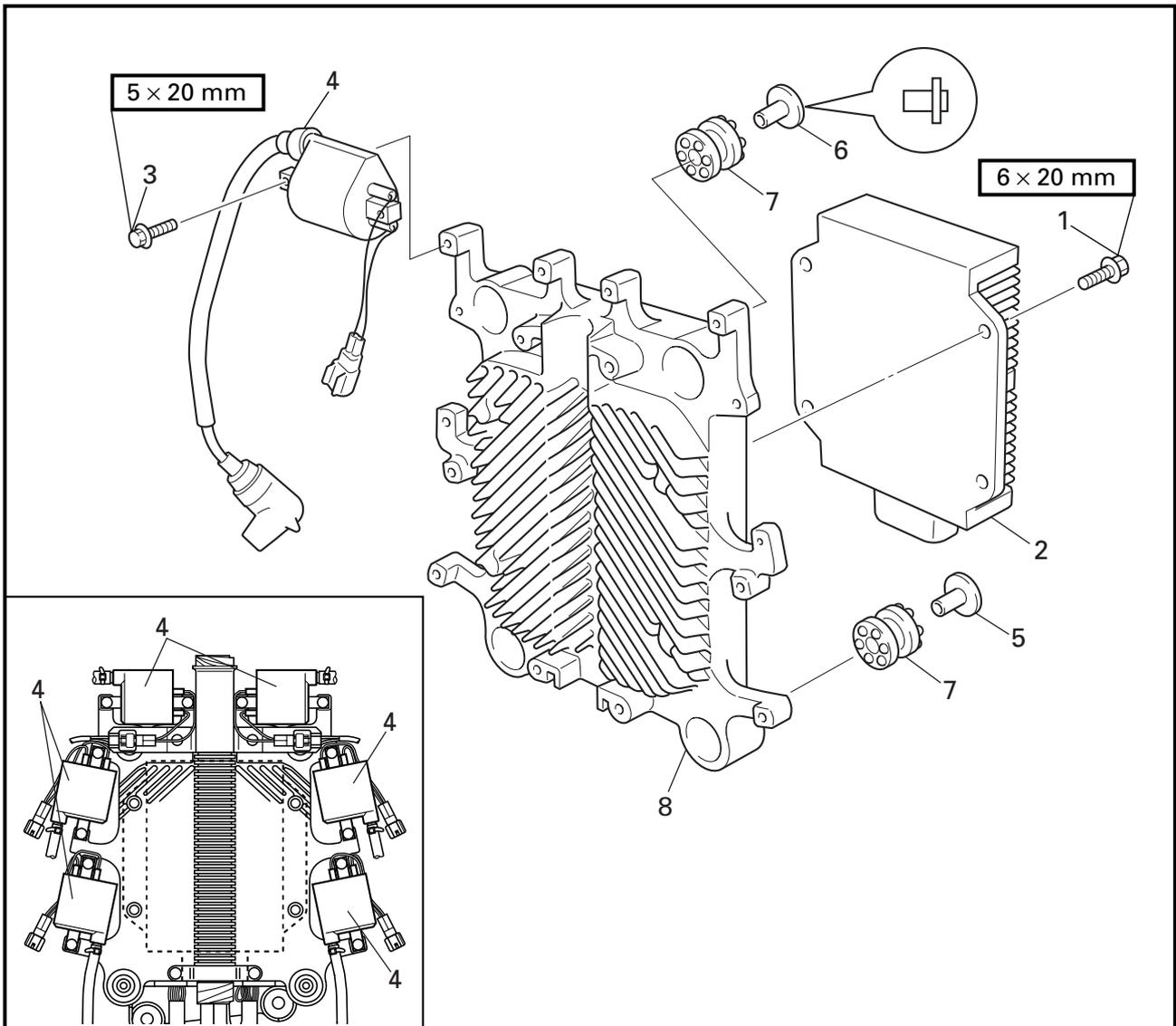
### NOTE:

- Disconnect the injector driver coupler by pressing on the release plate part (a) and pressing up the lock plate (b) using both thumbs until it stops.
- For disconnection, hold the entire the injection driver coupler.

### CAUTION:

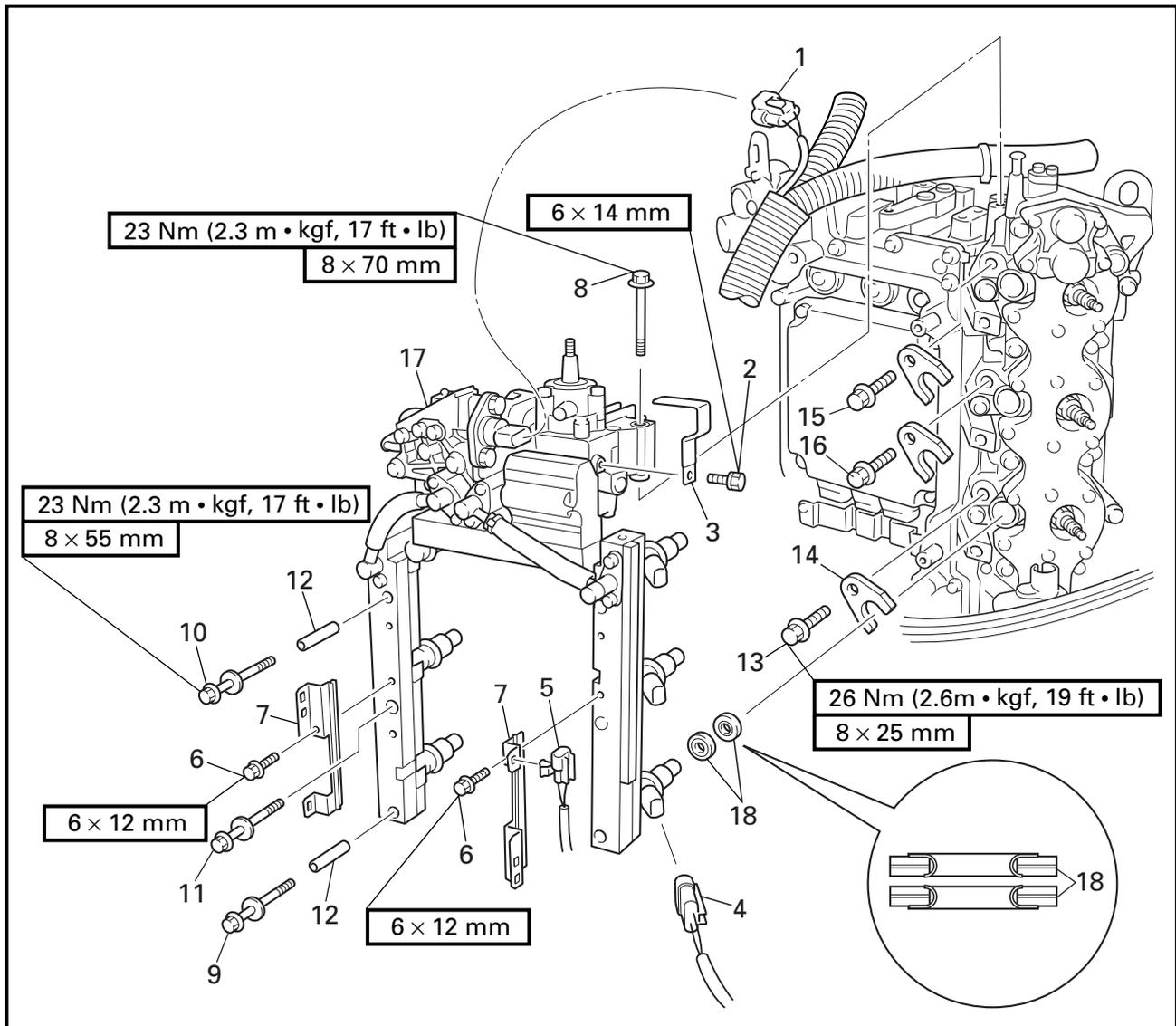
Do not pull on the lock plate (b) to remove the injector driver coupler, otherwise, the lock plate could be damaged.

**DISASSEMBLING/ASSEMBLING THE INJECTOR DRIVER**



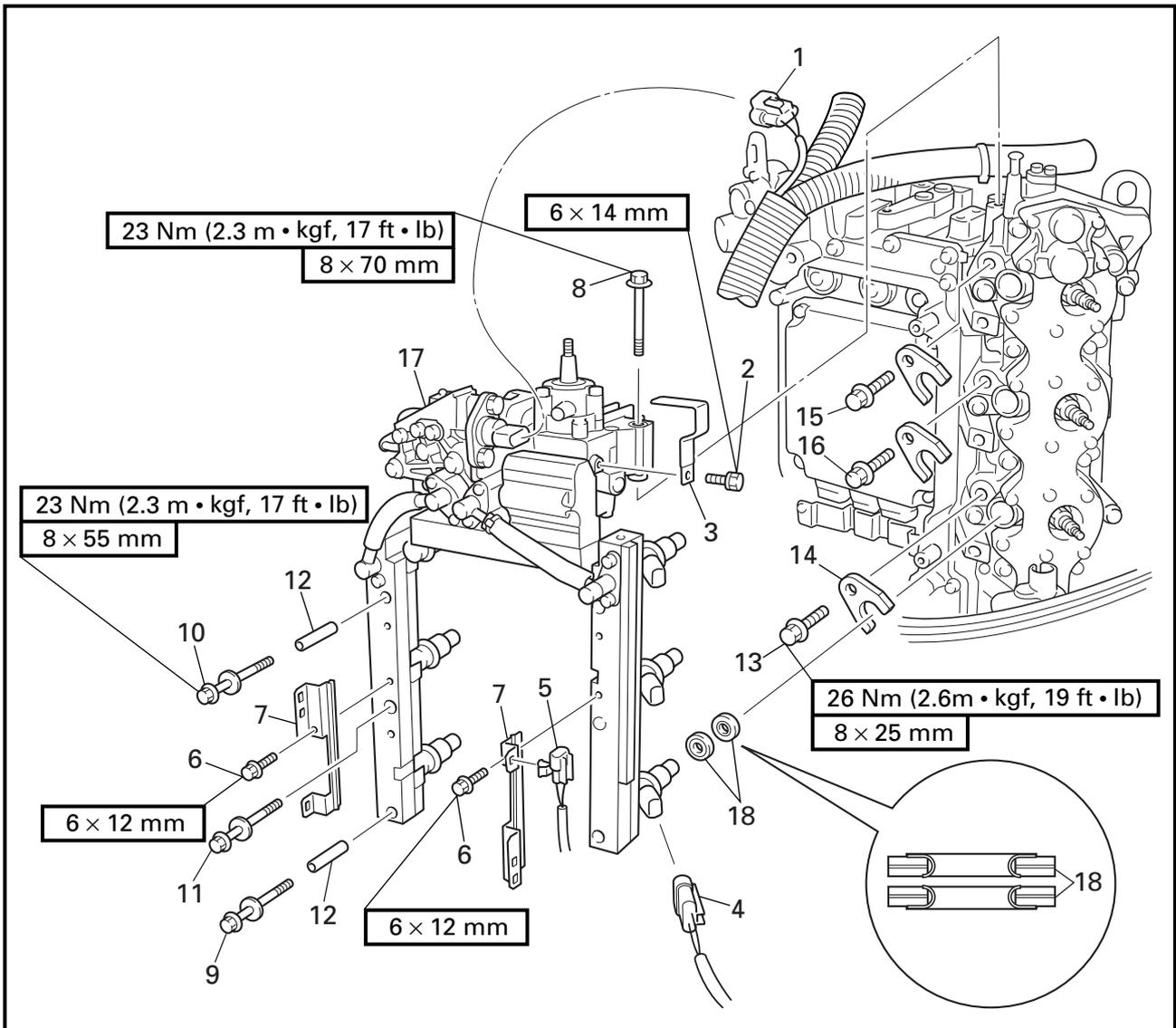
Order	Job/Part	Q'ty	Remarks
1	Bolt	4	
2	Injector driver	1	
3	Bolt	12	
4	Ignition coil	6	
5	Collar	2	
6	Collar	2	
7	Grommet	4	
8	Injector driver case	1	
			For assembly, reverse the disassembly procedure.

**HIGH-PRESSURE FUEL LINE ASSEMBLY  
REMOVING/INSTALLING THE HIGH-PRESSURE FUEL LINE ASSEMBLY**



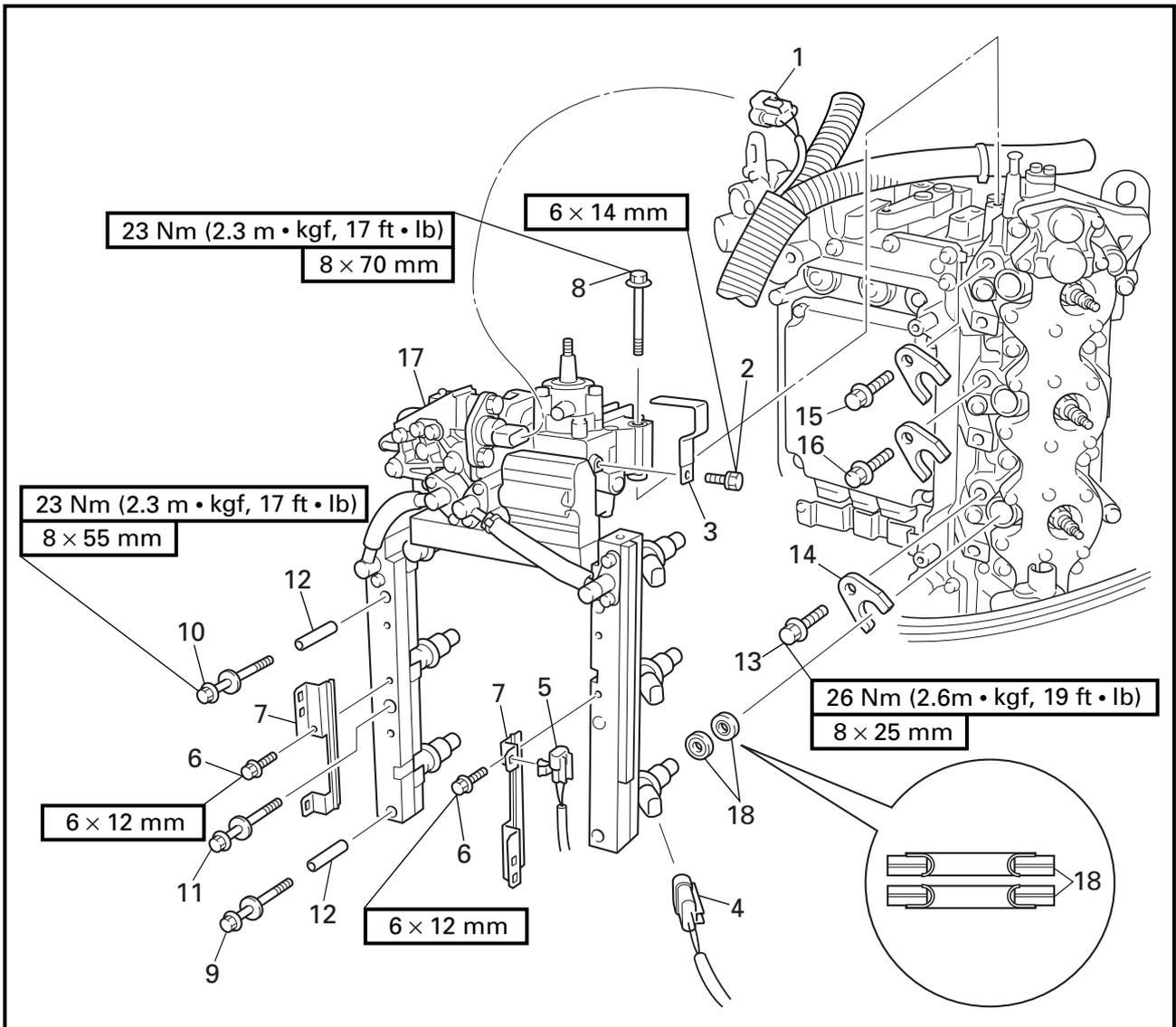
Order	Job/Part	Q'ty	Remarks
	Fuel return hose and fuel feed hose		Refer to "MEDIUM-PRESSURE FUEL LINE" on page 4-2.
	Driven sprocket		Before performing the following procedure, reduce the fuel pressure (medium-pressure fuel line).
	Injector driver assembly		Refer to "DRIVE BELT" on page 4-22.
1	Fuel pressure sensor coupler	1	Refer to "INJECTOR DRIVER" on page 4-26.
2	Bolt	1	

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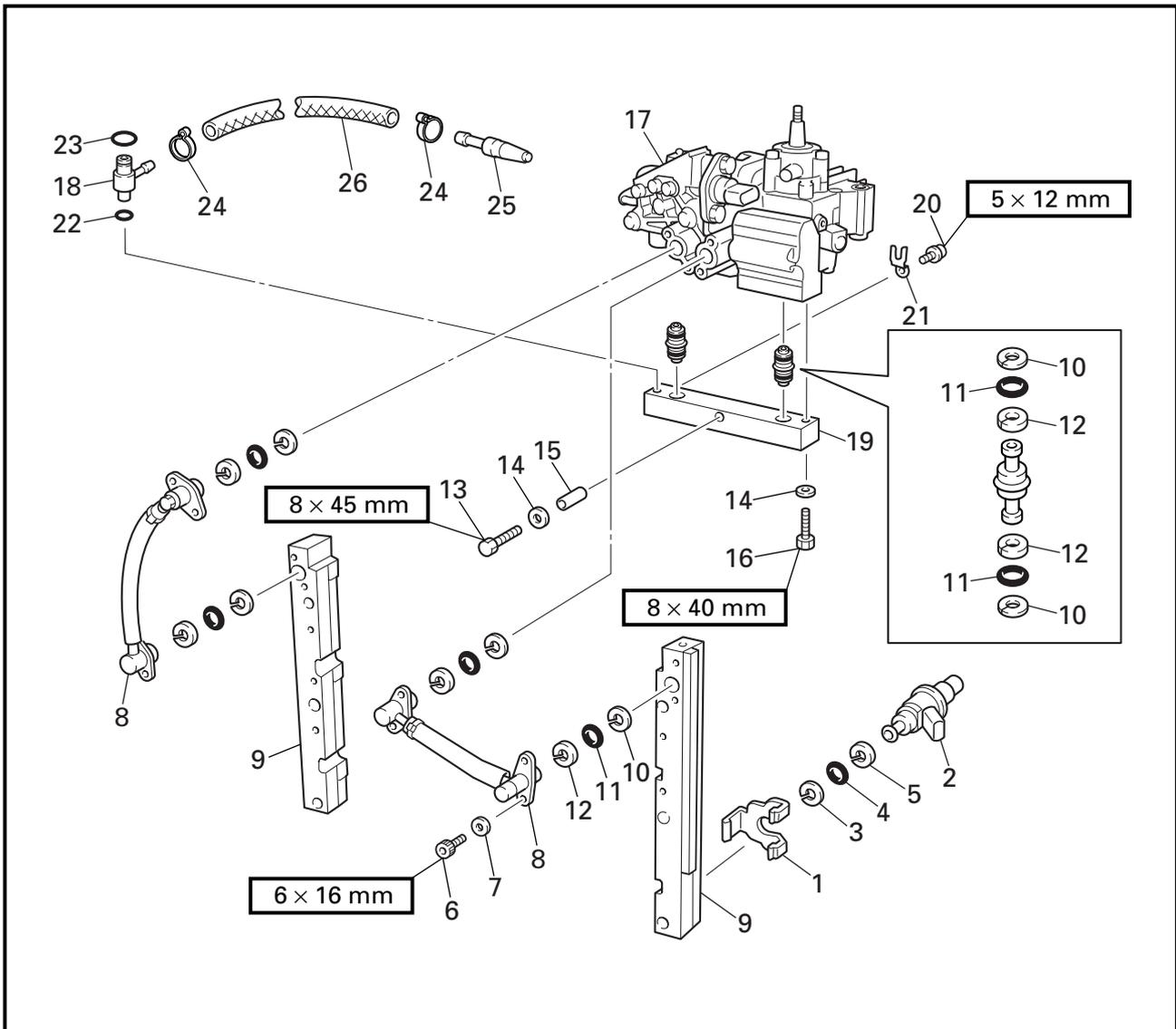
Order	Job/Part	Q'ty	Remarks
3	Clamp	1	
4	Fuel injector coupler	6	
5	Ignition coil coupler	4	
6	Bolt	2	
7	Ignition coil coupler bracket	2	
8	Bolt	3	
9	Bolt	2	
10	Bolt	2	

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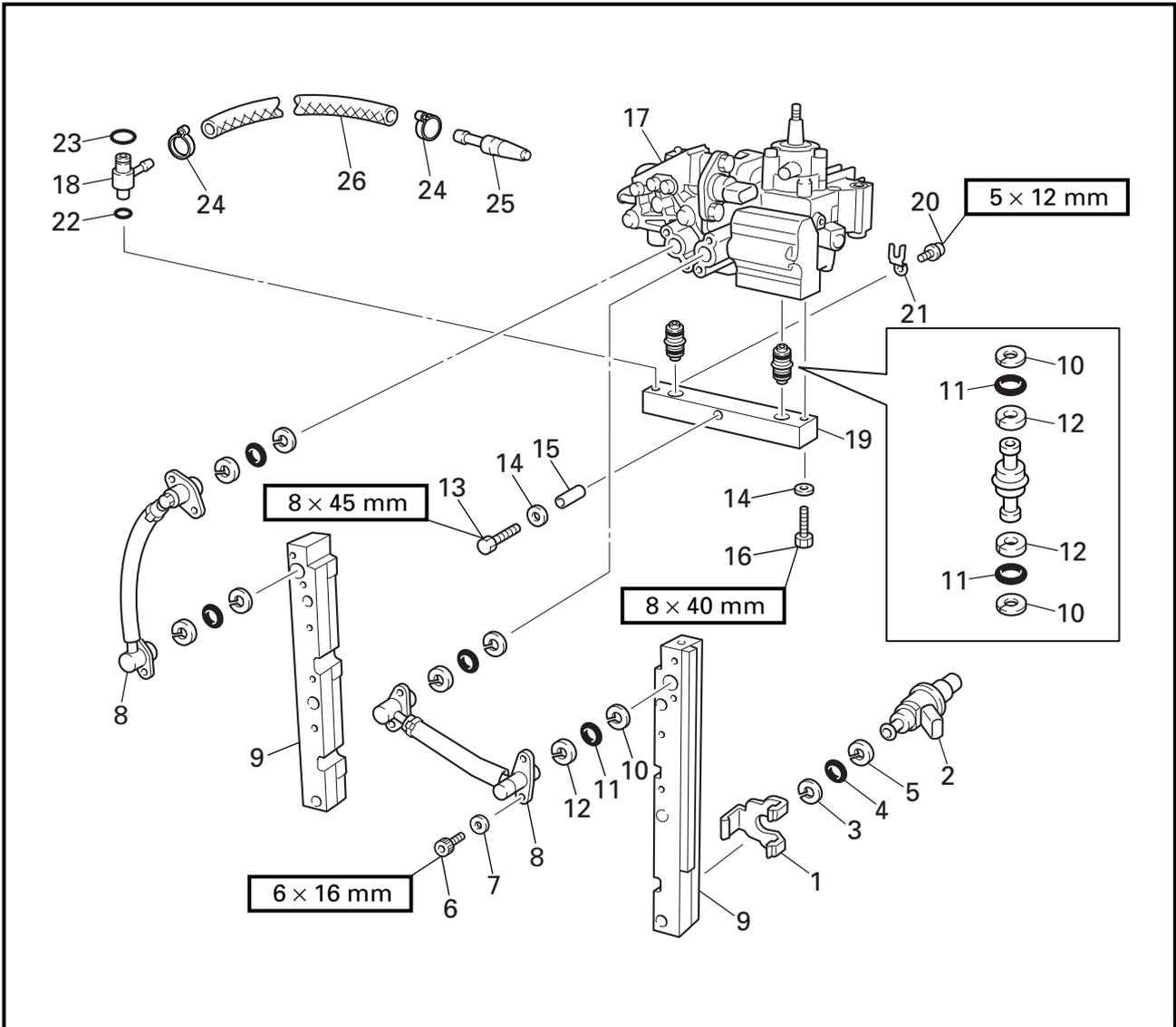
Order	Job/Part	Q'ty	Remarks
11	Bolt	2	
12	Collar	4	
13	Bolt	2	
14	Fuel injector cap	6	
15	Bolt	2	
16	Bolt	2	
17	High-pressure fuel line assembly	1	
18	Gasket	12	<b>Not reusable</b> For installation, reverse the removal procedure.

**DISASSEMBLING/ASSEMBLING THE HIGH-PRESSURE FUEL LINE ASSEMBLY**



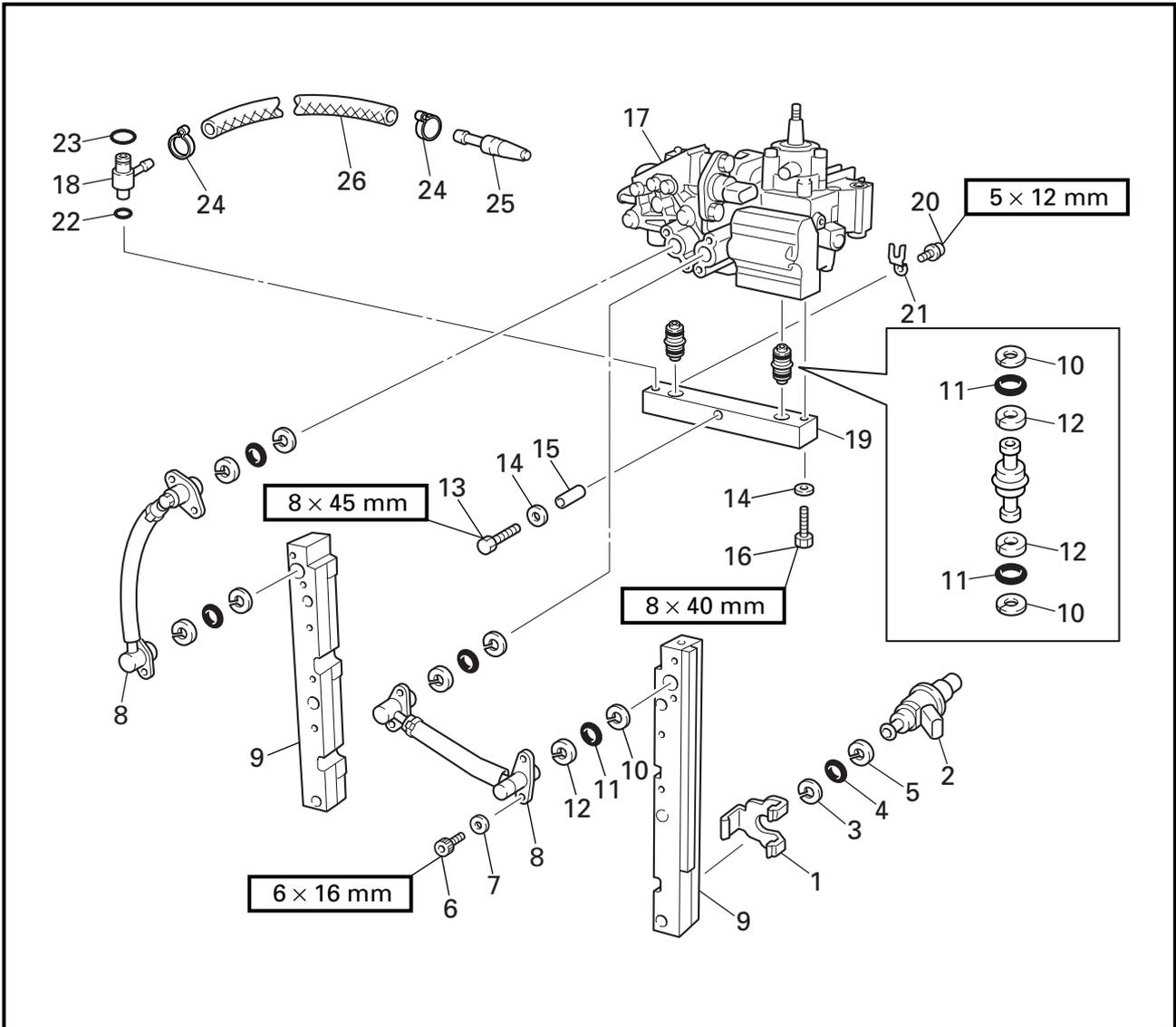
Order	Job/Part	Q'ty	Remarks
1	Fuel injector holder	6	
2	Fuel injector	6	
3	Seal ring (thin)	6	<b>Not reusable</b>
4	O-ring	6	<b>Not reusable</b>
5	Seal ring (thick)	6	<b>Not reusable</b>
6	Bolt	8	
7	Washer	8	
8	Fuel pipe	2	

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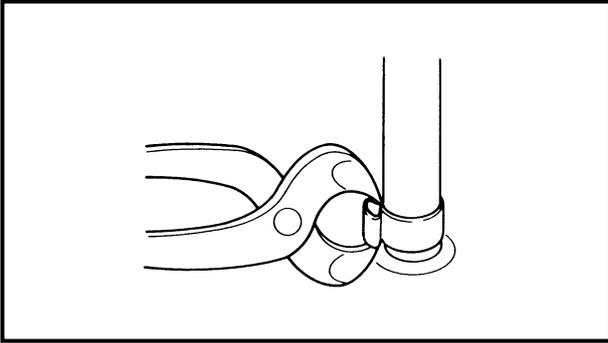


Order	Job/Part	Q'ty	Remarks
9	Fuel rail	2	
10	Seal ring (thin)	8	<b>Not reusable</b>
11	O-ring	8	<b>Not reusable</b>
12	Seal ring (thick)	8	<b>Not reusable</b>
13	Bolt	1	
14	Washer	2	
15	Collar	1	
16	Bolt	1	
17	Mechanical fuel pump assembly	1	

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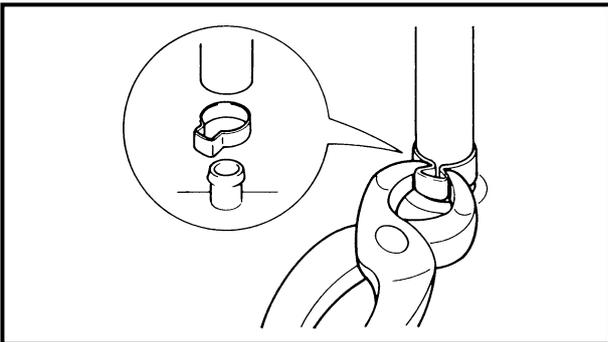


Order	Job/Part	Q'ty	Remarks
18	Fuel feed hose joint	1	
19	Center fuel rail	1	
20	Screw	1	
21	Fuel feed hose guide	1	
22	O-ring	1	<b>Not reusable</b>
23	O-ring	1	<b>Not reusable</b>
24	Hose clamp	2	<b>Not reusable</b>
25	Fuel feed hose connector	1	
26	Fuel feed hose	1	
			For assembly, reverse the disassembly procedure.

**REMOVING THE HOSE CLAMPS**

Remove:

- Hose clamp

**NOTE:** \_\_\_\_\_Remove the hose clamp by cutting its joint.  
\_\_\_\_\_**CAUTION:** \_\_\_\_\_**The fuel hose will be damaged if a hose clamp is removed without cutting the joint.**  
\_\_\_\_\_**INSTALLING THE HOSE CLAMPS**

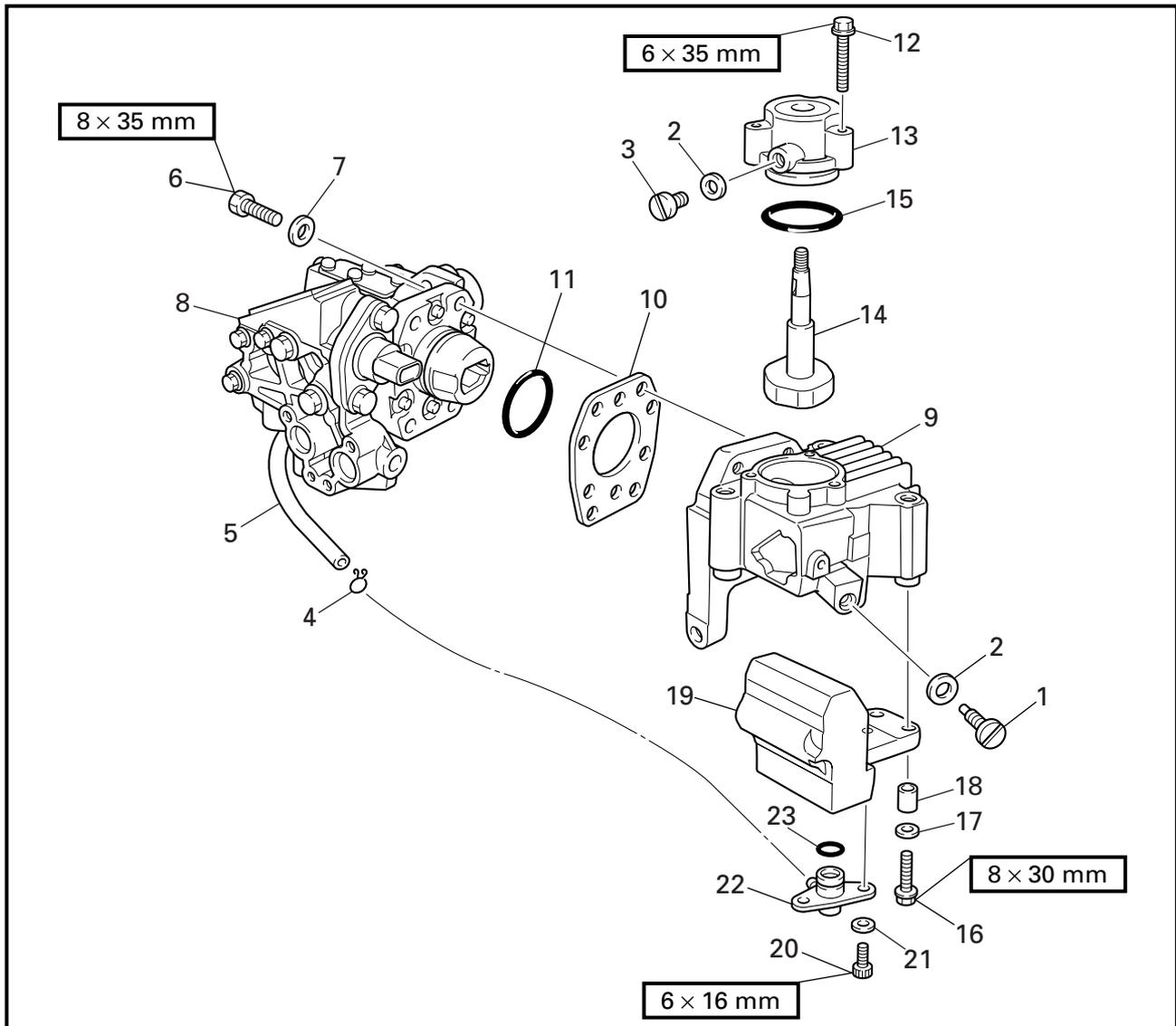
Install:

- Hose clamp

**⚠ WARNING** \_\_\_\_\_**Do not reuse hose clamps, only use new ones.**  
\_\_\_\_\_**NOTE:** \_\_\_\_\_Properly crimp the hose clamp so it is securely fastened.  
\_\_\_\_\_

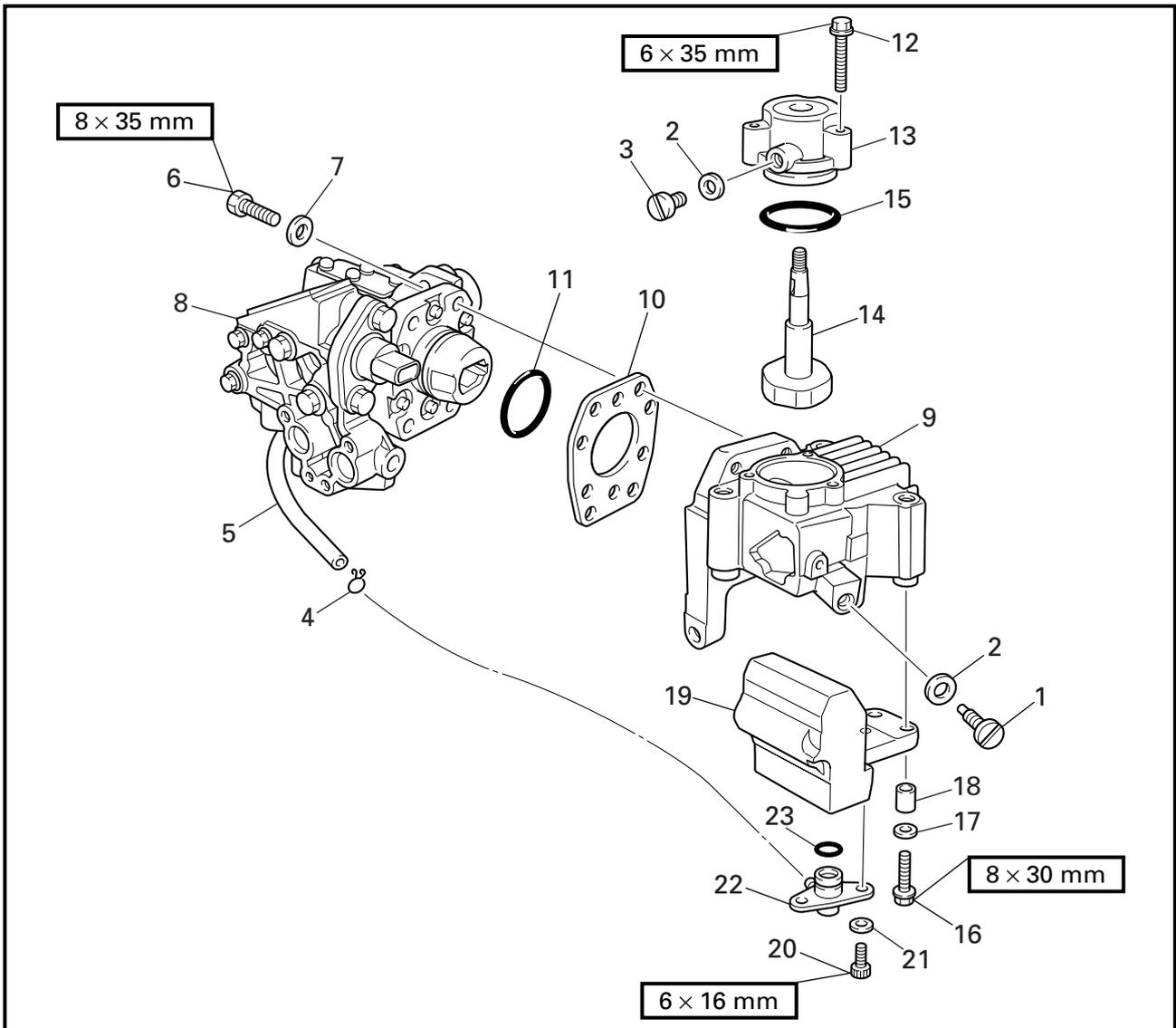
**MECHANICAL FUEL PUMP**

**DISASSEMBLING/ASSEMBLING THE MECHANICAL FUEL PUMP BODY**



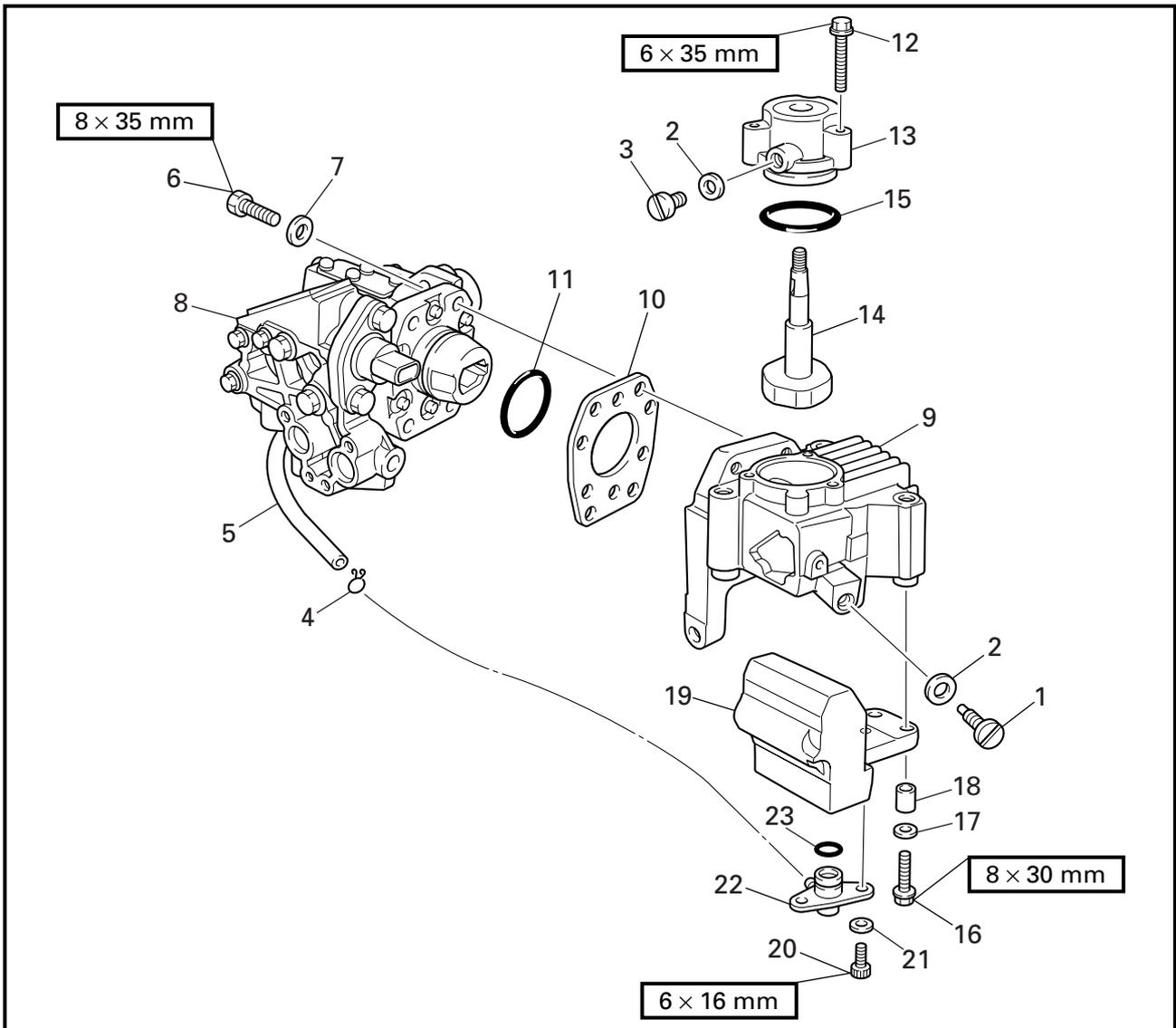
Order	Job/Part	Q'ty	Remarks
	Gear oil		Refer to "CHANGING THE MECHANICAL FUEL PUMP OIL" on page 3-6.
1	Gear oil drain screw	1	
2	Gasket	2	
3	Gear oil level check screw	1	
4	Clip	1	
5	Fuel return hose	1	(mechanical fuel pump regulator-to-hose joint)
6	Bolt	4	
7	Washer	4	

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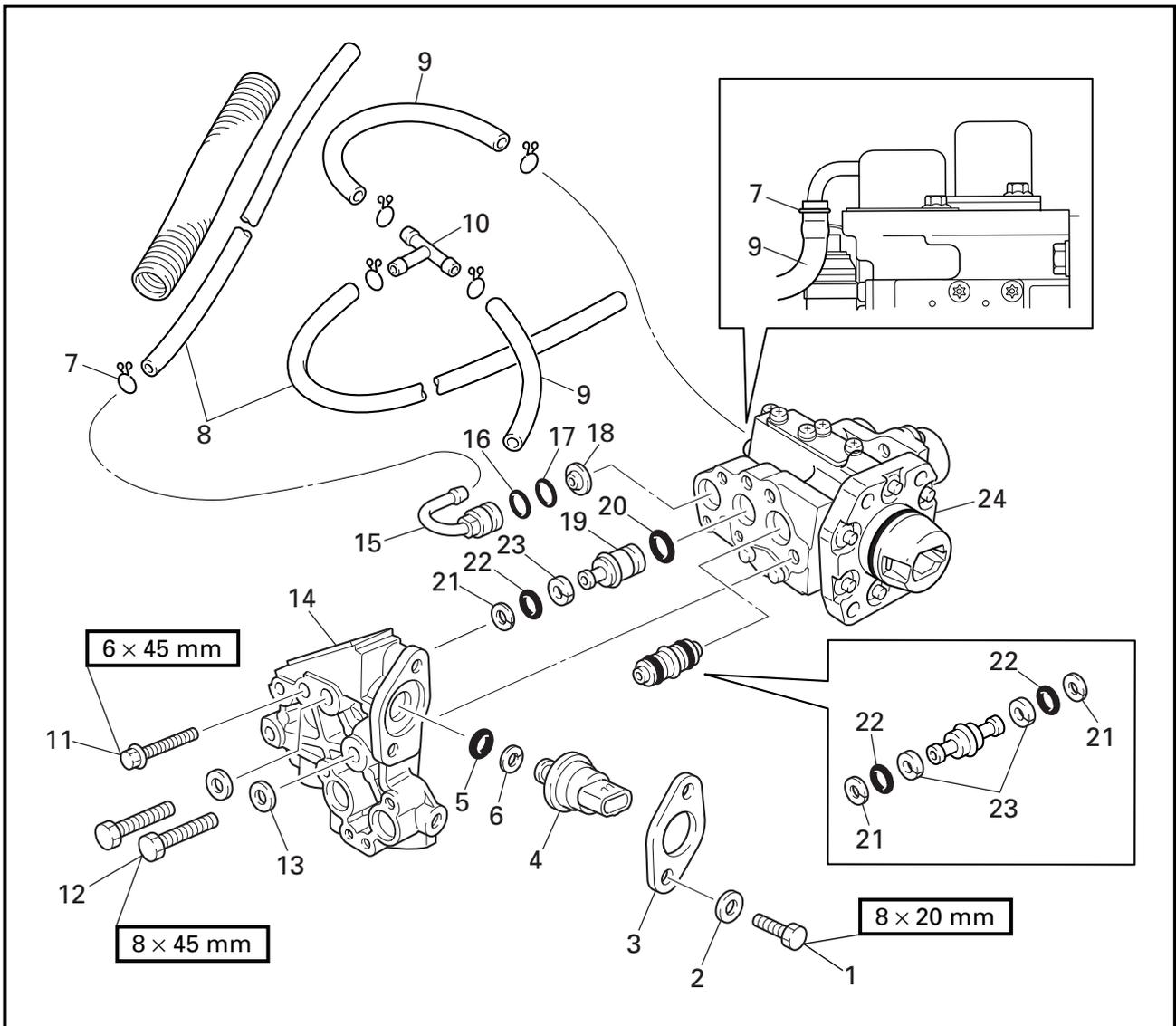
Order	Job/Part	Q'ty	Remarks
8	Mechanical fuel pump assembly	1	
9	Mechanical fuel pump body	1	
10	Joint plate	1	
11	O-ring	1	<b>Not reusable</b>
12	Bolt	3	
13	Mechanical fuel pump body cover	1	
14	Camshaft	1	
15	O-ring	1	<b>Not reusable</b>

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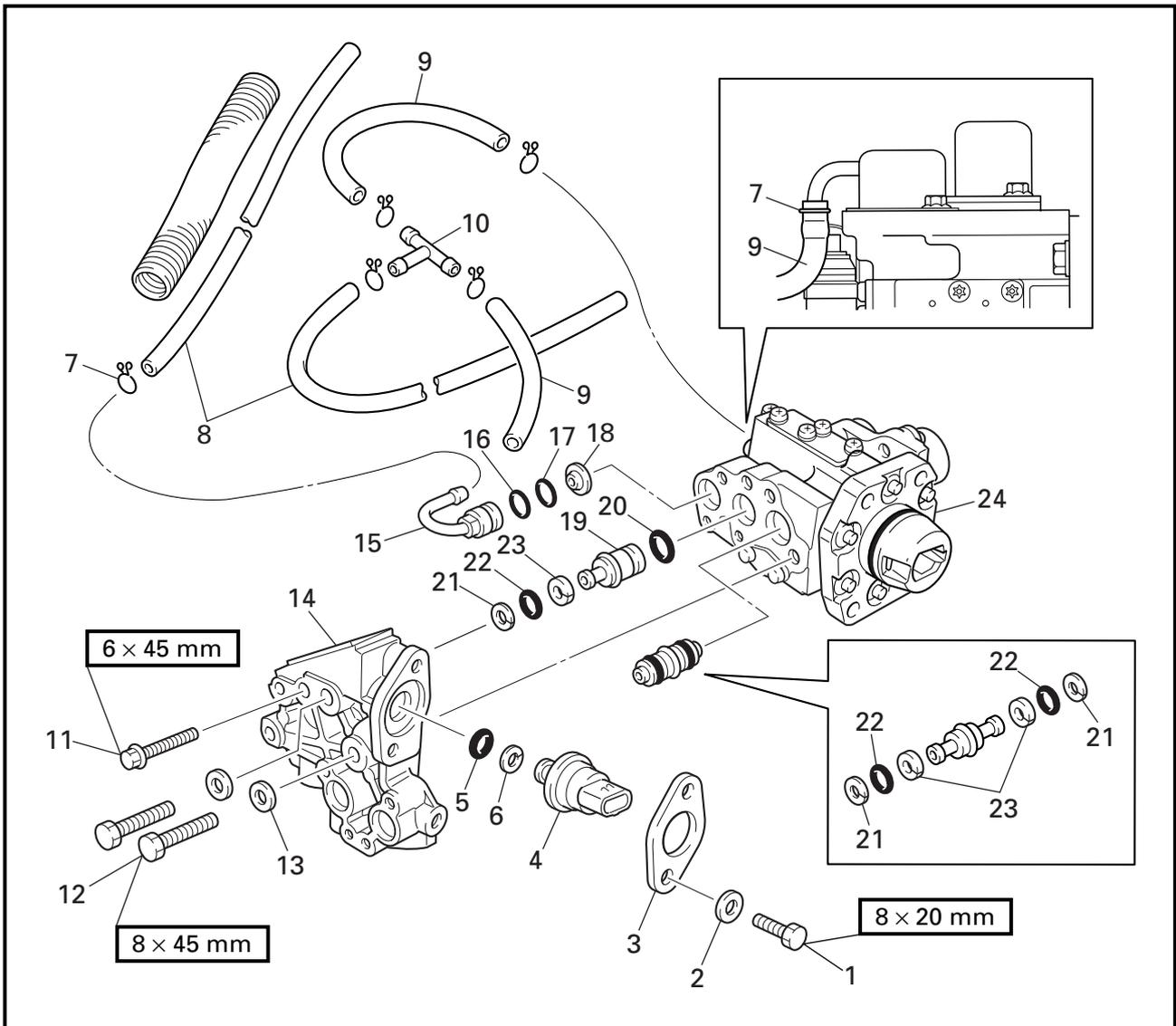
Order	Job/Part	Q'ty	Remarks
16	Bolt	2	
17	Washer	2	
18	Collar	2	
19	Mechanical fuel pump regulator	1	
20	Bolt	2	
21	Washer	2	
22	Fuel return hose joint	1	
23	O-ring	1	<b>Not reusable</b> For assembly, reverse the disassembly procedure.

**DISASSEMBLING/ASSEMBLING THE MECHANICAL FUEL PUMP ASSEMBLY**



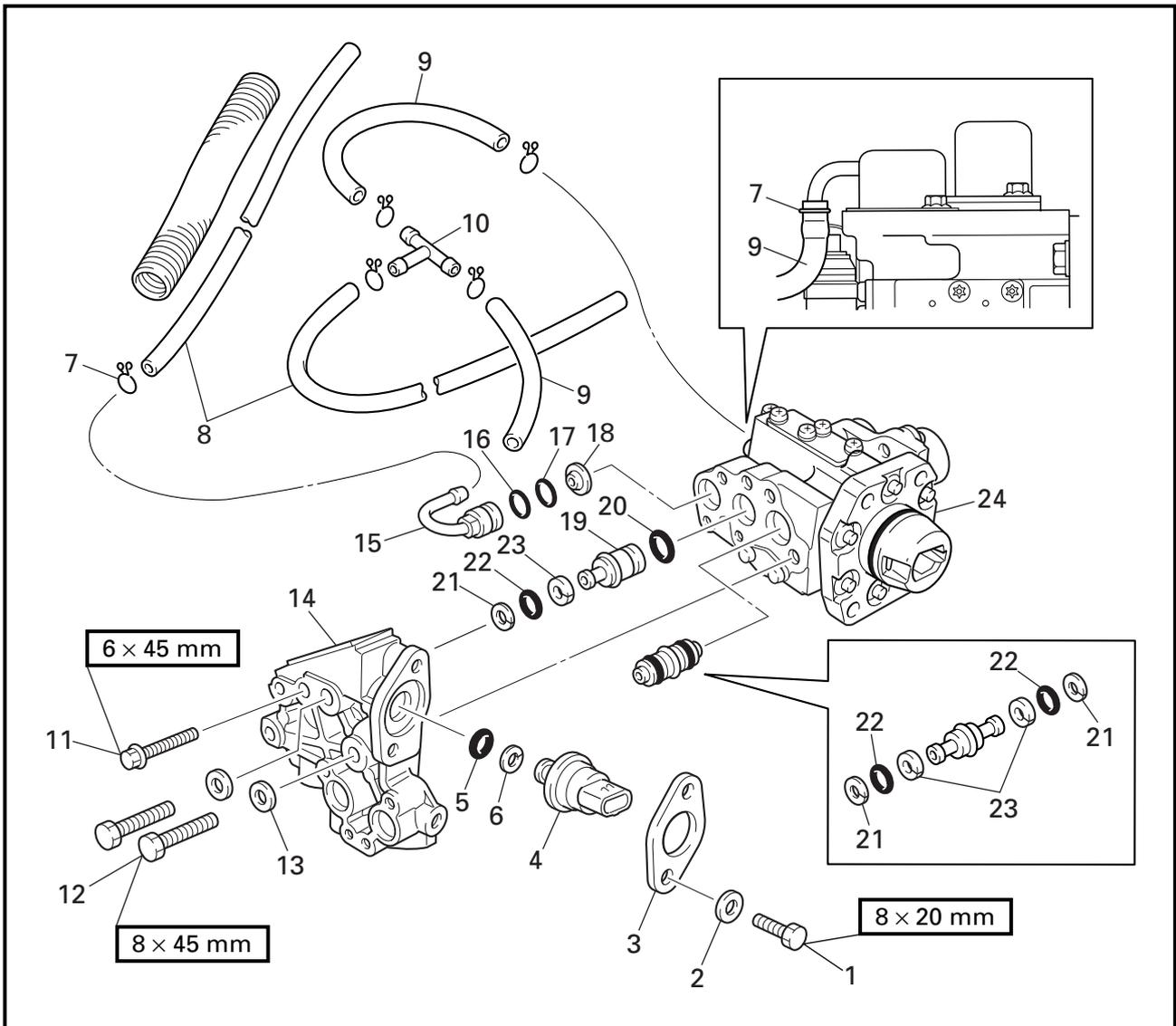
Order	Job/Part	Q'ty	Remarks
1	Bolt	2	
2	Washer	2	
3	Fuel pressure sensor plate	1	
4	Fuel pressure sensor	1	
5	O-ring	1	<b>Not reusable</b>
6	Seal ring	1	<b>Not reusable</b>
7	Clip	5	
8	Fuel return hose	2	(mechanical fuel pump-to-vapor separator)

Continued on next page.



Order	Job/Part	Q'ty	Remarks
9	Fuel return hose	2	(hose joint-to-mechanical fuel pump)
10	Hose joint	1	
11	Bolt	3	
12	Bolt	2	
13	Washer	2	
14	Mechanical fuel pump cover	1	
15	Fuel return hose adaptor	1	
16	O-ring	1	<b>Not reusable</b>
17	O-ring	1	<b>Not reusable</b>

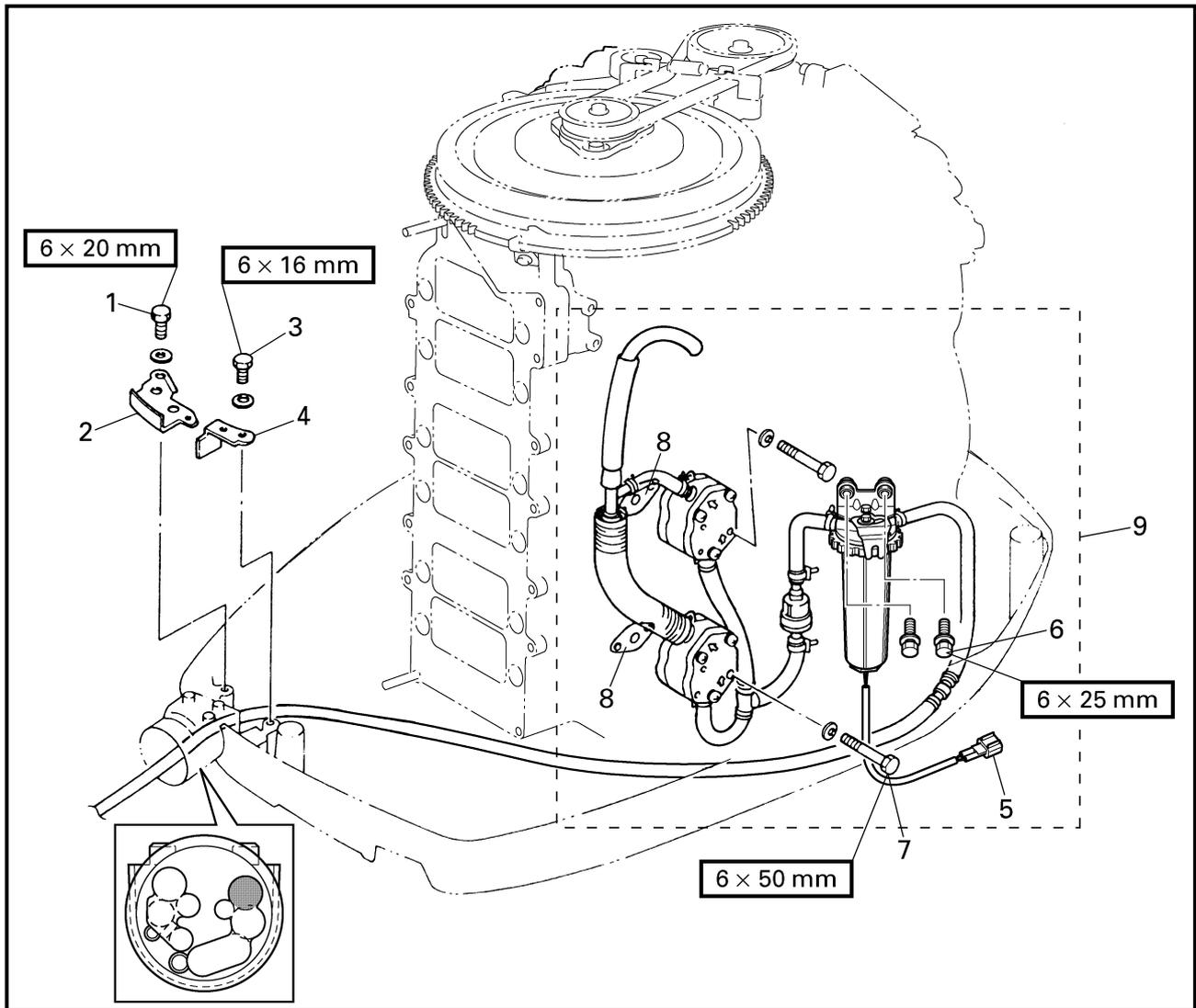
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Order	Job/Part	Q'ty	Remarks
18	Outlet valve	1	
19	Mechanical fuel pump joint	1	
20	O-ring	1	<b>Not reusable</b>
21	Seal ring (thin)	3	<b>Not reusable</b>
22	O-ring	3	<b>Not reusable</b>
23	Seal ring (thick)	3	<b>Not reusable</b>
24	Mechanical fuel pump	1	
			For assembly, reverse the disassembly procedure.



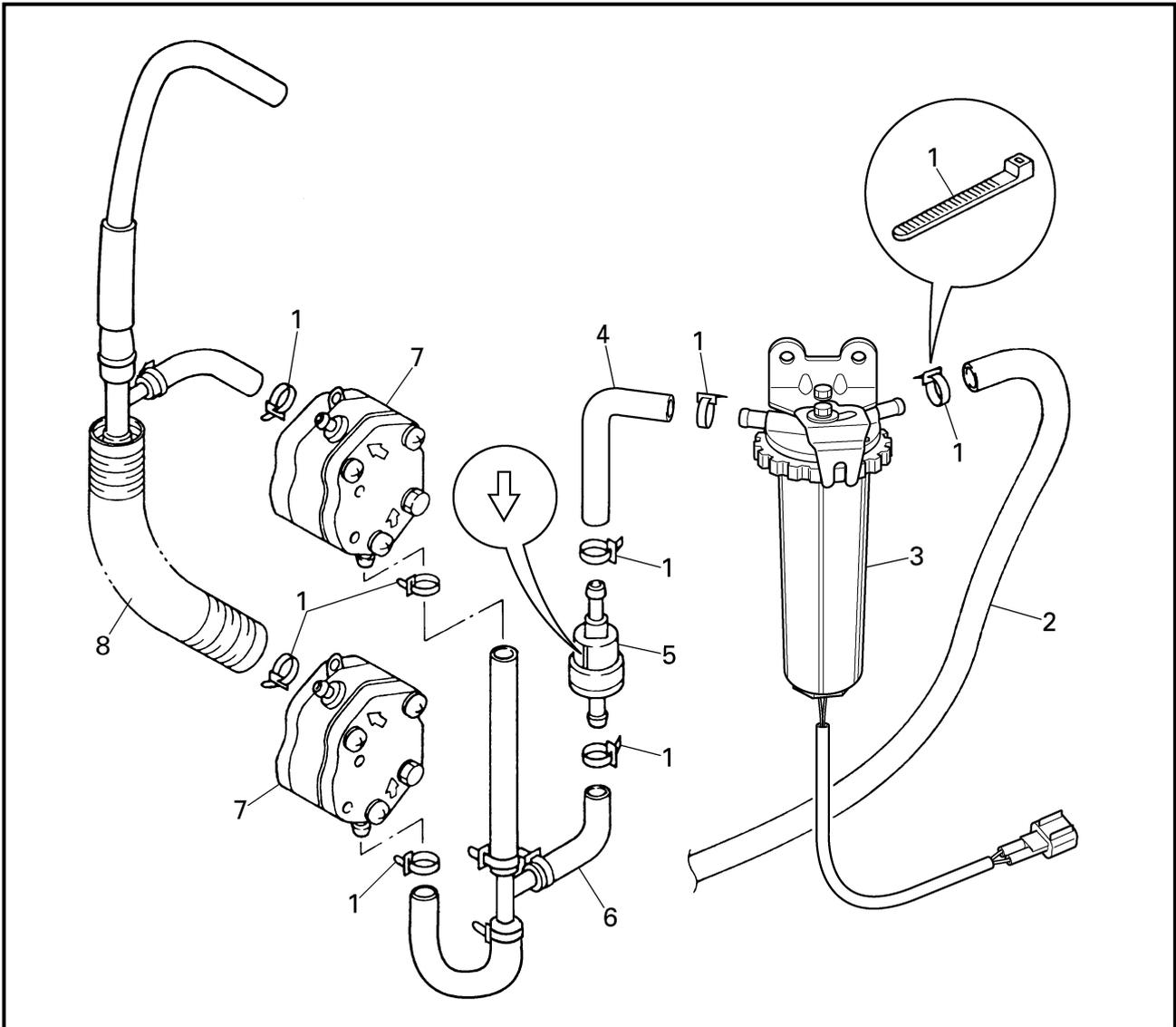
**LOW-PRESSURE FUEL LINE  
REMOVING/INSTALLING THE LOW-PRESSURE FUEL LINE**



Order	Job/Part	Q'ty	Remarks
	Vapor separator		Refer to "VAPOR SEPARATOR" on page 4-7.
1	Bolt	2	
2	Bracket	1	
3	Bolt	1	
4	Holder	1	
5	Water detection switch coupler	1	
6	Bolt	2	
7	Bolt	4	
8	Gasket	2	<b>Not reusable</b>
9	Low-pressure fuel line	1	For installation, reverse the removal procedure.



DISASSEMBLING/ASSEMBLING THE LOW-PRESSURE FUEL LINE



Order	Job/Part	Q'ty	Remarks
1	Plastic locking tie	8	<b>Not reusable</b>
2	Fuel hose	1	(hose joint-to-fuel filter)
3	Fuel filter	1	
4	Fuel hose	1	(check valve-to-fuel filter)
5	Check valve	1	
6	Fuel hose assembly	1	(check valve-to-fuel pump)
7	Fuel pump	2	
8	Fuel hose assembly	1	(fuel pump-to-vapor separator)

For assembly, reverse the disassembly procedure.

**CHECKING THE CHECK VALVE**

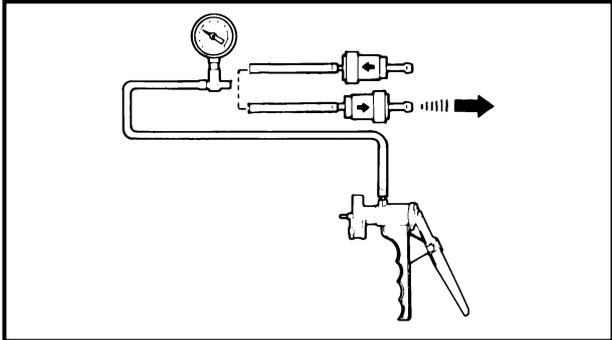
Check:

- Check valve operation  
Damage/reverse air flow → Replace.

**Checking steps**

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

Do not overpressurize the check valve. Excessive pressure may cause air to leak out.



- (1) Install the Mity vac onto the check valve as shown.

	<b>Mity vac</b> <b>YB-35956 / 90890-06756</b>
---	--

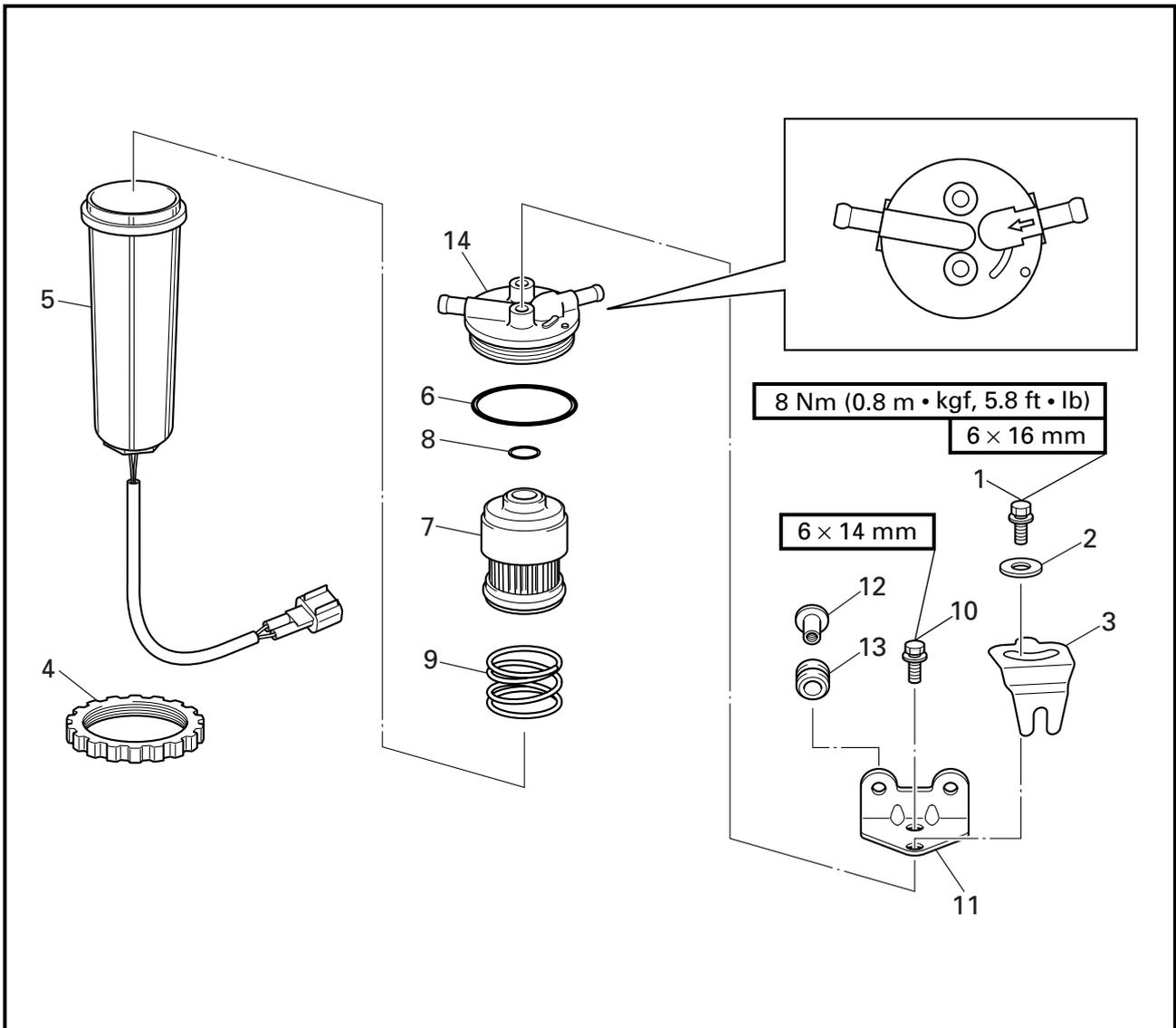
- (2) Apply the specified pressure with the Mity vac.

	<b>Check valve pressure</b> <b>80 kPa (0.8 kg/cm<sup>2</sup>, 11.4 psi)</b>
--	--

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

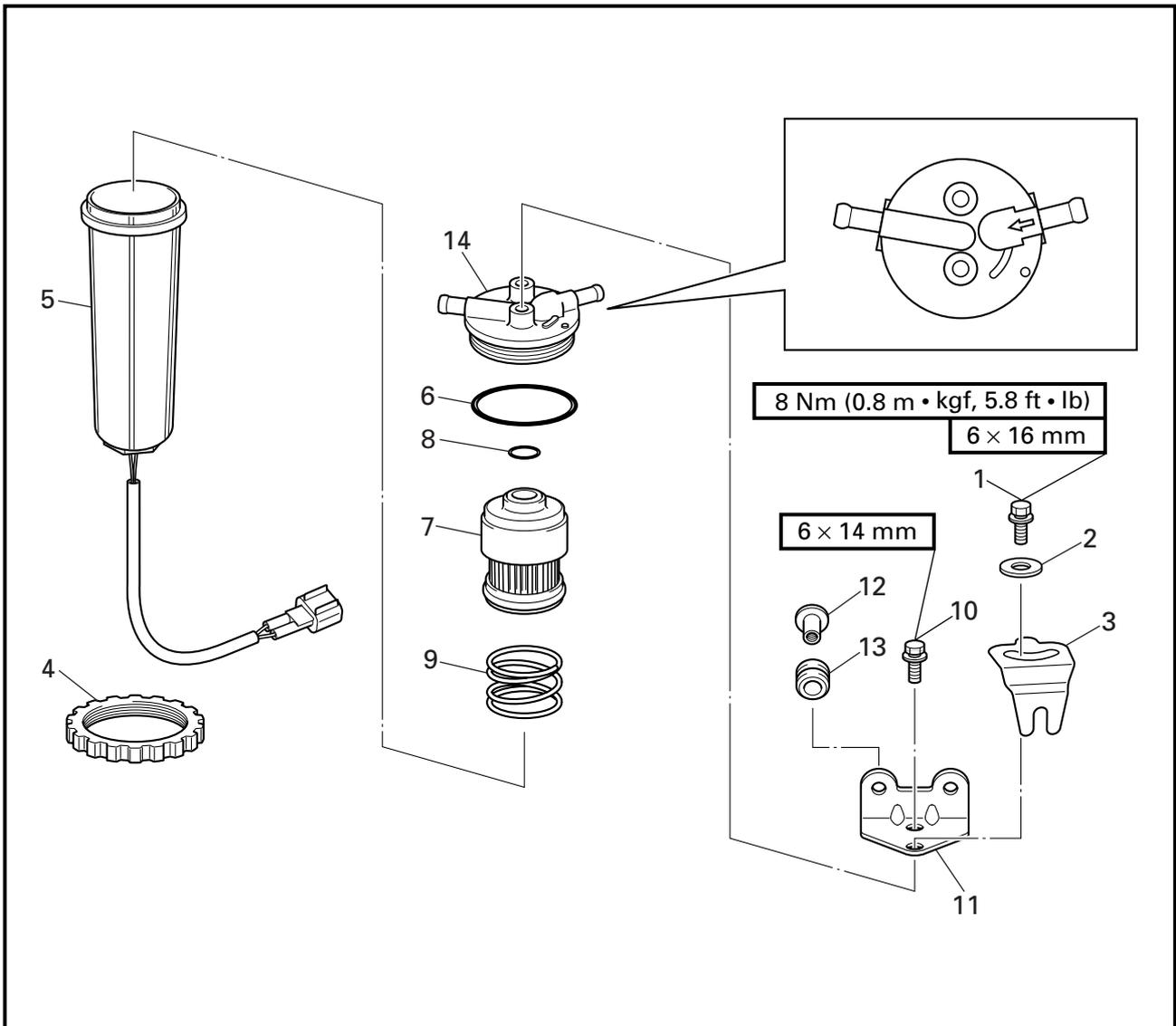
Make sure no air comes out of the opposite side of the check valve.

**FUEL FILTER  
DISASSEMBLING/ASSEMBLING THE FUEL FILTER**



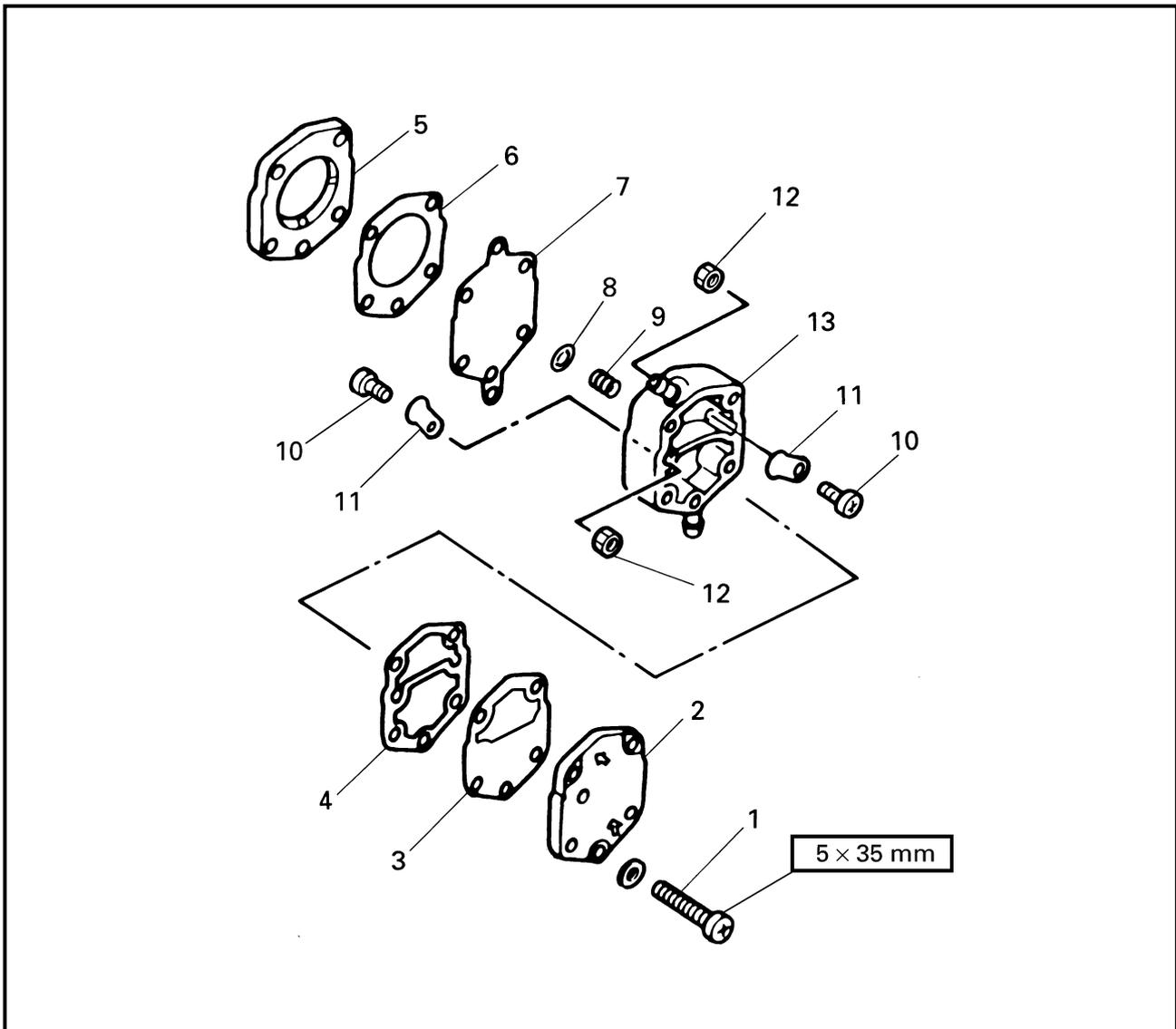
Order	Job/Part	Q'ty	Remarks
1	Bolt	1	
2	Washer	1	
3	Fuel filter nut holder	1	
4	Fuel filter nut	1	
5	Fuel filter cup/water detection switch assembly	1	
6	O-ring	1	
7	Fuel filter element	1	

Continued on next page.



Order	Job/Part	Q'ty	Remarks
8	O-ring	1	
9	Spring	1	
10	Bolt	1	
11	Fuel filter bracket	1	
12	Collar	2	
13	Grommet	2	
14	Fuel filter cap	1	
			For assembly, reverse the disassembly procedure.

**FUEL PUMP**  
**DISASSEMBLING/ASSEMBLING THE FUEL PUMP**



Order	Job/Part	Q'ty	Remarks
1	Screw	3	
2	Diaphragm body	1	
3	Diaphragm	1	
4	Gasket	1	<b>Not reusable</b>
5	Fuel pump base	1	
6	Gasket	1	<b>Not reusable</b>
7	Diaphragm	1	

Continued on next page.





**CHECKING THE FUEL PUMPS**

1. Check:
  - Diaphragm
  - Fuel pump valves  
Damage → Replace.
2. Check:
  - Fuel pumps  
Reverse air flow → Replace.

**Checking steps**

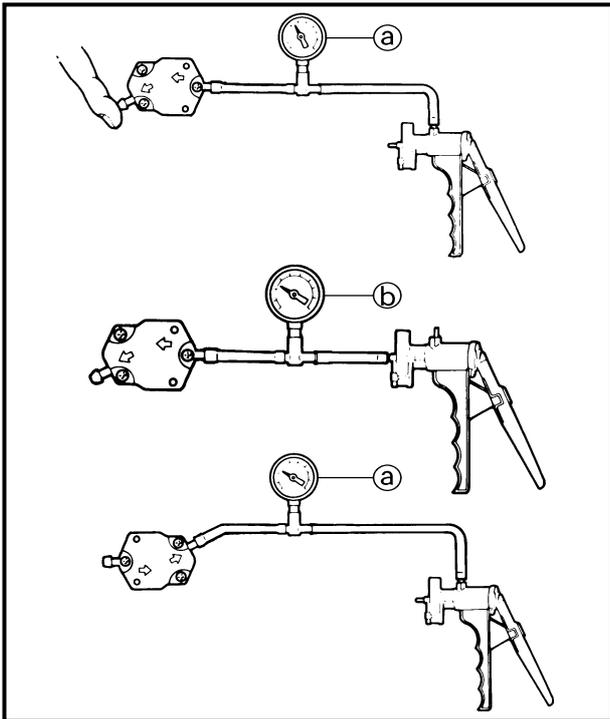
**NOTE:** \_\_\_\_\_  
Do not overpressurize the fuel pump. Excessive pressure may cause air to leak out.

- (1) Install the Mity vac onto the fuel pump as shown.

	<p><b>Mity vac</b> YB-35956 / 90890-06756</p>
--	---

- (2) Apply the specified pressure with the Mity vac.

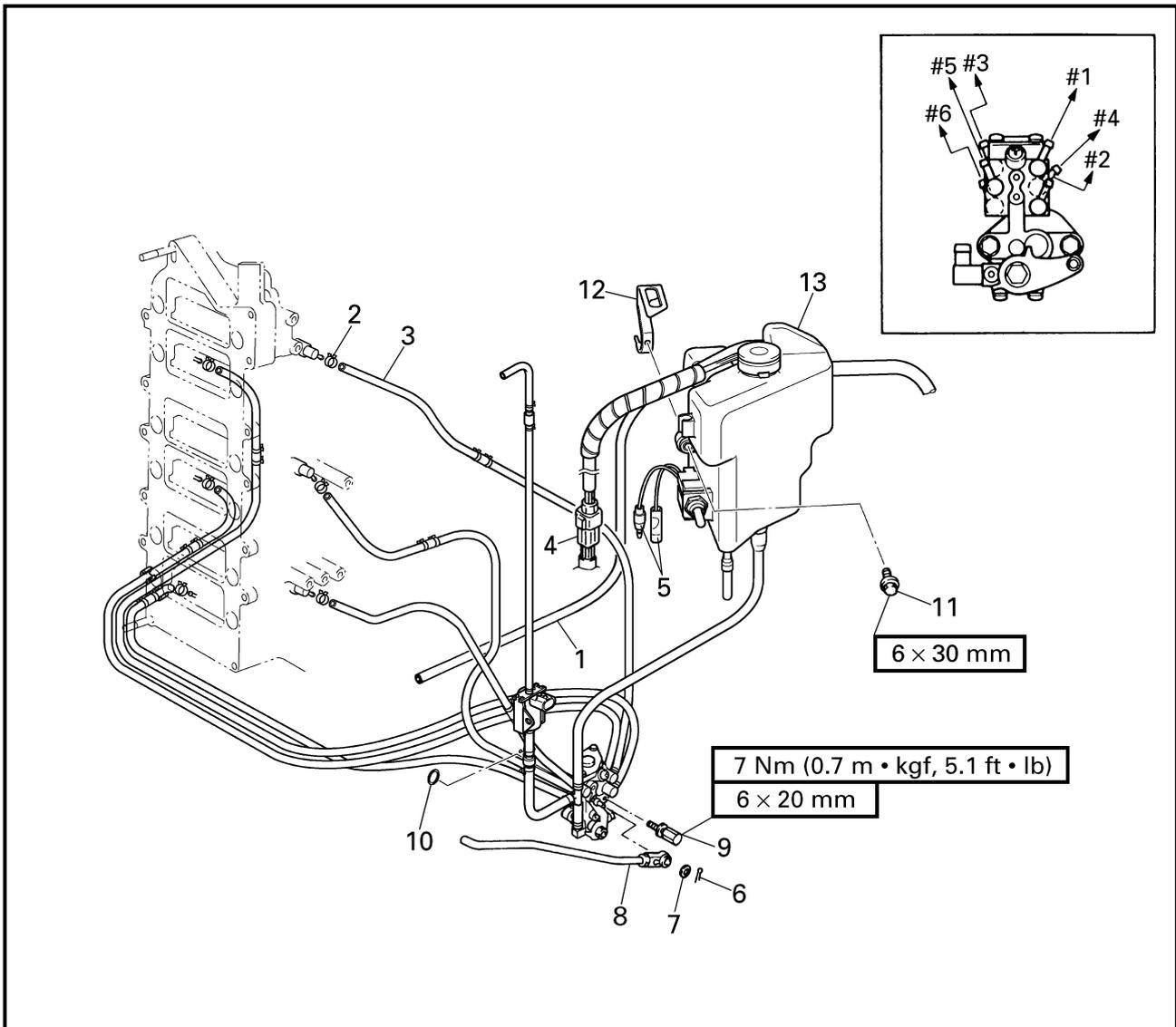
	<p><b>Fuel pump pressure <sup>Ⓐ</sup></b> 50 kPa (0.5 kg/cm<sup>2</sup>, 7.1 psi) <b>Fuel pump negative pressure <sup>Ⓑ</sup></b> 30 kPa (0.3 kg/cm<sup>2</sup>, 4.3 psi)</p>
--	---



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

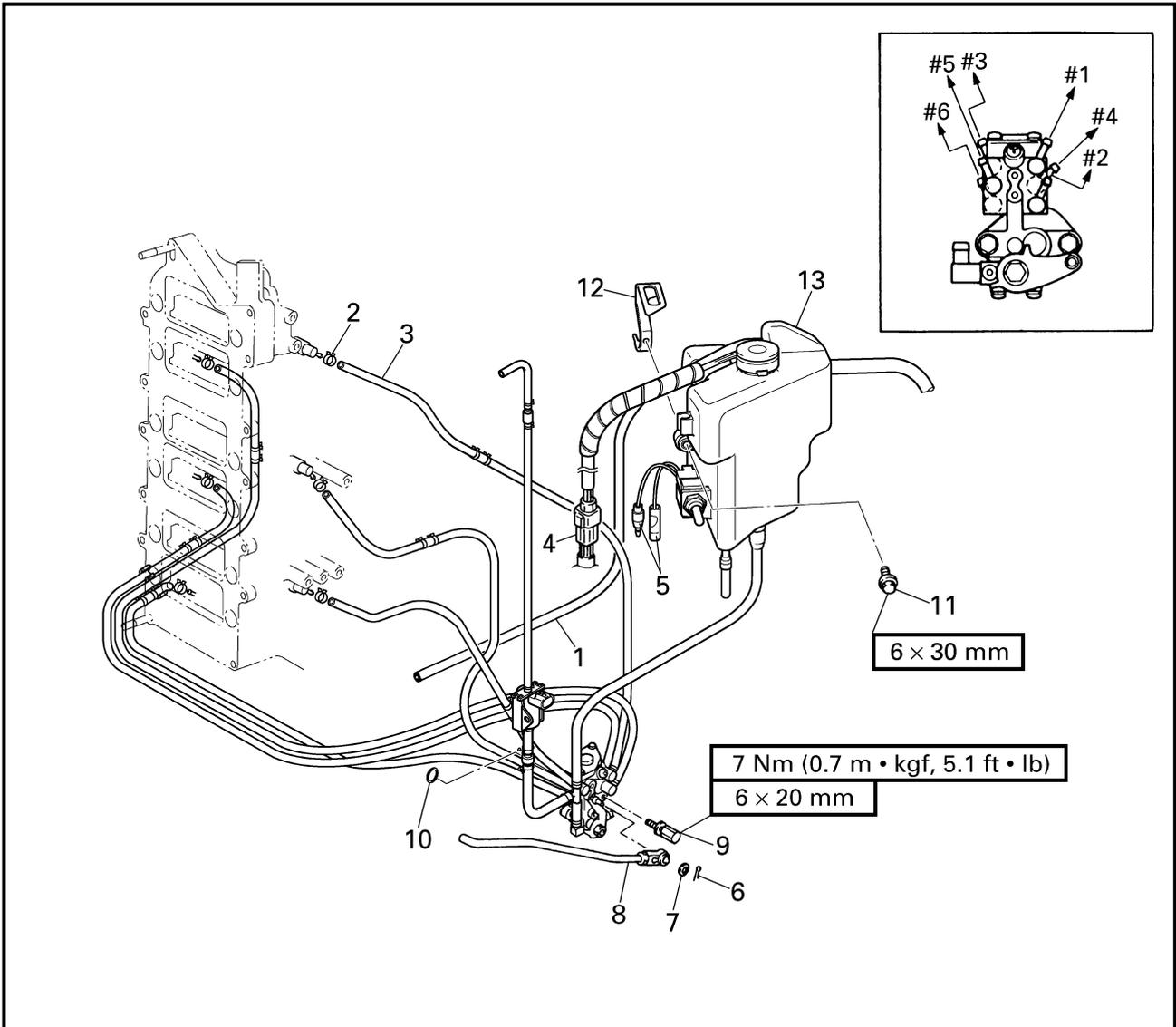
- Make sure no air comes out of the opposite side of the fuel pump.
- To eliminate any gaps between the fuel pump valves and the fuel pump body, and to ensure a better seal, make sure the inside of the fuel pump is wet (i.e., with gas).

**OIL INJECTION SYSTEM  
REMOVING/INSTALLING THE OIL INJECTION SYSTEM**



Order	Job/Part	Q'ty	Remarks
	Electric oil pump hose, electric oil pump coupler and electric oil pump assembly		Refer to "MEDIUM-PRESSURE FUEL LINE" on page 4-2.
	Junction box assembly		Refer to "JUNCTION BOX ASSEMBLY" on page 5-18.
	Starter motor		Refer to "STARTER MOTOR" on page 5-28.
1	Oil tank air vent hose	1	(intake silencer-to-oil tank)
2	Metal clamp	6	
3	Oil feed hose	6	(crankcase-to-oil pump)
4	Oil level sensor coupler	1	

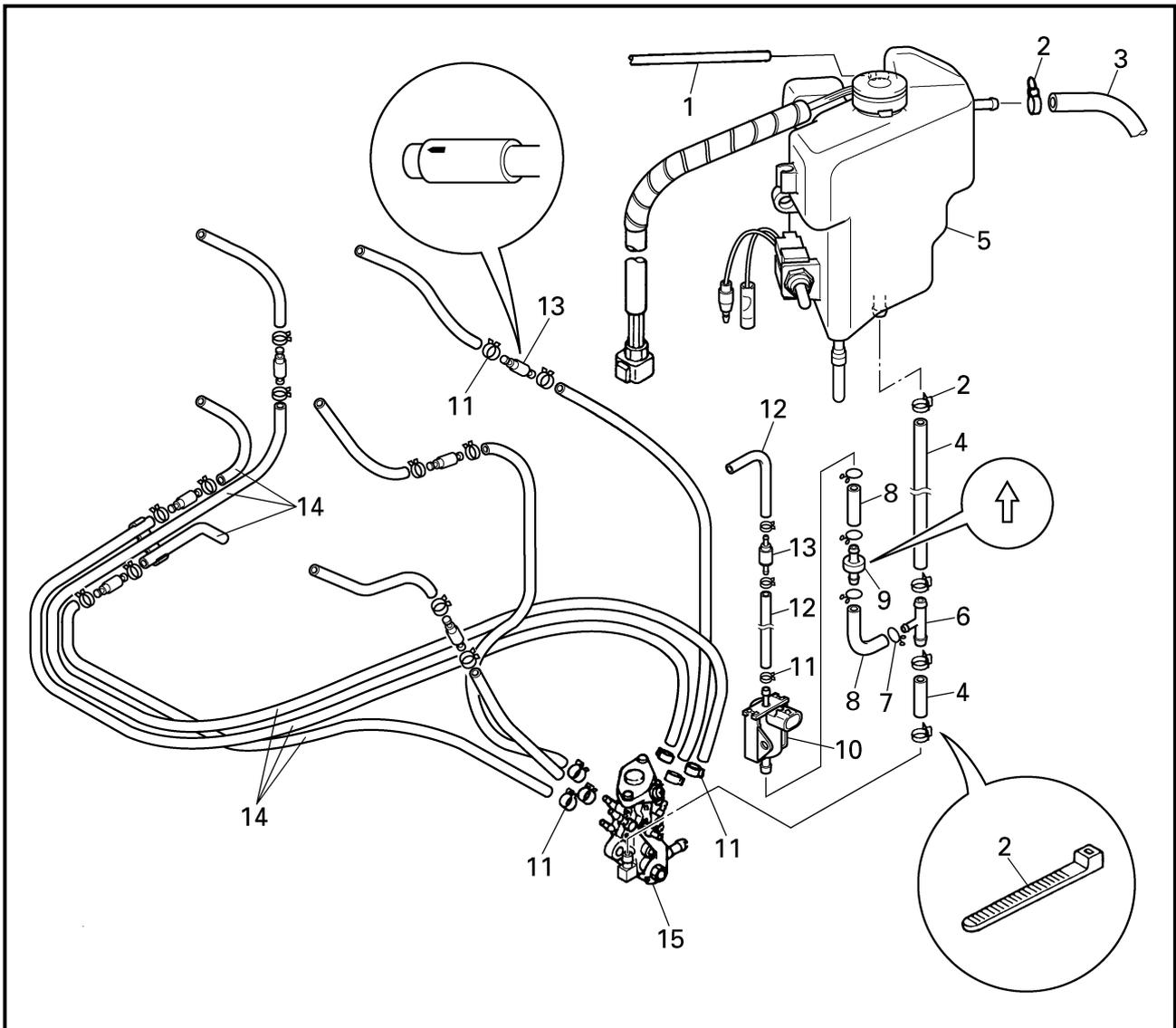
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Order	Job/Part	Q'ty	Remarks
5	Emergency switch connector	2	For installation, reverse the removal procedure.
6	Clip	1	
7	Plastic washer	1	
8	Oil pump link rod	1	
9	Bolt	2	
10	O-ring	1	
11	Bolt	3	
12	Clamp	1	
13	Oil injection system assembly	1	



DISASSEMBLING/ASSEMBLING THE OIL INJECTION SYSTEM



Order	Job/Part	Q'ty	Remarks
1	Oil tank air vent hose	1	(oil tank-to-intake silencer)
2	Plastic locking tie	5	<b>Not reusable</b>
3	Oil hose	1	(sub oil tank-to-oil tank)
4	Oil hose	2	(oil tank-to-oil pump)
5	Oil tank assembly	1	
6	Oil hose joint	1	
7	Clip	4	
8	Oil hose	2	(oil pump-to-electric oil pump)

Continued on next page.





## CHECKING THE CHECK VALVE

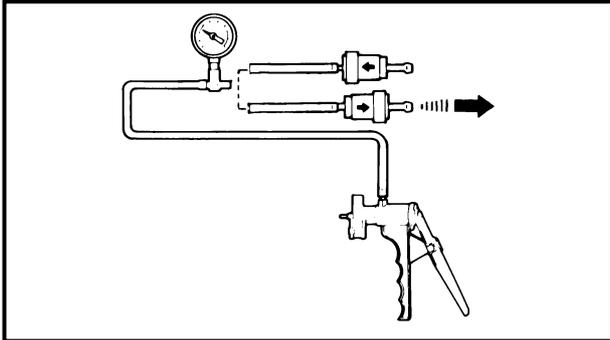
Check:

- Check valve operation  
Damage/reverse air flow → Replace.

### Checking steps

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

Do not overpressurize the check valve. Excessive pressure may cause air to leak out.



- (1) Install the Mity vac onto the check valve as shown.



**Mity vac**  
**YB-35956 / 90890-06756**

- (2) Apply the specified pressure with the Mity vac.

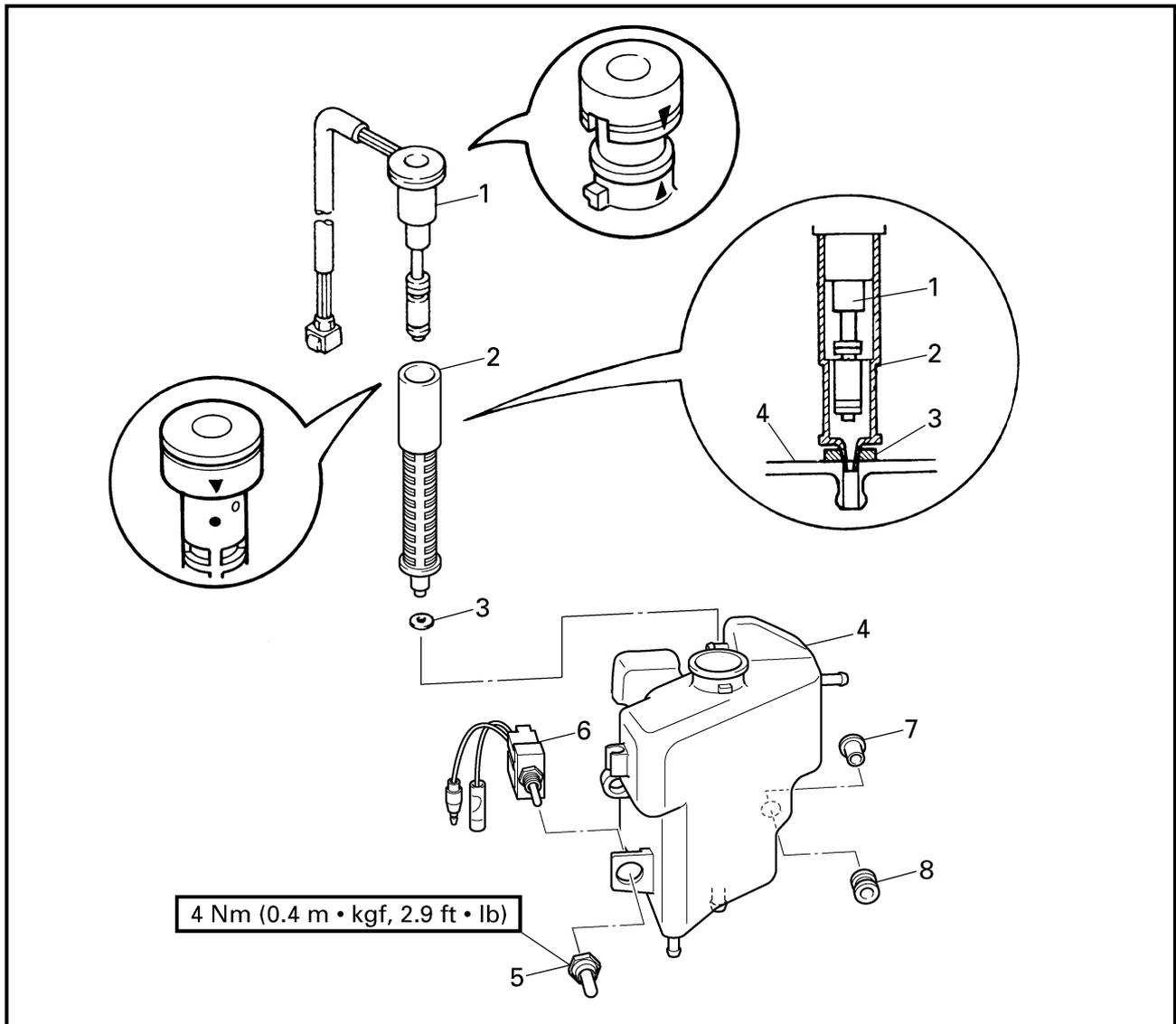


**Check valve pressure**  
**80 kPa (0.8 kg/cm<sup>2</sup>, 11.4 psi)**

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

Make sure no air comes out of the opposite side of the check valve.

**OIL TANK  
DISASSEMBLING/ASSEMBLING THE OIL TANK**



Order	Job/Part	Q'ty	Remarks
1	Oil level sensor	1	
2	Oil strainer	1	
3	Washer	1	
4	Oil tank	1	
5	Cap nut	1	
6	Emergency switch	1	
7	Collar	3	
8	Grommet	3	
			For assembly, reverse the disassembly procedure.

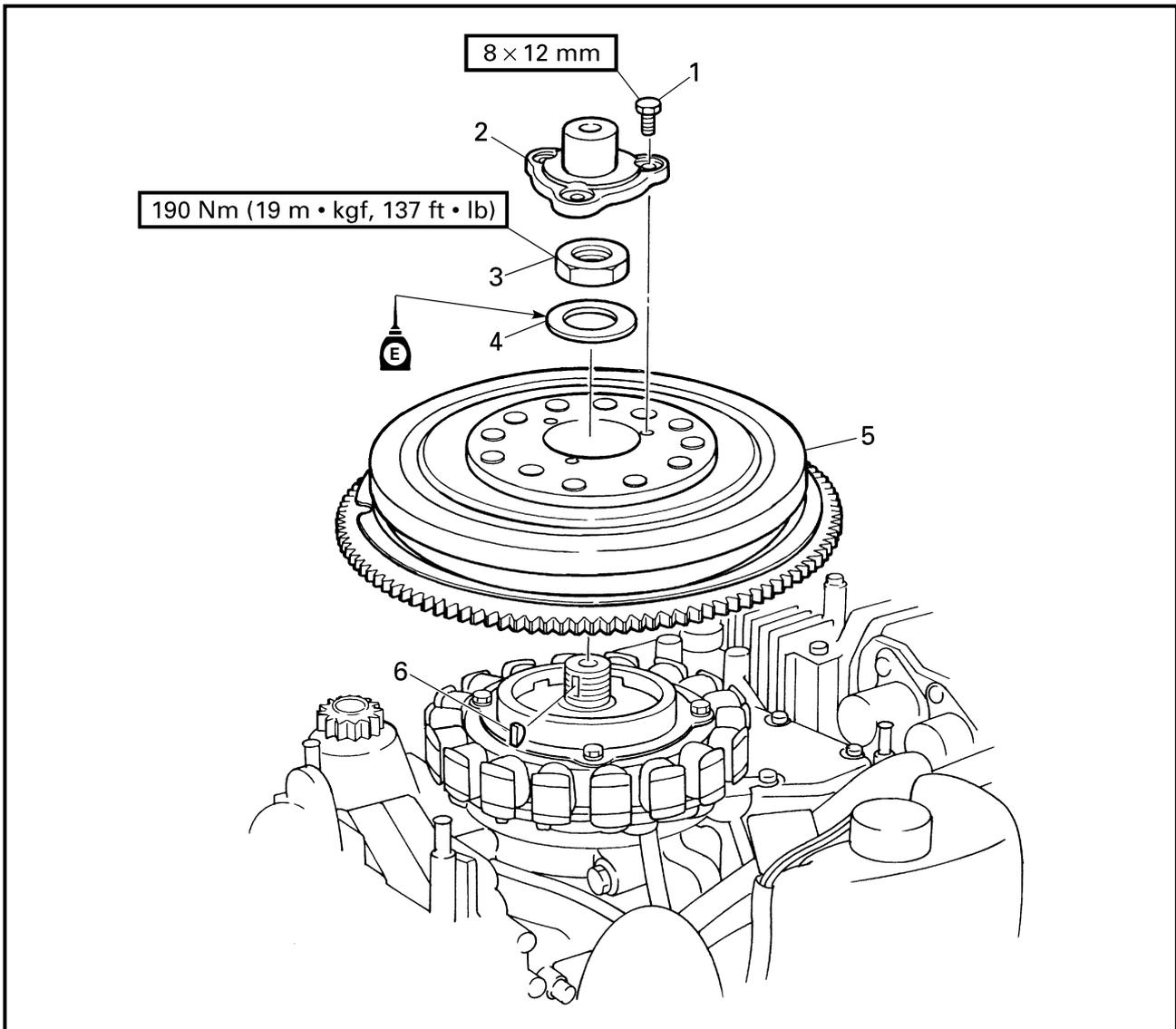
## CHAPTER 5 POWER UNIT

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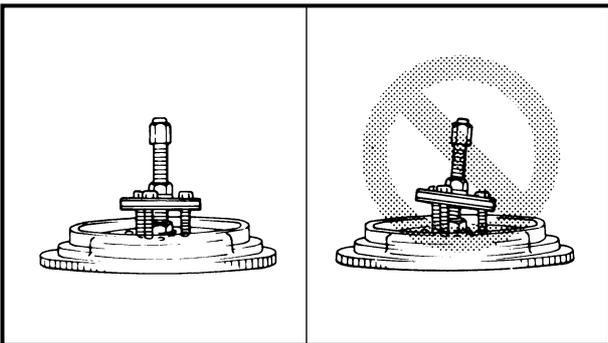
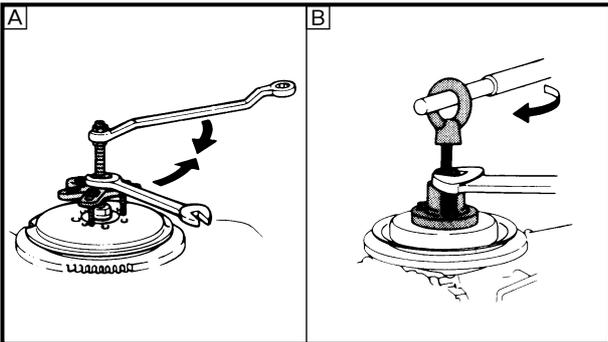
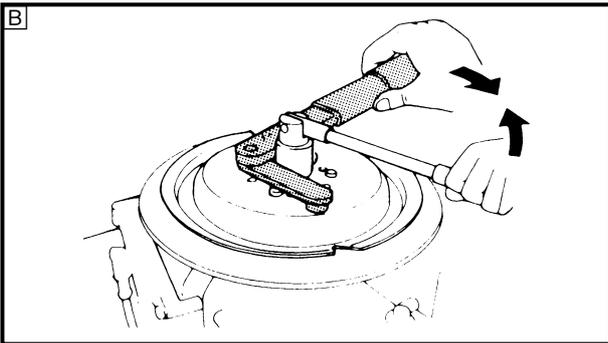
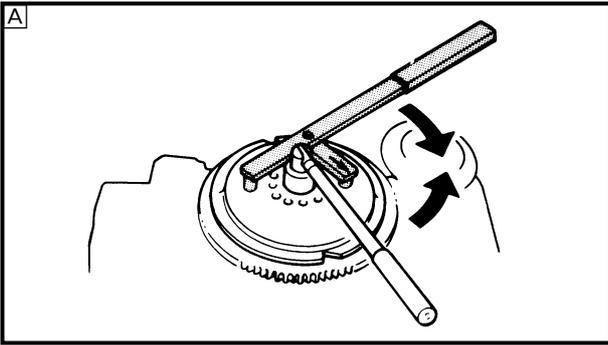


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**FLYWHEEL MAGNET ASSEMBLY  
REMOVING/INSTALLING THE FLYWHEEL MAGNET ASSEMBLY**



Order	Job/Part	Q'ty	Remarks
	Drive sprocket		Refer to "DRIVE BELT" on page 4-22.
1	Bolt	3	
2	Drive sprocket bracket	1	
3	Flywheel magnet assembly nut	1	
4	Washer	1	
5	Flywheel magnet assembly	1	
6	Woodruff key	1	
			For installation, reverse the removal procedure.



**REMOVING THE FLYWHEEL MAGNET ASSEMBLY**

Remove:

- Flywheel magnet assembly

**Removing steps**

(1) Remove the flywheel magnet assembly nut.

	<p><b>Flywheel magnet assembly holder</b> YB-06139 / 90890-06522</p>
--	--

A For USA and Canada

B For worldwide

**NOTE:**

The major load should be applied in the direction of the arrows. If the load is not applied as shown, the flywheel magnet assembly holder may easily slip off of the flywheel magnet assembly.

(2) Remove the flywheel magnet assembly

	<p><b>Universal puller</b> YB-06117 / 90890-06521</p>
--	---

A For USA and Canada

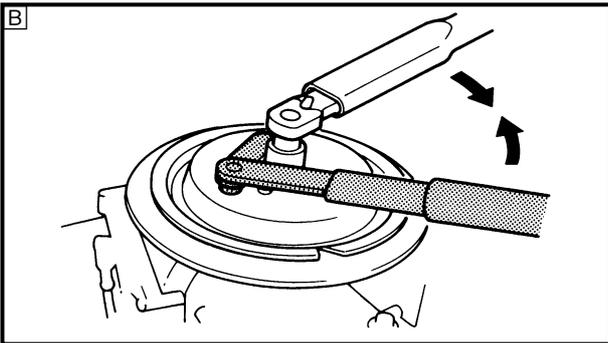
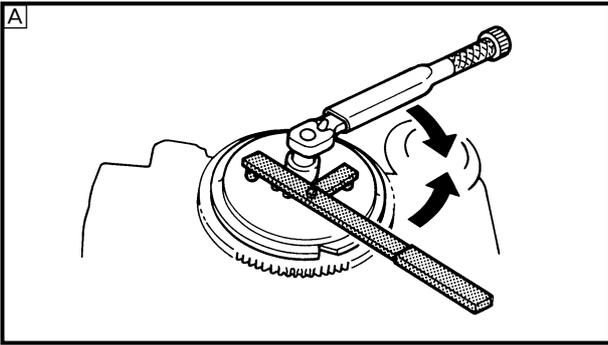
B For worldwide

**NOTE:**

- The major load should be applied in the direction of the arrows.
- Apply the load until the flywheel magnet assembly comes off the tapered portion of the crankshaft.

**CAUTION:**

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



**INSTALLING THE FLYWHEEL MAGNET ASSEMBLY**

Install:

- Flywheel magnet assembly nut



**Flywheel magnet assembly holder**  
YB-06139 / 90890-06522

**A** For USA and Canada

**B** For worldwide

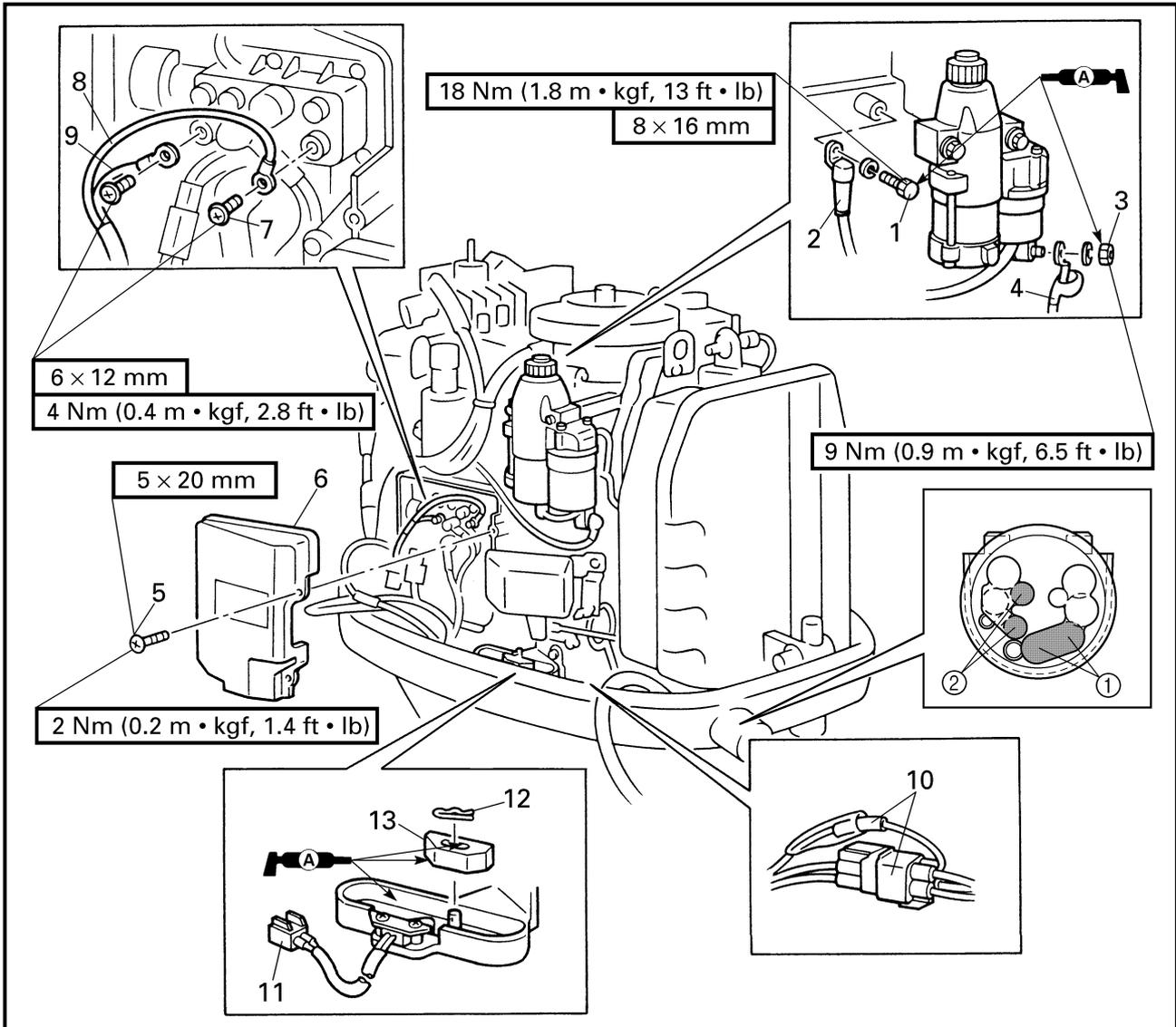
**NOTE:**

The major load should be applied in the direction of the arrows. If the load is not applied as shown, the flywheel magnet assembly holder may easily slip off of the flywheel magnet assembly.



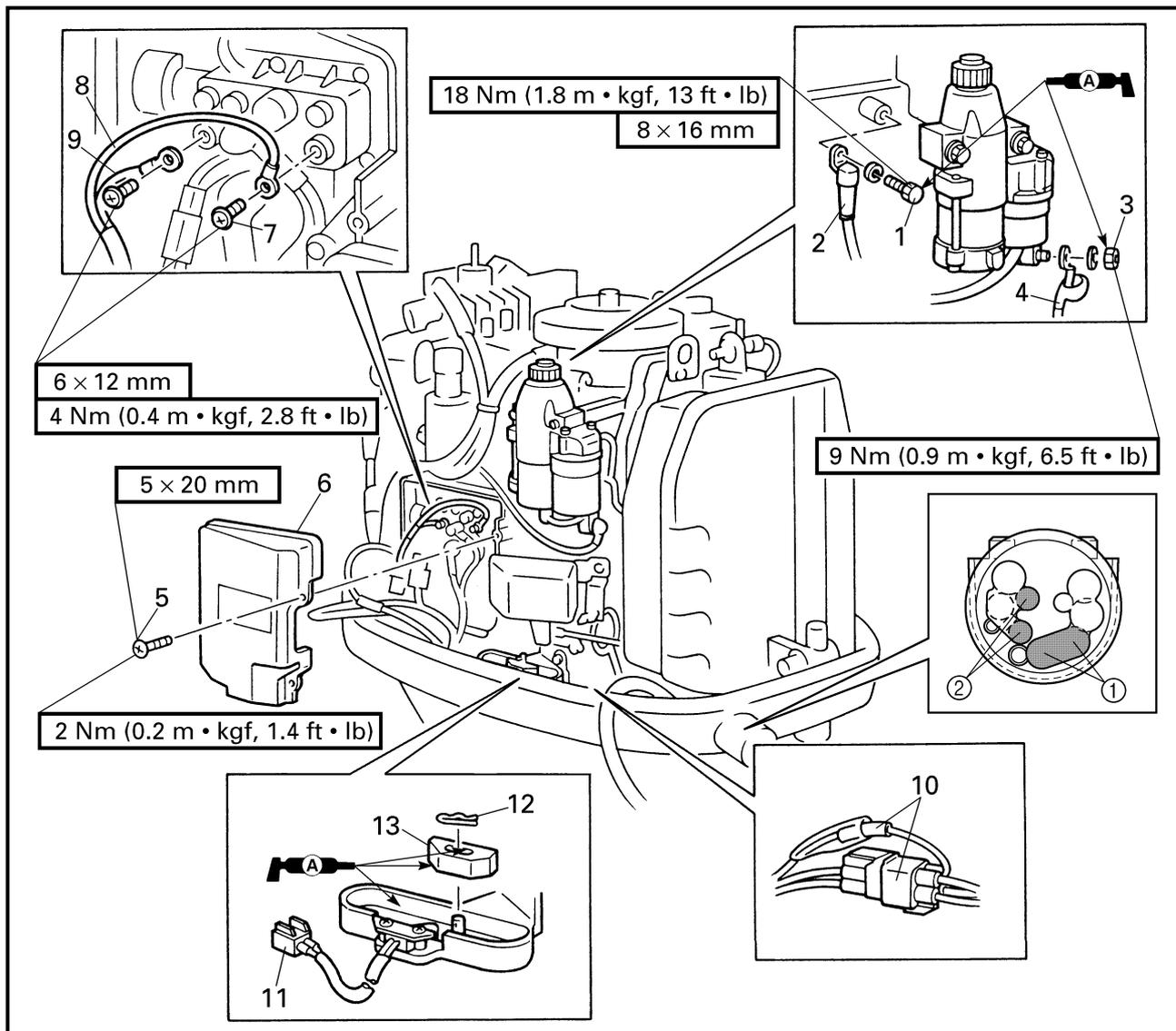
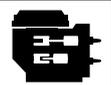
**Flywheel magnet assembly nut**  
190 Nm (19 m • kgf, 137 ft • lb)

**POWER UNIT  
DISCONNECTING/CONNECTING THE LEADS**



Order	Job/Part	Q'ty	Remarks
	Battery leads ①		(from the battery)
	Remote control shift and throttle rods and cables ②		
1	Bolt	1	
2	Negative battery lead	1	
3	Nut	1	
4	Positive battery lead	1	
5	Screw	2	
6	Junction box cover	1	

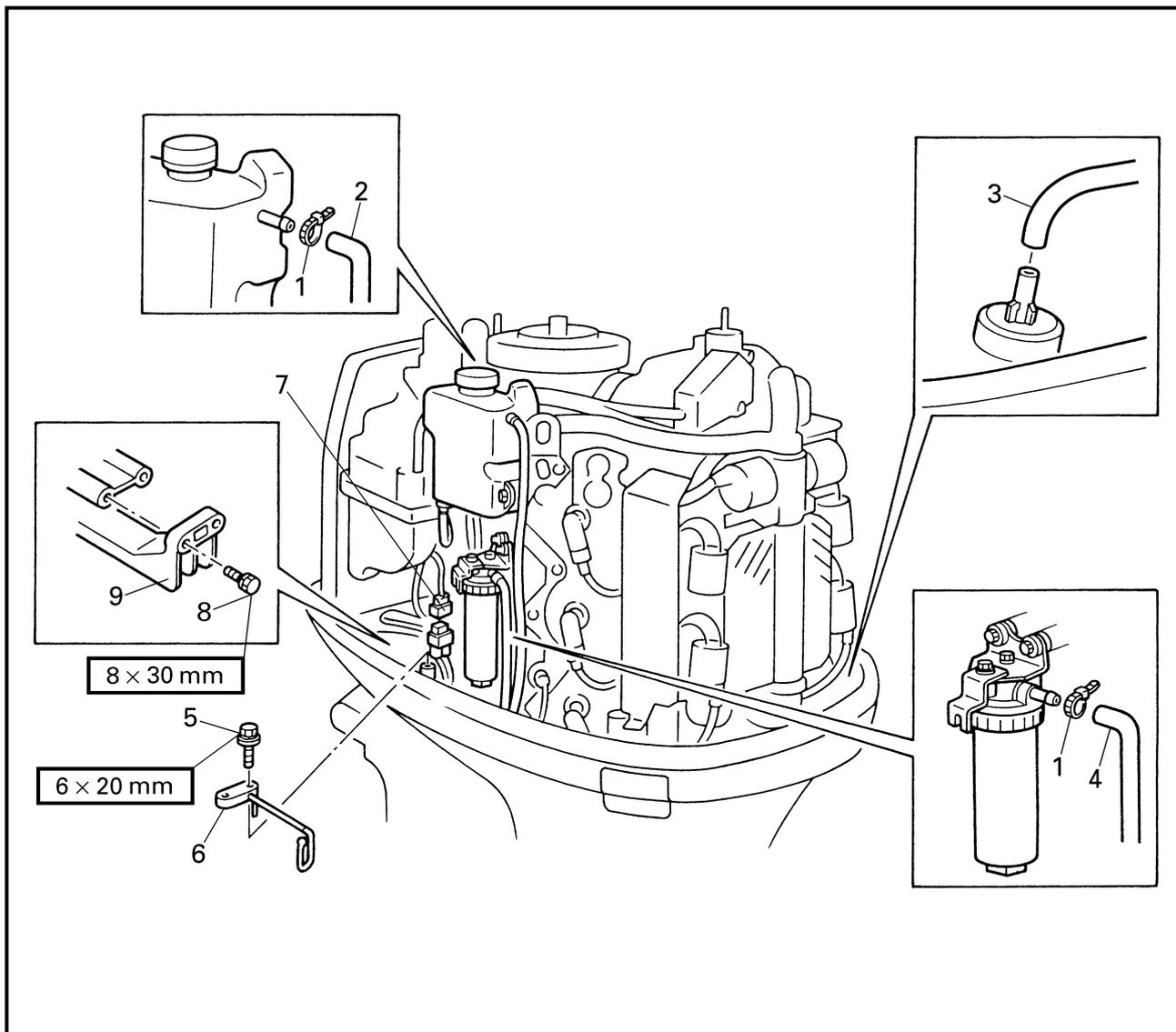
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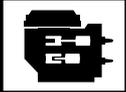
Order	Job/Part	Q'ty	Remarks
7	Bolt	2	
8	Power trim and tilt lead	1	(blue)
9	Power trim and tilt lead	1	(green)
10	Trim sensor coupler and connector	2	
11	Shift position switch coupler	1	
12	Clip	1	
13	Shift rod lever bushing	1	
For installation, reverse the removal procedure.			



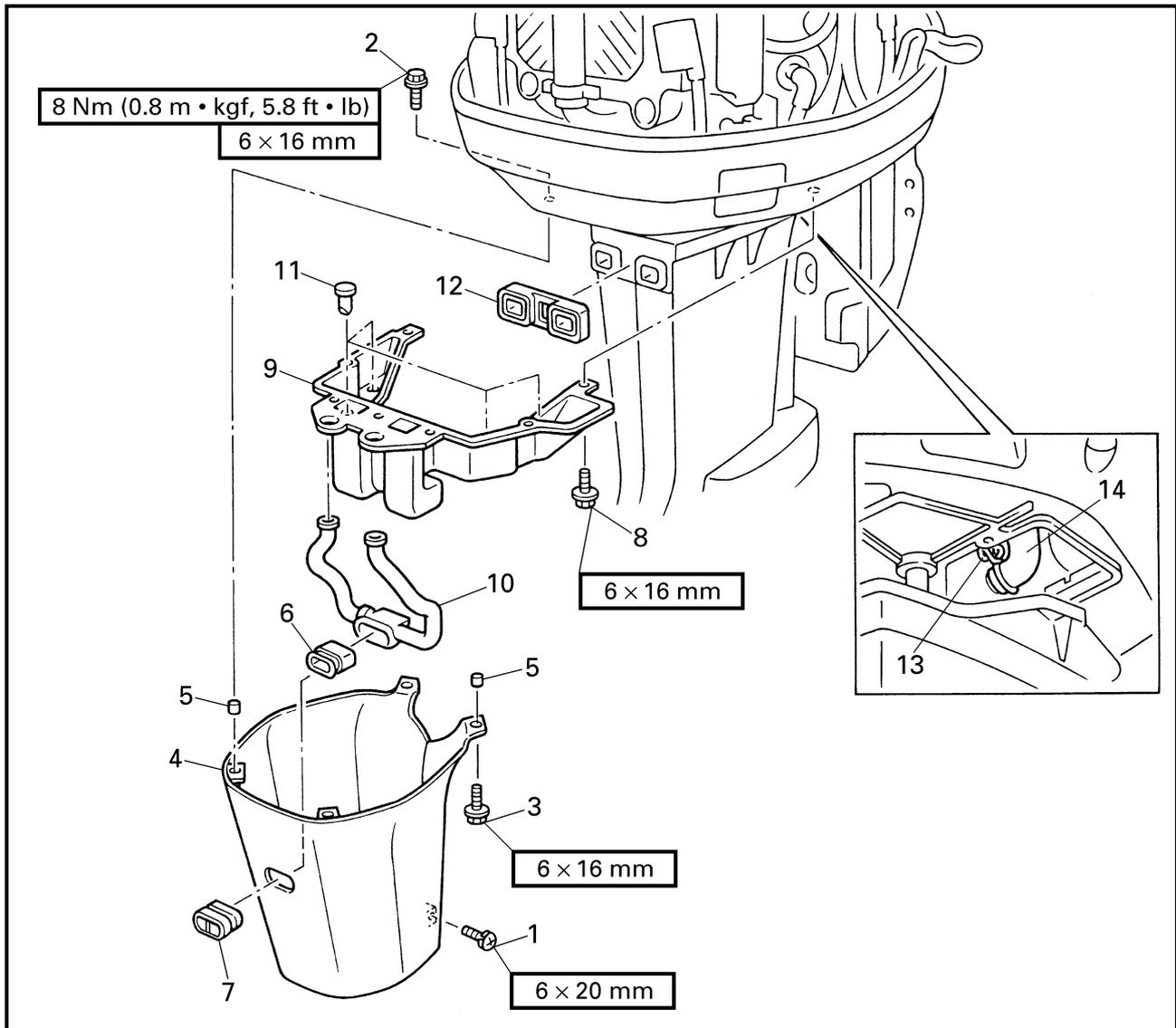
DISCONNECTING/CONNECTING THE HOSES



Order	Job/Part	Q'ty	Remarks
1	Plastic locking tie	2	<b>Not reusable</b>
2	Oil hose	1	(oil tank-to-sub-oil tank)
3	Pilot water hose	1	(pilot water outlet-to-rectifier/regulator)
4	Fuel hose	1	(fuel filter-to-hose joint)
5	Bolt	1	
6	Cable guide	1	
7	Trailer switch coupler	1	
8	Bolt	2	
9	Shift rod assembly	1	
			For installation, reverse the removal procedure.

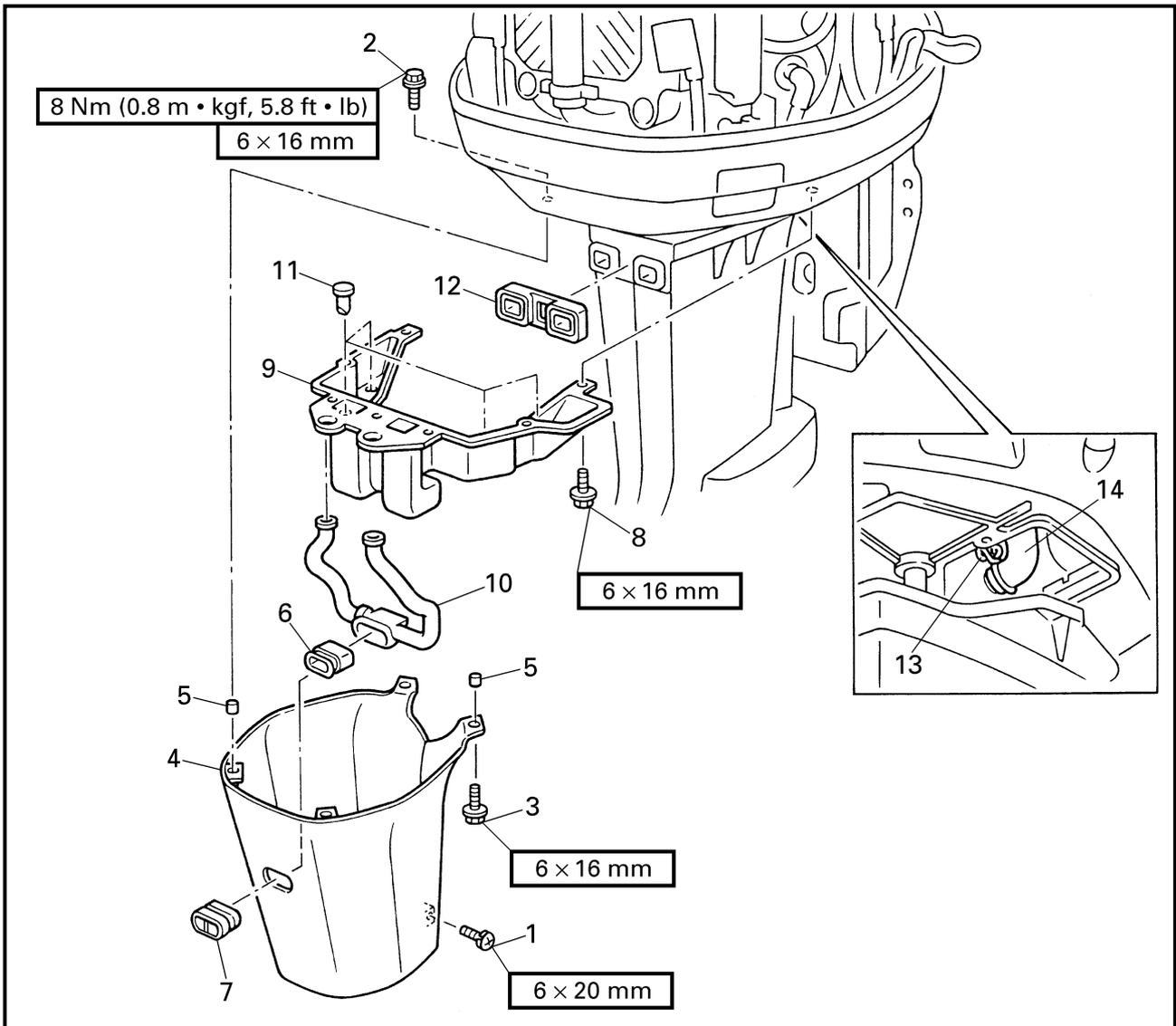


**REMOVING/INSTALLING THE EXHAUST EXPANSION CHAMBER**

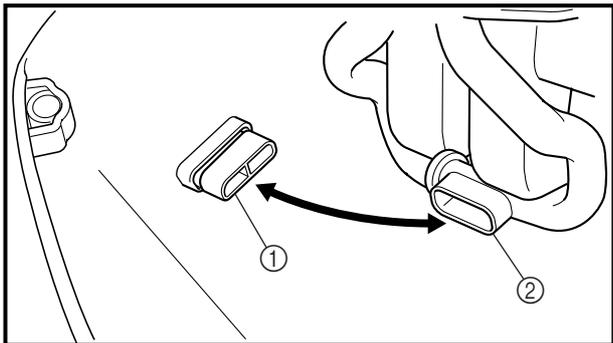


Order	Job/Part	Q'ty	Remarks
1	Screw	1	
2	Bolt	2	
3	Bolt	2	
4	Apron	1	
5	Collar	4	
6	Hose joint	1	
7	Rubber seal	1	
8	Bolt	9	

Continued on next page.



Order	Job/Part	Q'ty	Remarks
9	Exhaust expansion chamber	1	
10	Exhaust expansion chamber hose	1	
11	Rubber seal	4	
12	Rubber seal	1	
13	Clip	1	
14	Cooling water hose	1	(exhaust manifold-to-power unit) For installation, reverse the removal procedure.



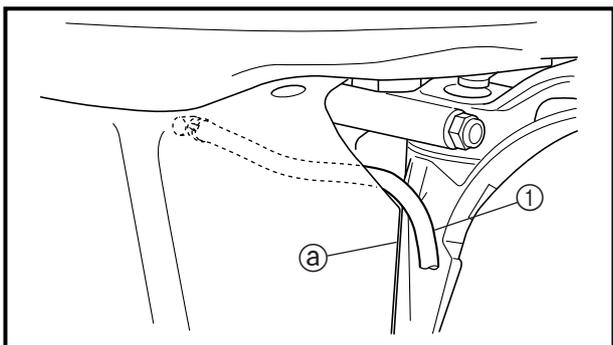
**INSTALLING THE APRON**

1. Install:
  - Hose joint

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

First insert the hose joint ① in the exhaust expansion chamber hose ②, and then insert the apron securely in the hose joint.

---



2. Install:
  - Apron

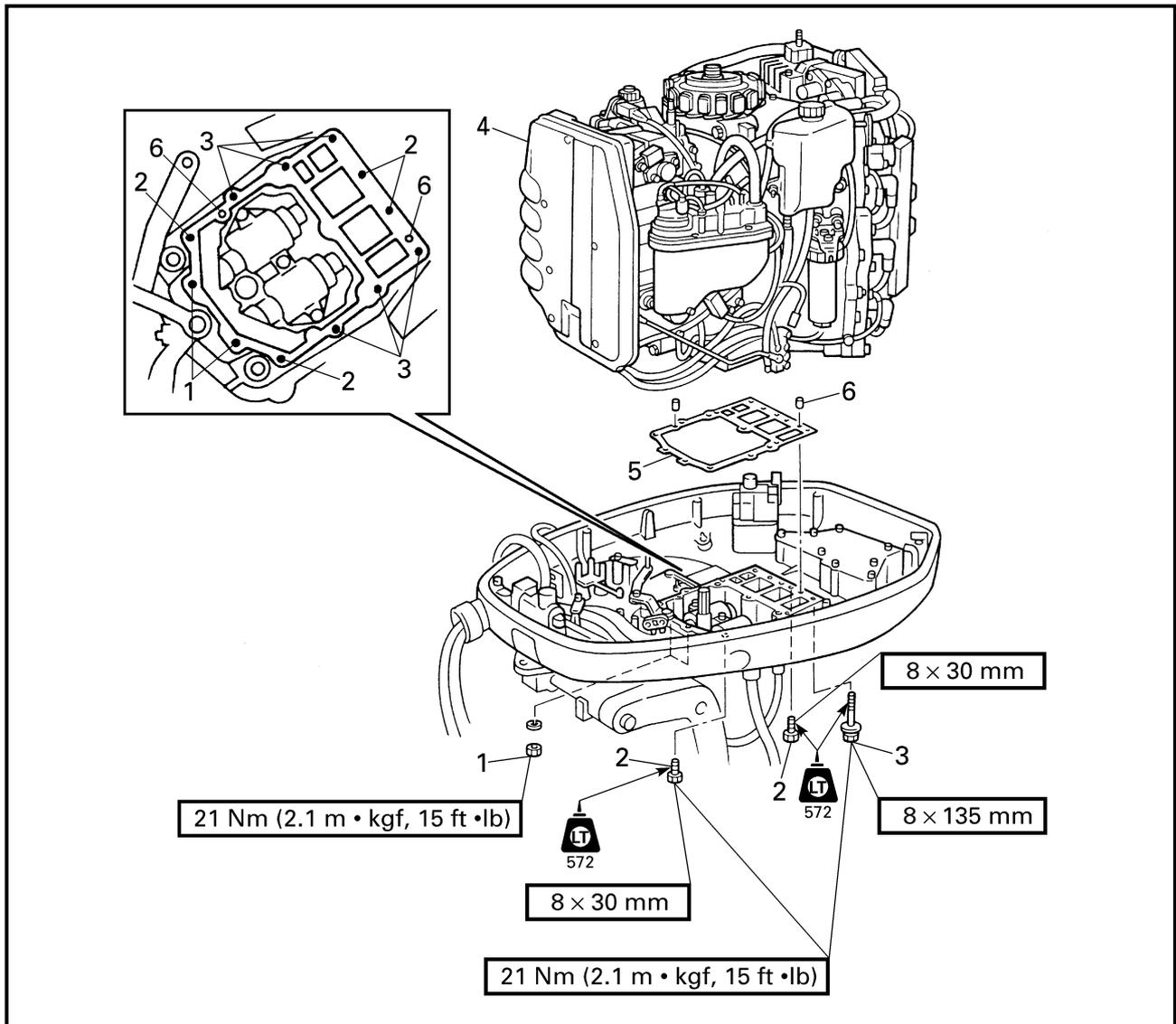
**CAUTION:** \_\_\_\_\_

**Make sure not to get the flushing hose ① caught between the mating surfaces ② of the apron when installing it.**

---

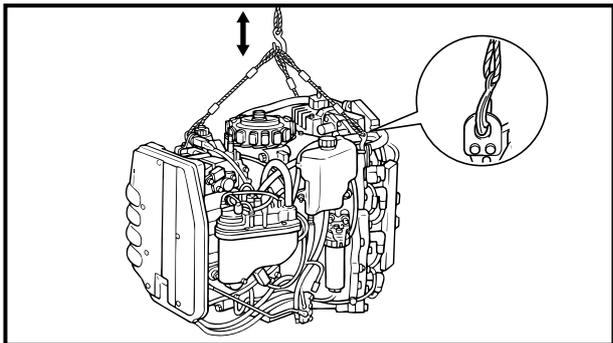


REMOVING/INSTALLING THE POWER UNIT



Order	Job/Part	Q'ty	Remarks
1	Nut	2	
2	Bolt	4	
3	Bolt	6	
4	Power unit	1	
5	Gasket	1	<b>Not reusable</b>
6	Dowel pin	2	

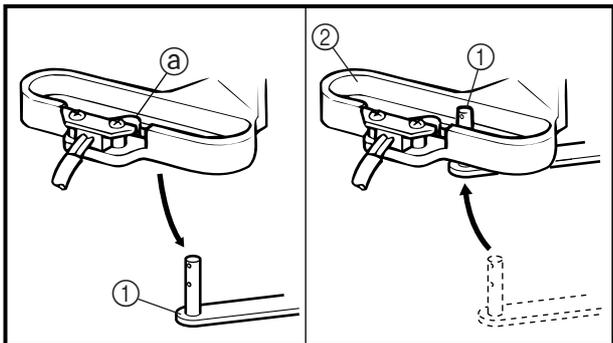
For installation, reverse the removal procedure.



**SUSPENDING THE POWER UNIT**

**CAUTION:**

Make sure to use engine hangers in three different areas when suspending the power unit as shown. If the engine hangers are not used correctly the power unit will not be balanced, which could result in serious injury or death.



**INSTALLING THE POWER UNIT**

Install:

- Shift rod lever

**CAUTION:**

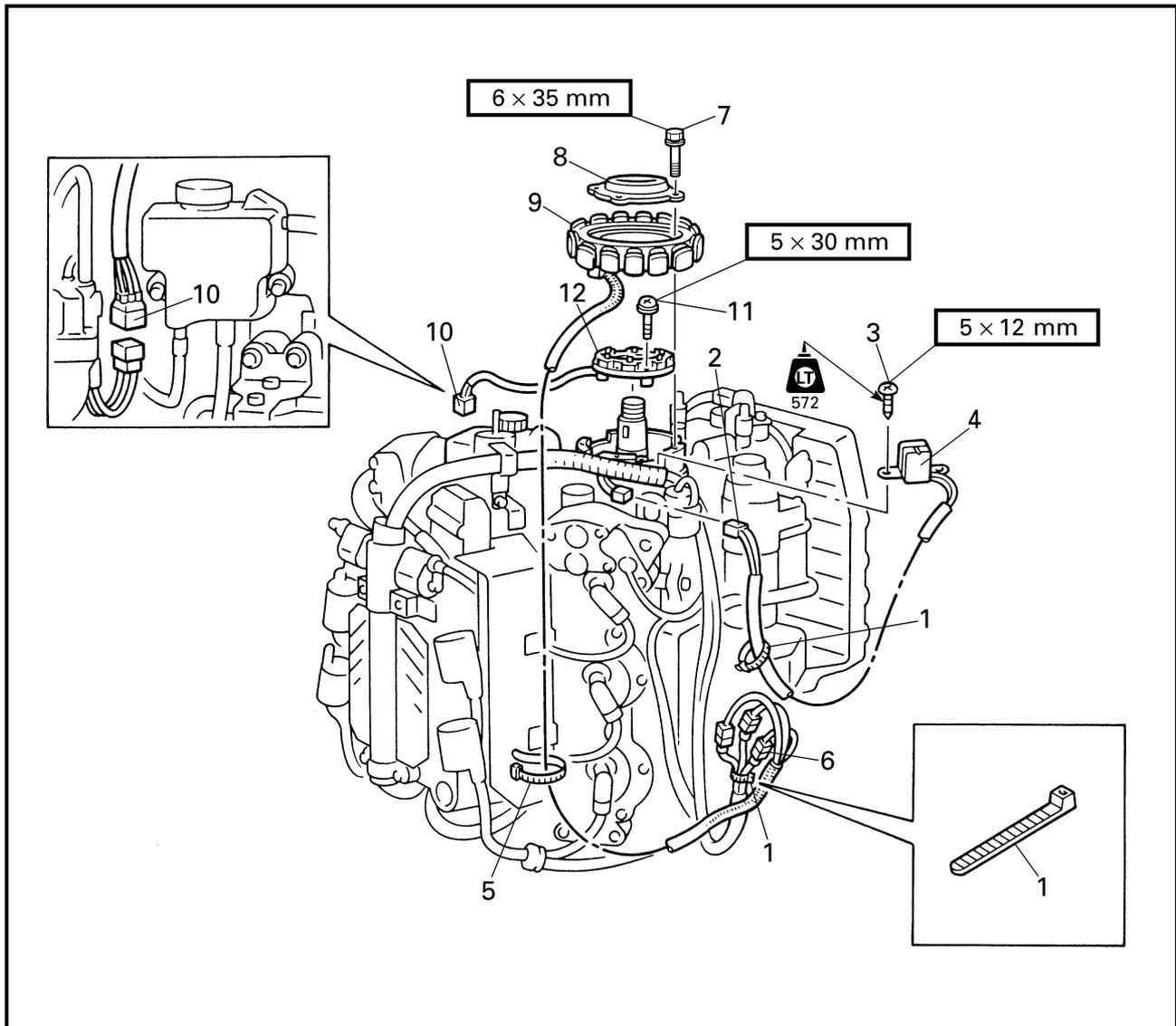
Make sure to push the shift rod lever ① to the outside when placing the power unit onto the bottom cowling, otherwise, interference with the shift position switch plate ② may occur and the shift rod lever could be damaged.

**NOTE:**

Make sure to place the shift rod lever ① in the shift rod lever bracket ② after placing the power unit securely onto the bottom cowling.

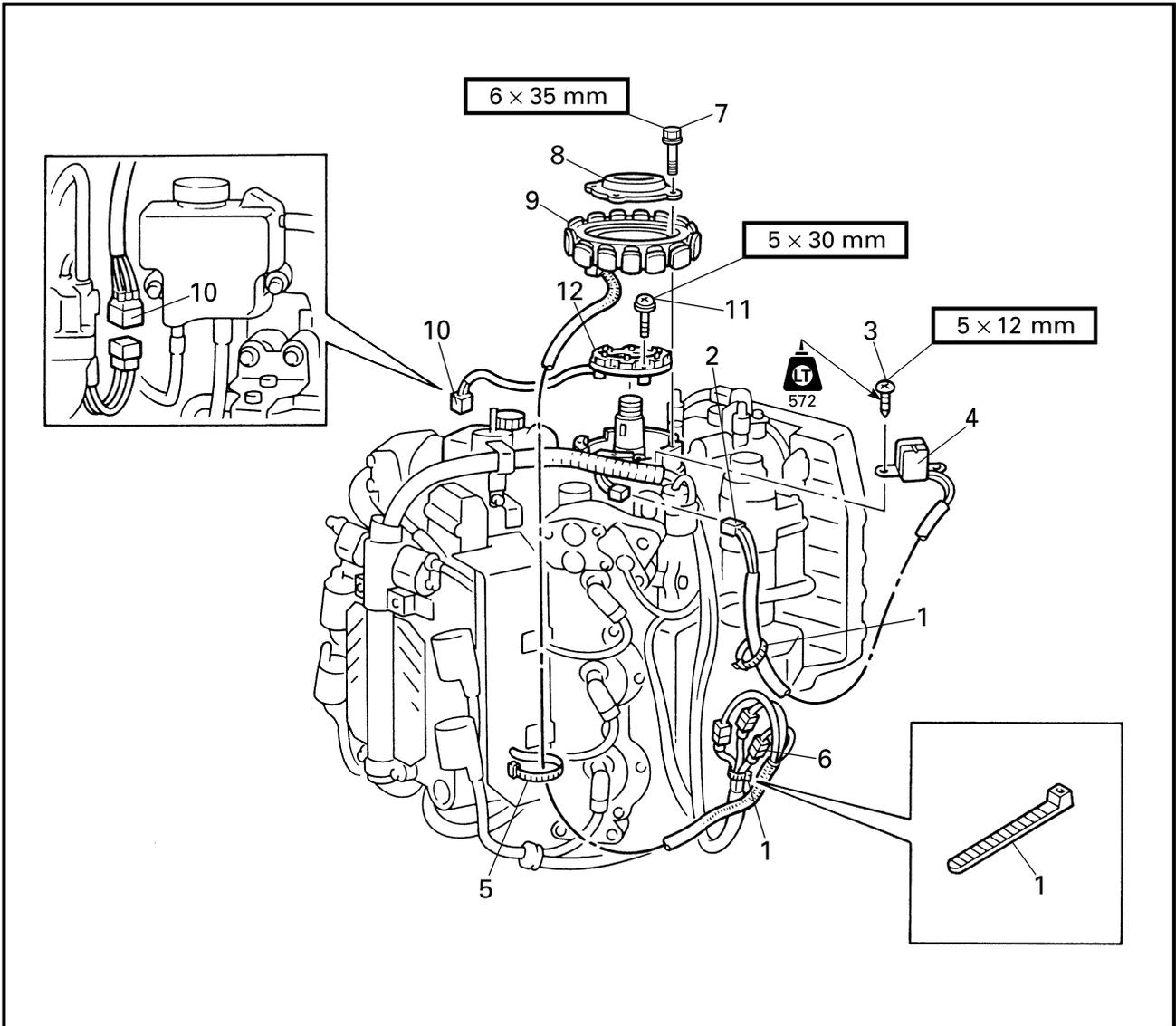


**STATOR ASSEMBLY  
REMOVING/INSTALLING THE STATOR ASSEMBLY**



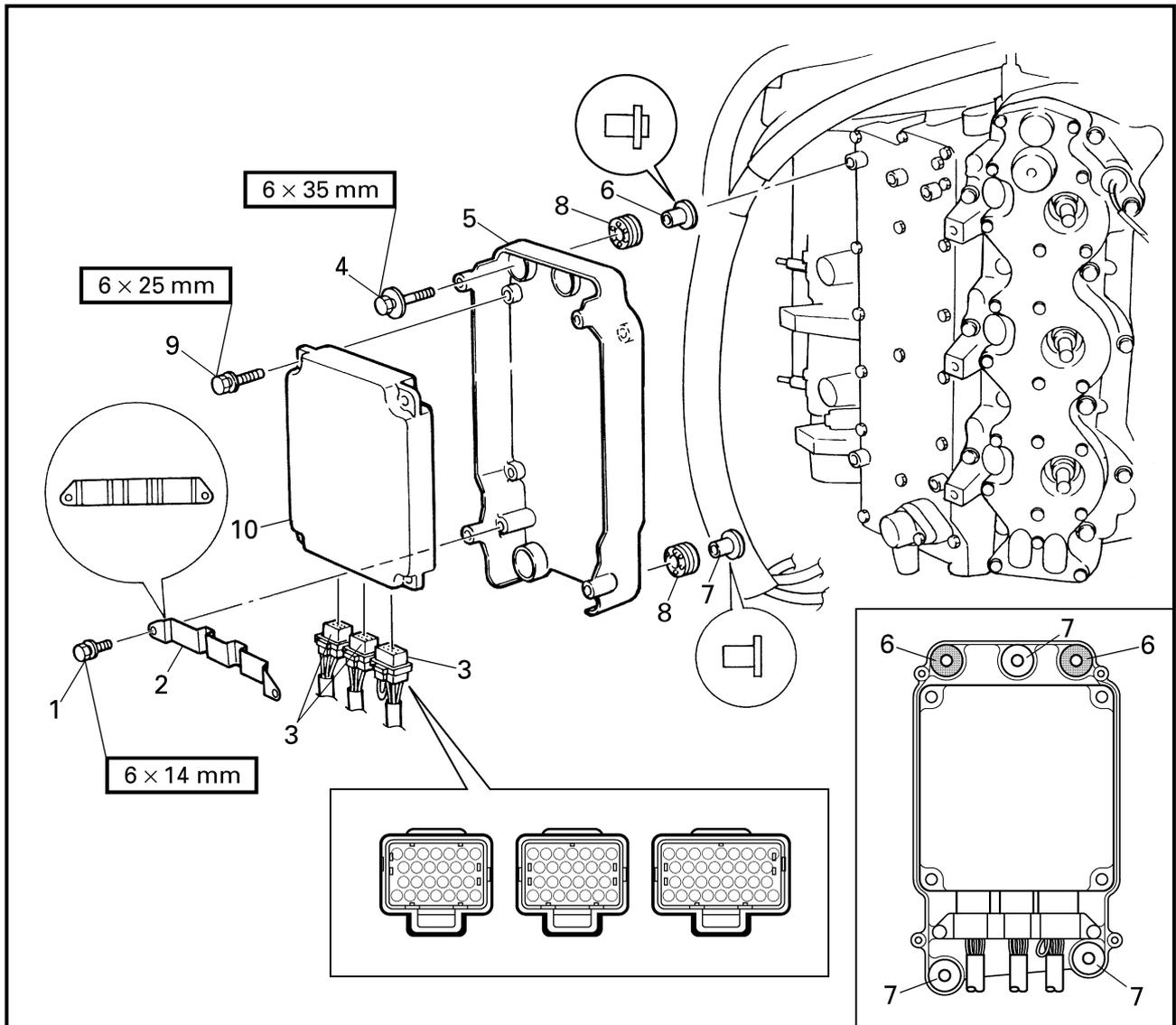
Order	Job/Part	Q'ty	Remarks
	Flywheel magnet assembly		Refer to "FLYWHEEL MAGNET ASSEMBLY" on page 5-1.
1	Plastic locking tie	2	<b>Not reusable</b>
2	Crank position sensor coupler	1	
3	Screw	2	
4	Crank position sensor	1	Refer to "ADJUSTING THE CRANK POSITION SENSOR" on page 3-12.
5	Clamp	1	
6	Lighting coil coupler	3	

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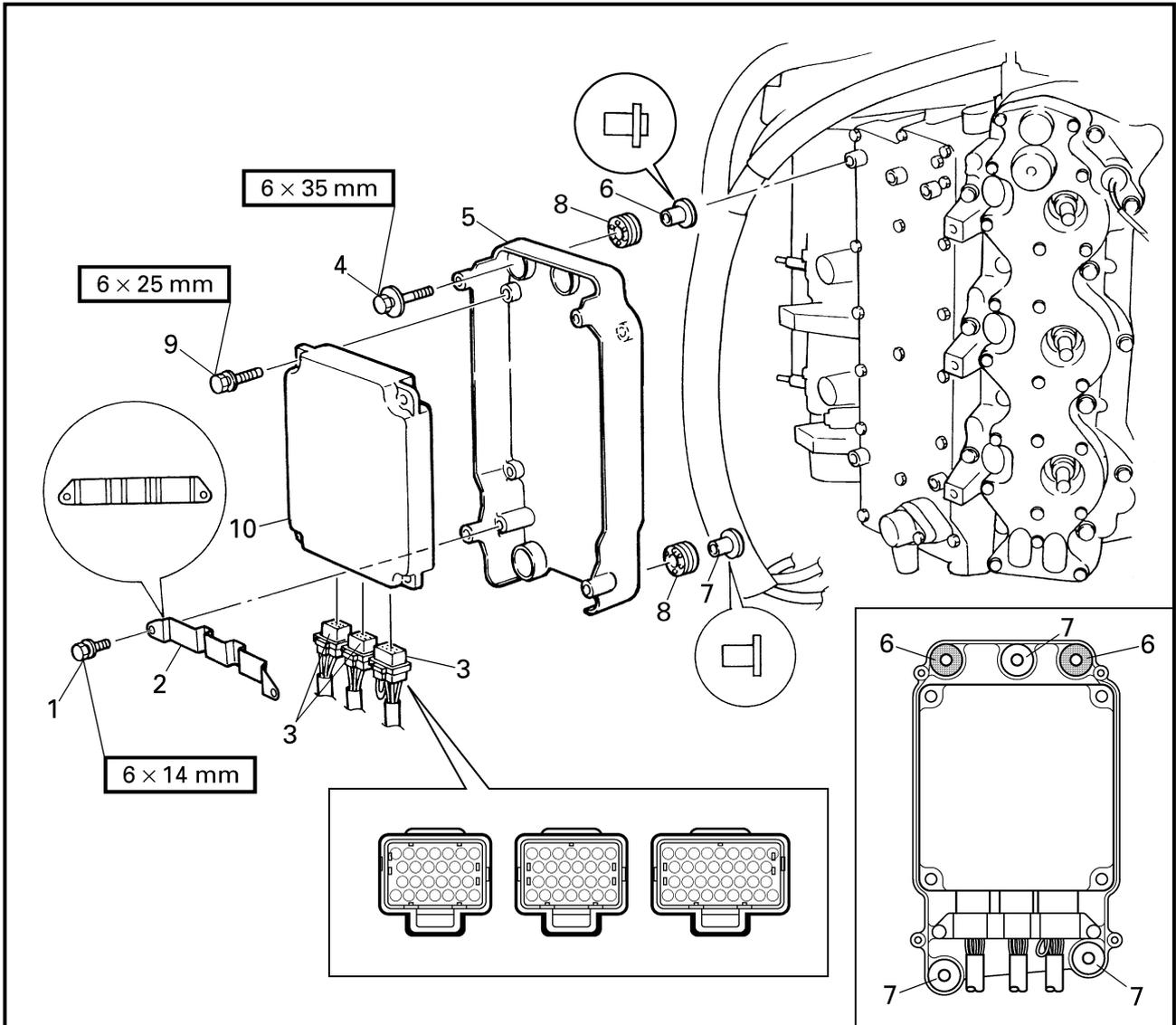
Order	Job/Part	Q'ty	Remarks
7	Bolt	4	
8	Stator assembly holder	1	
9	Stator assembly	1	
10	Pulser coil coupler	1	
11	Screw	3	
12	Pulser coil assembly	1	
			For installation, reverse the removal procedure.

**CONTROL UNIT  
REMOVING/INSTALLING THE CONTROL UNIT ASSEMBLY**



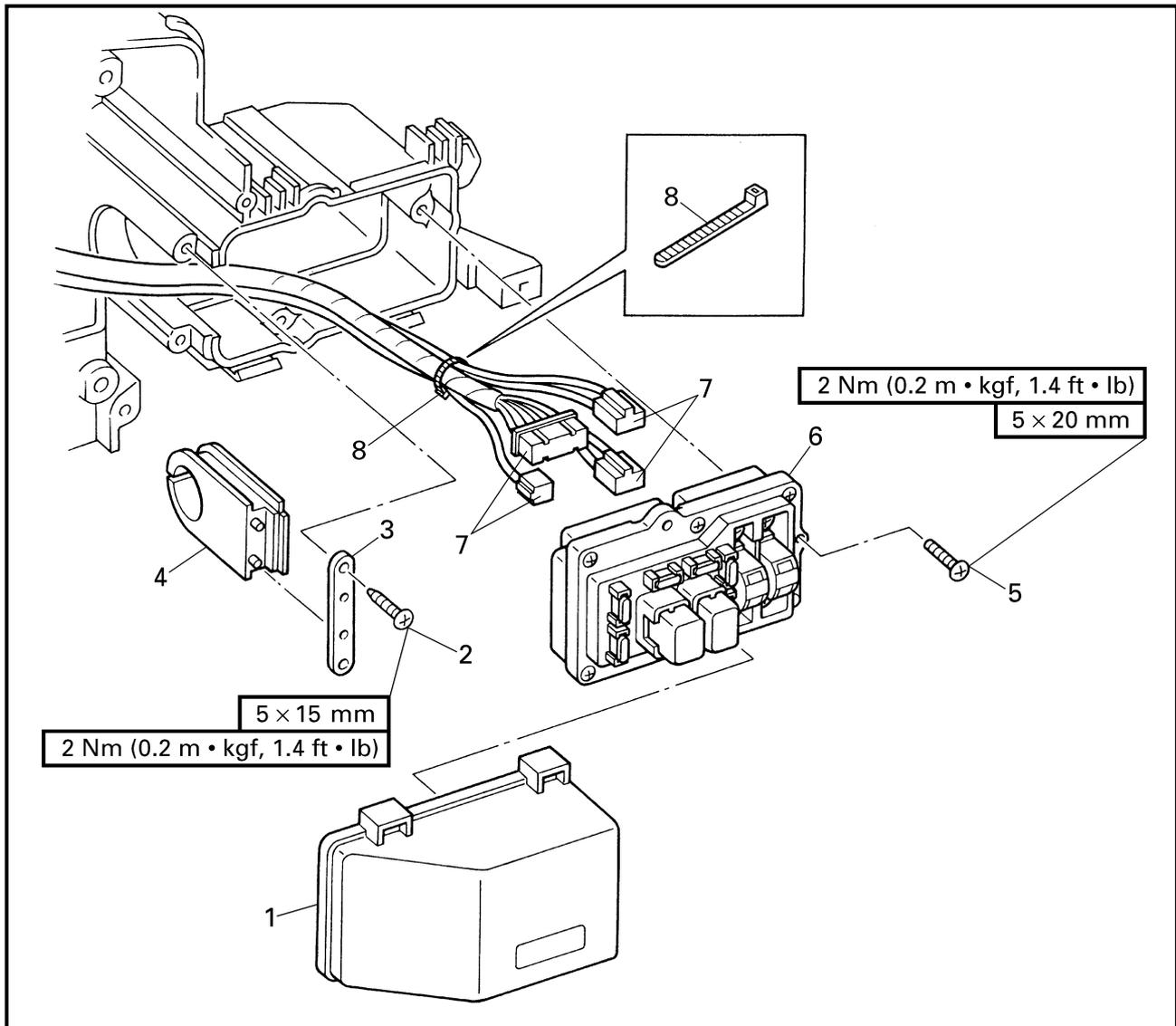
Order	Job/Part	Q'ty	Remarks
	High-pressure fuel line assembly		Refer to "HIGH-PRESSURE FUEL LINE ASSEMBLY" on page 4-30.
1	Bolt	2	
2	Control unit coupler guide	1	
3	Control unit coupler	3	
4	Bolt	5	
5	Control unit case	1	

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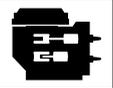


Order	Job/Part	Q'ty	Remarks
6	Collar	2	For installation, reverse the removal procedure.
7	Collar	3	
8	Grommet	5	
9	Bolt	4	
10	Control unit	1	

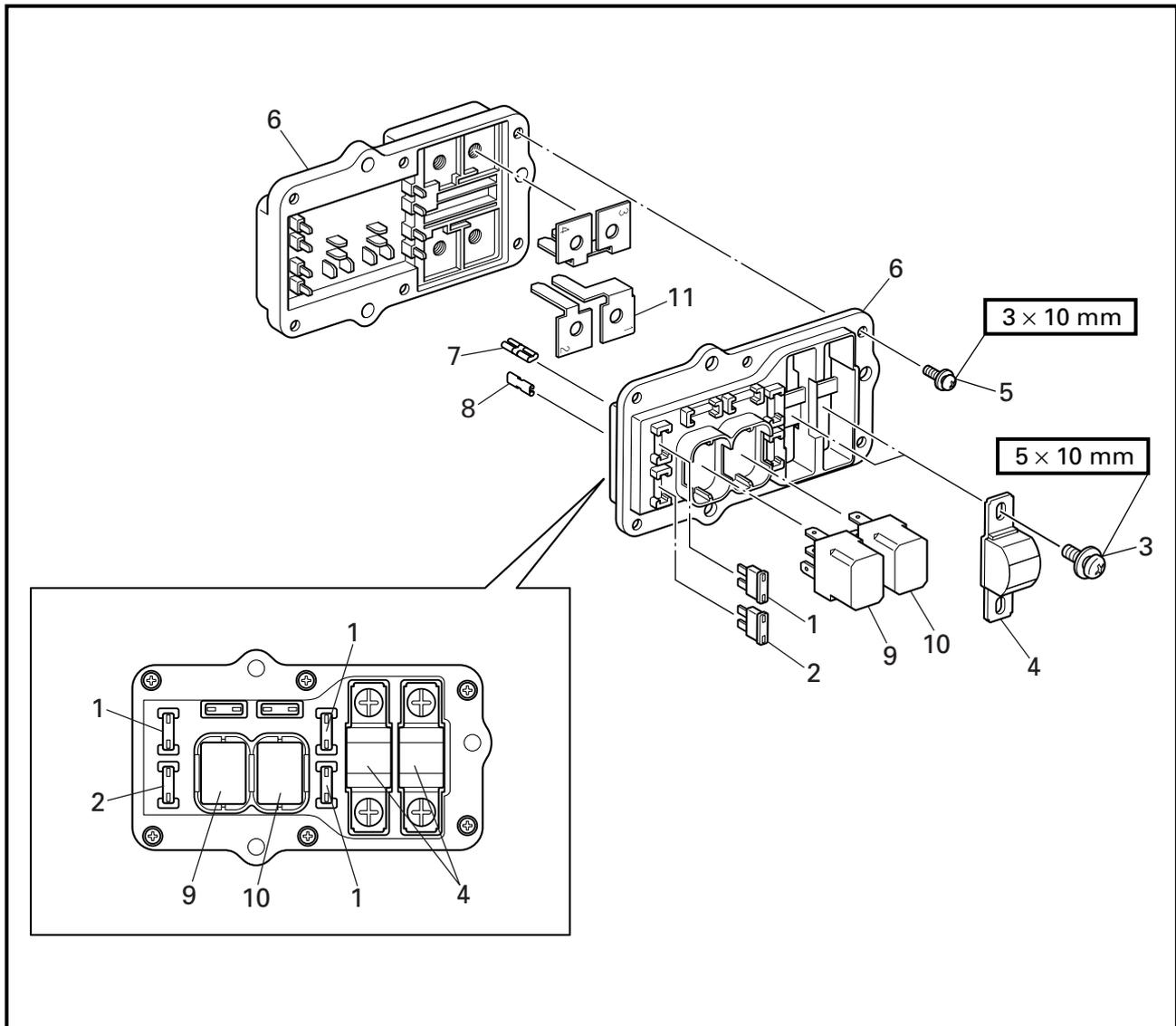
**FUSE HOLDER  
REMOVING/INSTALLING THE FUSE HOLDER**



Order	Job/Part	Q'ty	Remarks
	Junction box cover		Refer to "POWER UNIT" on page 5-4.
1	Fuel holder cover	1	
2	Screw	2	
3	Grommet holder	1	
4	Grommet	1	
5	Screw	3	
6	Fuse holder assembly	1	
7	Fuse holder coupler	4	
8	Plastic locking tie	1	<b>Not reusable</b> For installation, reverse the removal procedure.



DISASSEMBLING/ASSEMBLING THE FUSE HOLDER

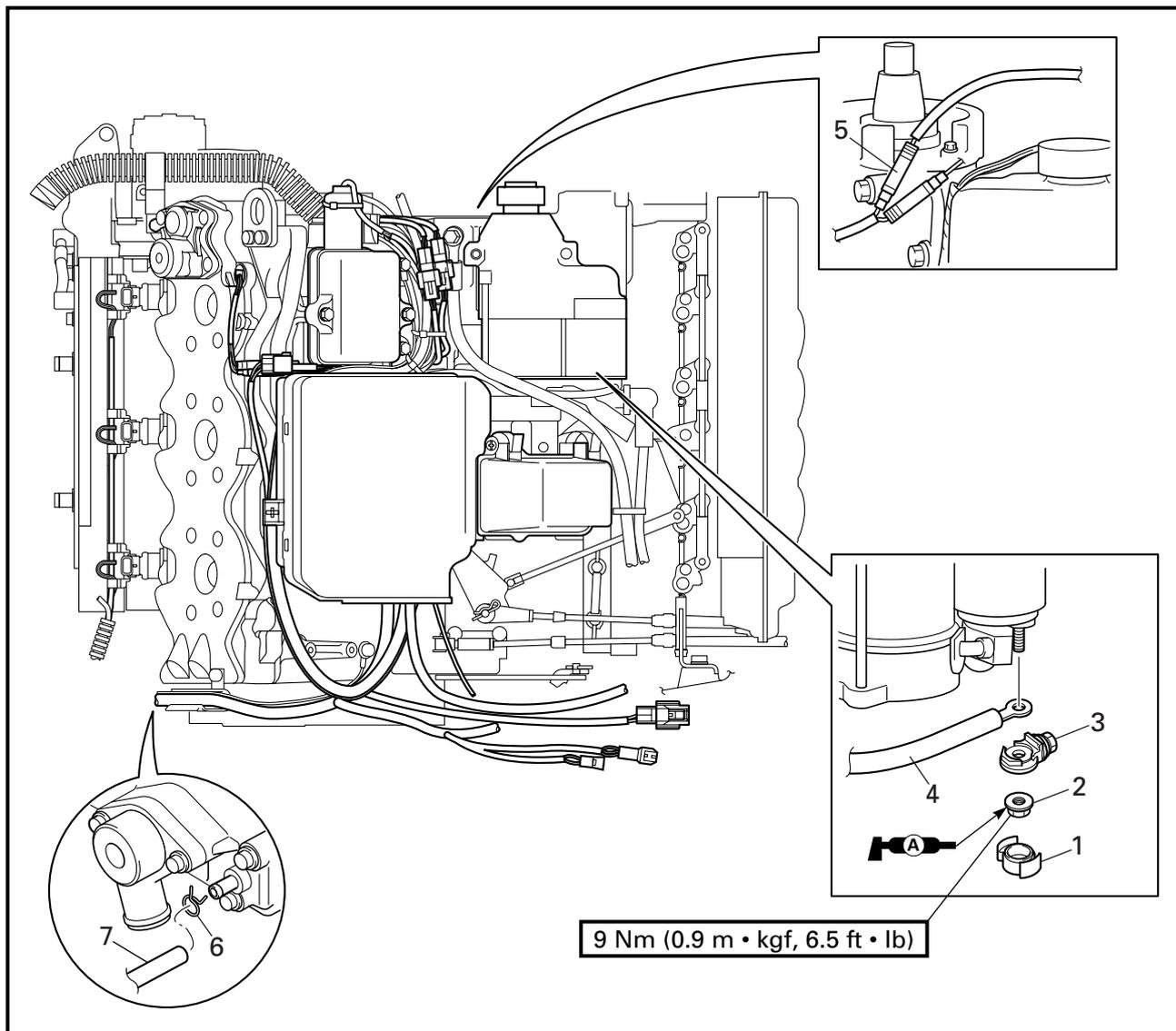


Order	Job/Part	Q'ty	Remarks
1	Fuse (20A)	3	For assembly, reverse the disassembly procedure.
2	Fuse (30A)	1	
3	Screw	4	
4	Fuse (80A)	2	
5	Screw	6	
6	Fuse holder	1	
7	Terminal (big)	4	
8	Terminal (small)	4	
9	Driver relay	1	
10	Main relay	1	
11	Terminal plate	4	



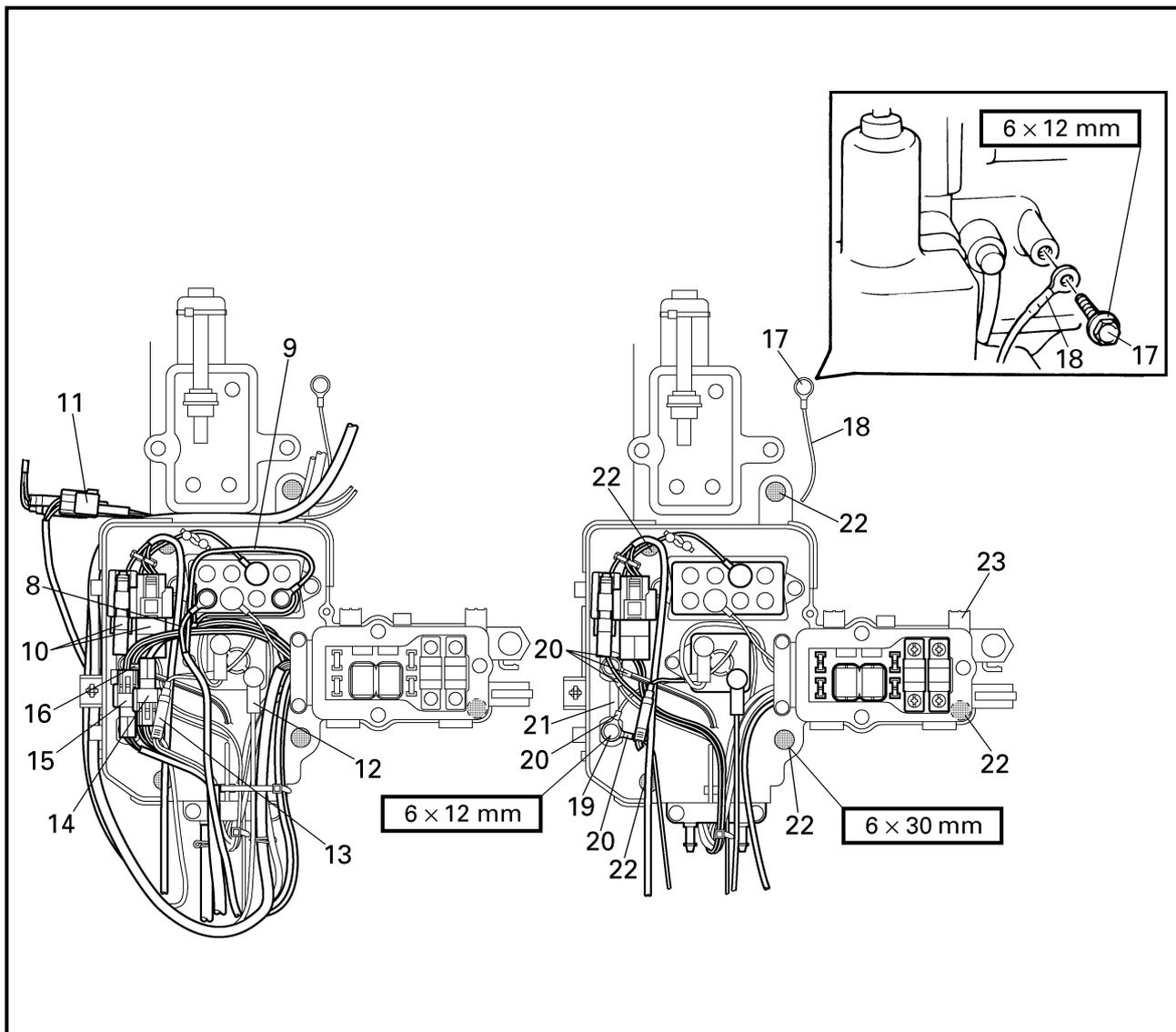
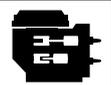
**JUNCTION BOX ASSEMBLY**

**REMOVING/INSTALLING THE JUNCTION BOX ASSEMBLY**

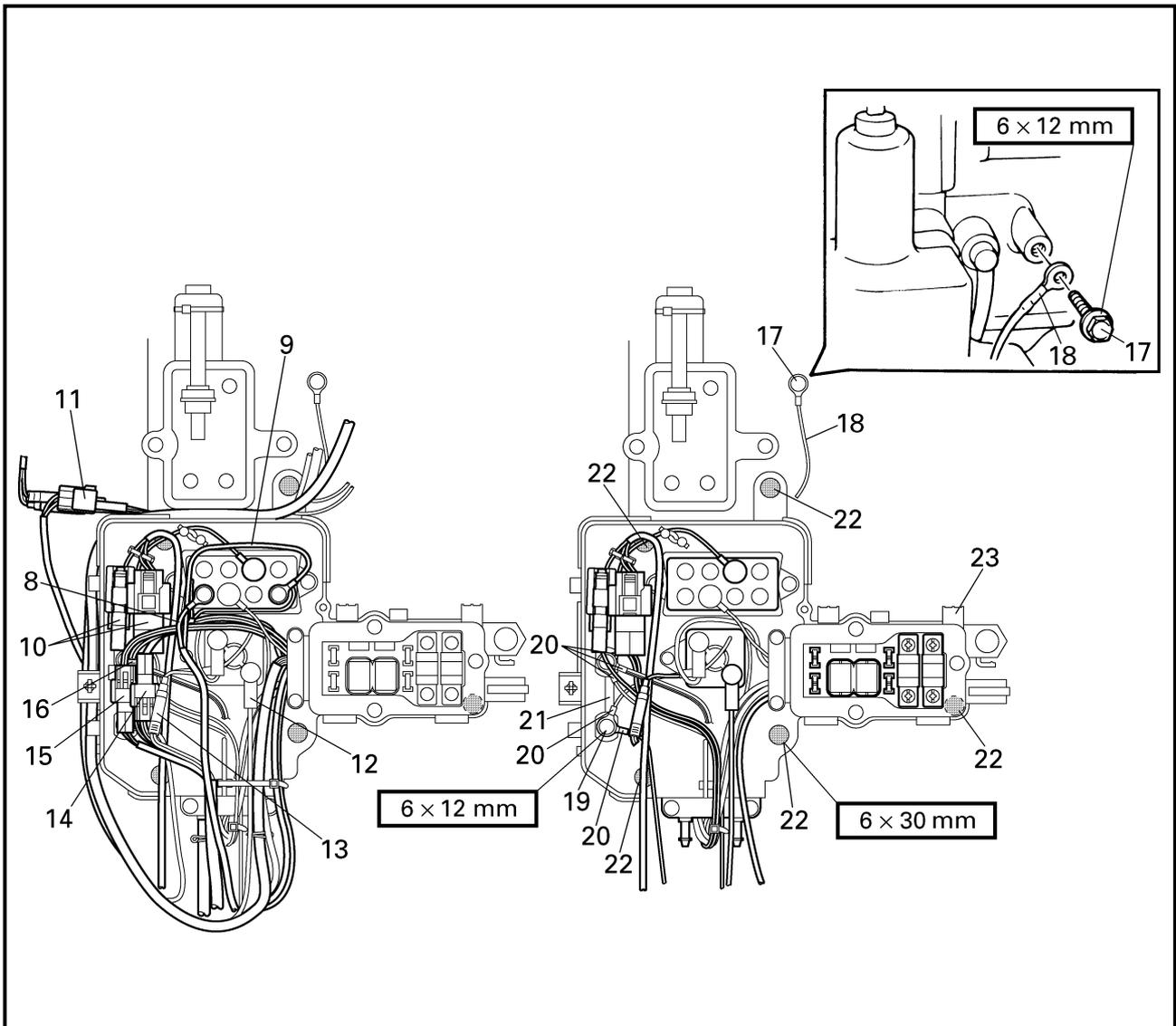


Order	Job/Part	Q'ty	Remarks
	Pilot water hose		Refer to "POWER UNIT" on page 5-4.
	Fuse holder coupler		Refer to "FUSE HOLDER" on page 5-16.
1	Terminal cover	1	
2	Nut	1	
3	Positive battery lead terminal	1	
4	Power trim and tilt lead	1	(red)
5	Electric fuel pump connector	1	(red)
6	Clip	1	
7	Cooling water hose	1	(exhaust outer cover-to-rectifier/ regulator)

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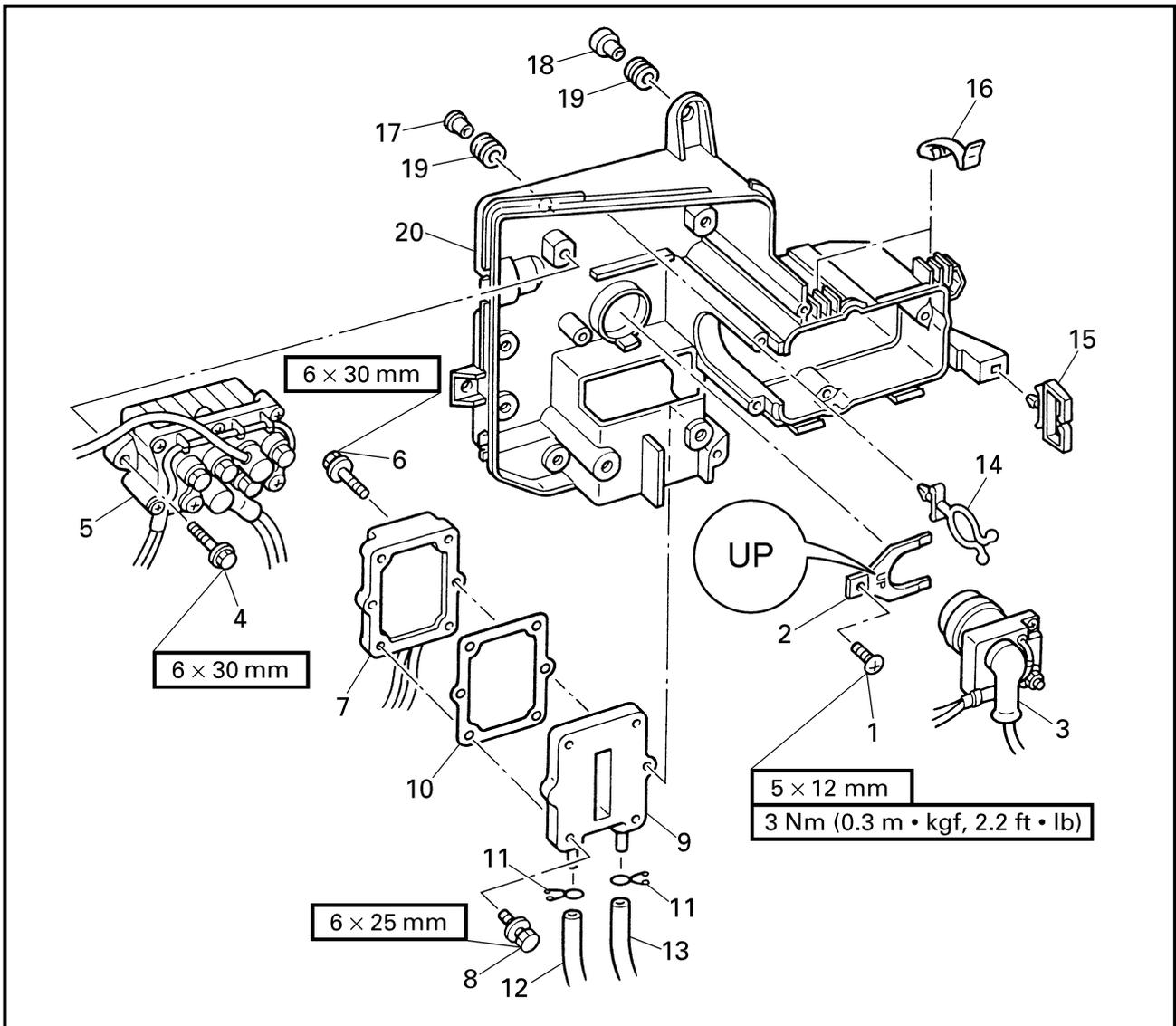
Order	Job/Part	Q'ty	Remarks
8	Power trim and tilt lead	1	(green)
9	Power trim and tilt lead	1	(blue)
10	Lighting coil coupler	2	
11	Oxygen density sensor coupler	1	(blue)
12	Starter motor lead	1	
13	Starter relay connector	1	
14	Power trim and tilt relay coupler	1	
15	Fuse holder coupler	1	
Continued on next page.			



Order	Job/Part	Q'ty	Remarks
16	Fuse holder connector	1	
17	Bolt	1	
18	Ground lead	1	
19	Bolt	2	
20	Ground lead	5	
21	Ground lead plate	1	
22	Bolt	5	
23	Junction box assembly	1	
			For installation, reverse the removal procedure.

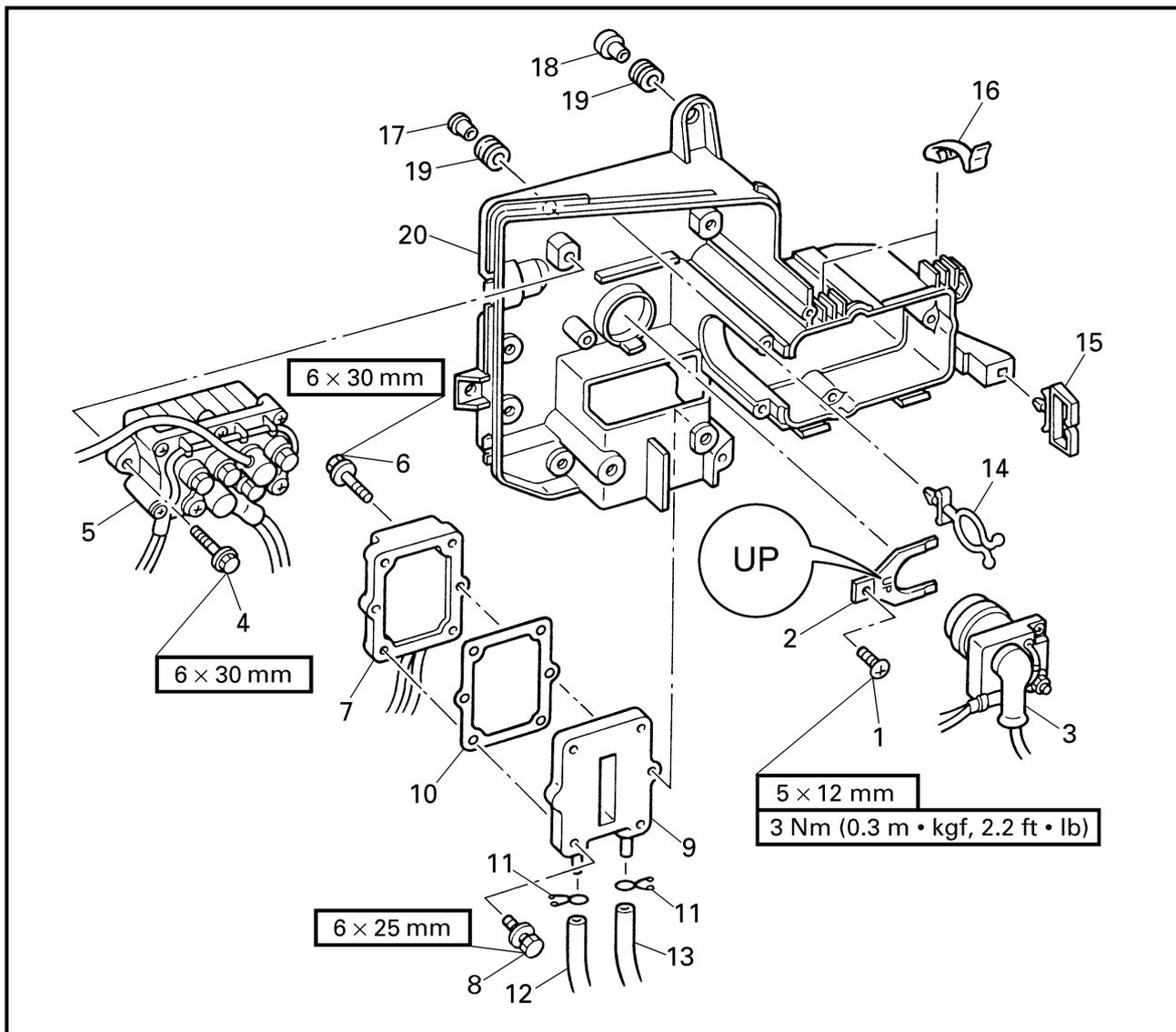
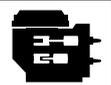


DISASSEMBLING/ASSEMBLING THE JUNCTION BOX ASSEMBLY



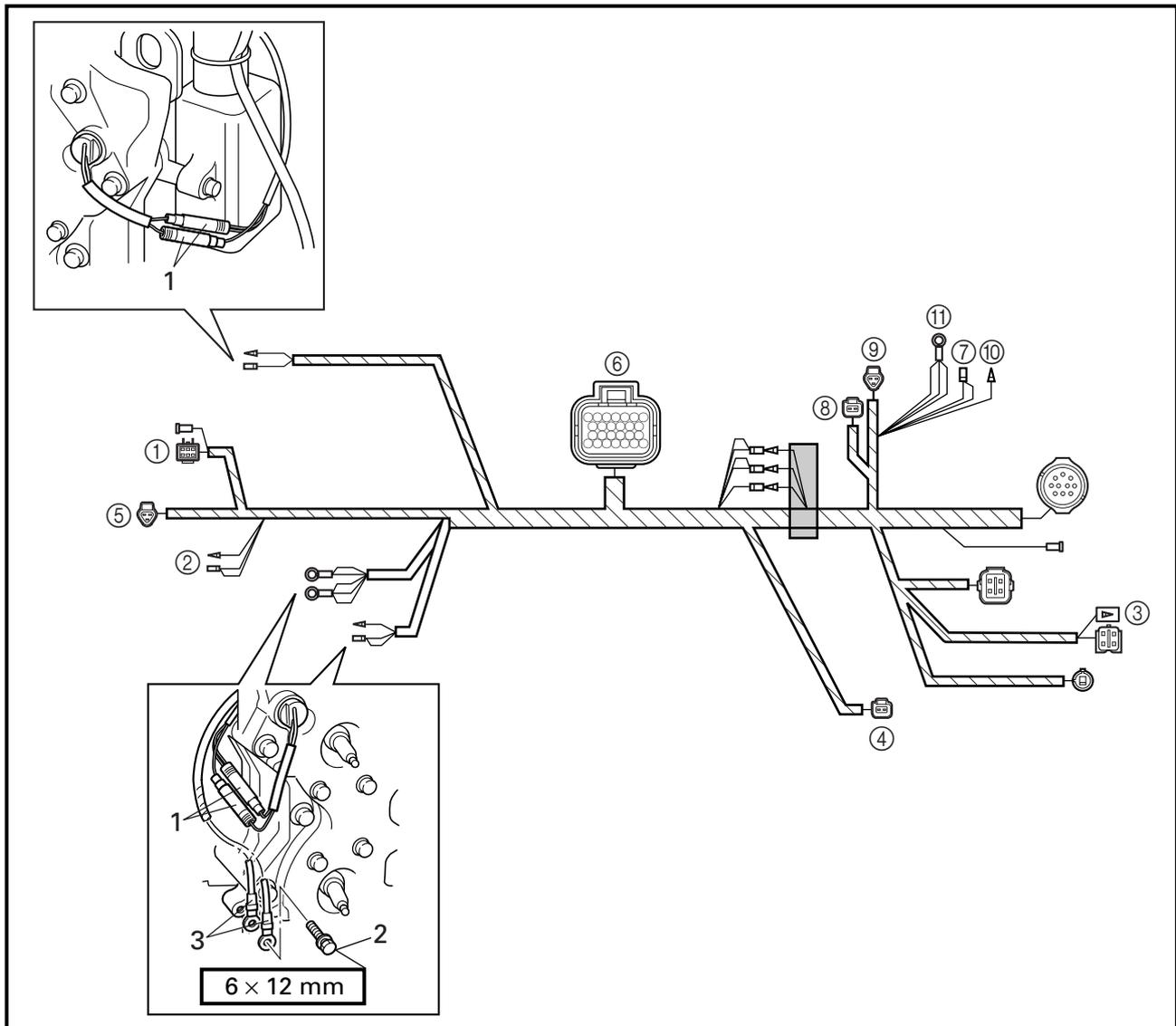
Order	Job/Part	Q'ty	Remarks
1	Screw	1	
2	Starter relay holder	1	
3	Starter relay	1	
4	Bolt	2	
5	Power trim and tilt relay	1	
6	Bolt	2	
7	Rectifier/regulator	1	
8	Bolt	4	
9	Rectifier/regulator cover	1	
10	Gasket	1	<b>Not reusable</b>
11	Clip	2	

Continued on next page.

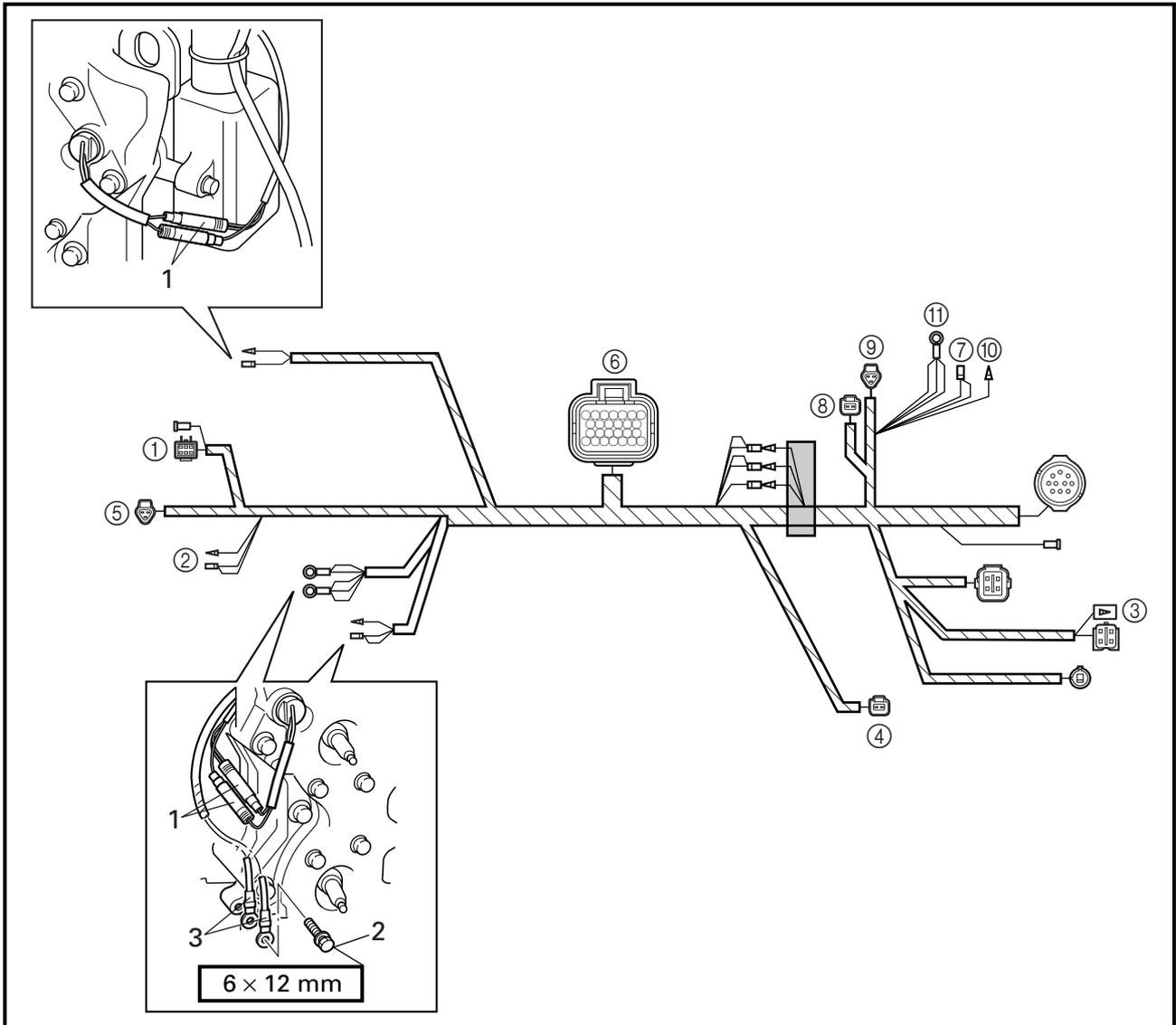


Order	Job/Part	Q'ty	Remarks
12	Cooling water hose	1	(rectifier/regulator-to-exhaust outer cover)
13	Cooling water hose	1	(rectifier/regulator-to-pilot water outlet)
14	Clamp	1	
15	Clamp	1	
16	Fuse holder cover hook	2	
17	Collar	4	
18	Collar	1	
19	Grommet	5	
20	Junction box	1	
			For assembly, reverse the disassembly procedure.

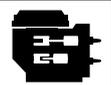
**WIRE HARNESSSES**  
**REMOVING/INSTALLING THE MAIN WIRE HARNESS**



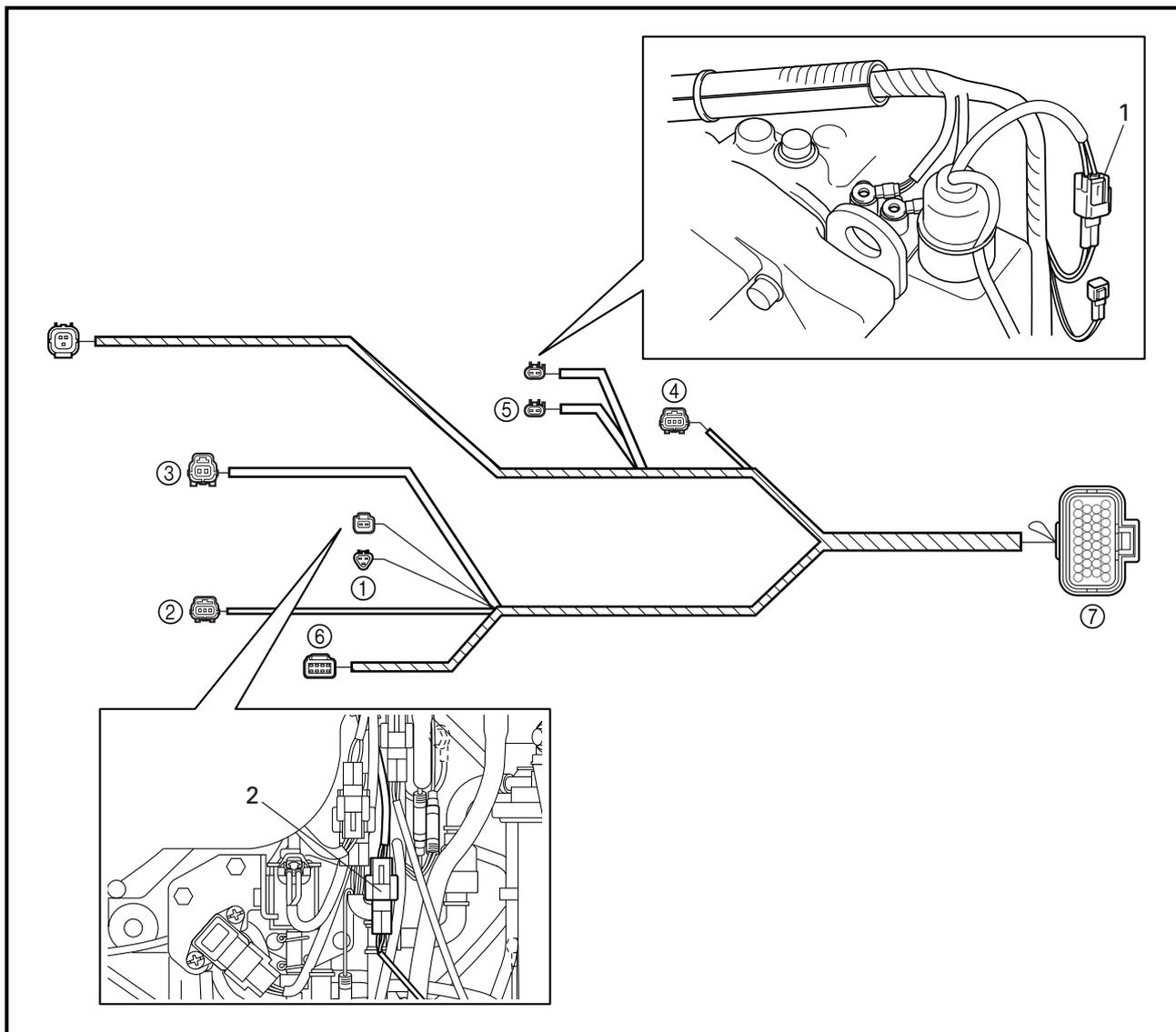
Order	Job/Part	Q'ty	Remarks
	Oil level sensor coupler ① and emergency switch connector ②		Refer to "OIL INJECTION SYSTEM" on page 4-51.
	Remote control cables		Refer to "POWER UNIT" on page 5-4.
	Trim sensor connector ③, shift position switch coupler ④ and trailer switch coupler ⑤		Refer to "CONTROL UNIT" on page 5-14.
	Control unit coupler ⑥		Refer to "JUNCTION BOX ASSEMBLY" on page 5-18.
	Starter relay connector ⑦, power trim and tilt relay coupler ⑧, fuse holder coupler ⑨, fuse holder connector ⑩ and ground lead ⑪		
			Continued on next page.



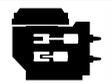
Order	Job/Part	Q'ty	Remarks
1	Thermo switch connector	4	For installation, reverse the removal procedure.
2	Bolt	1	
3	Ground lead	2	



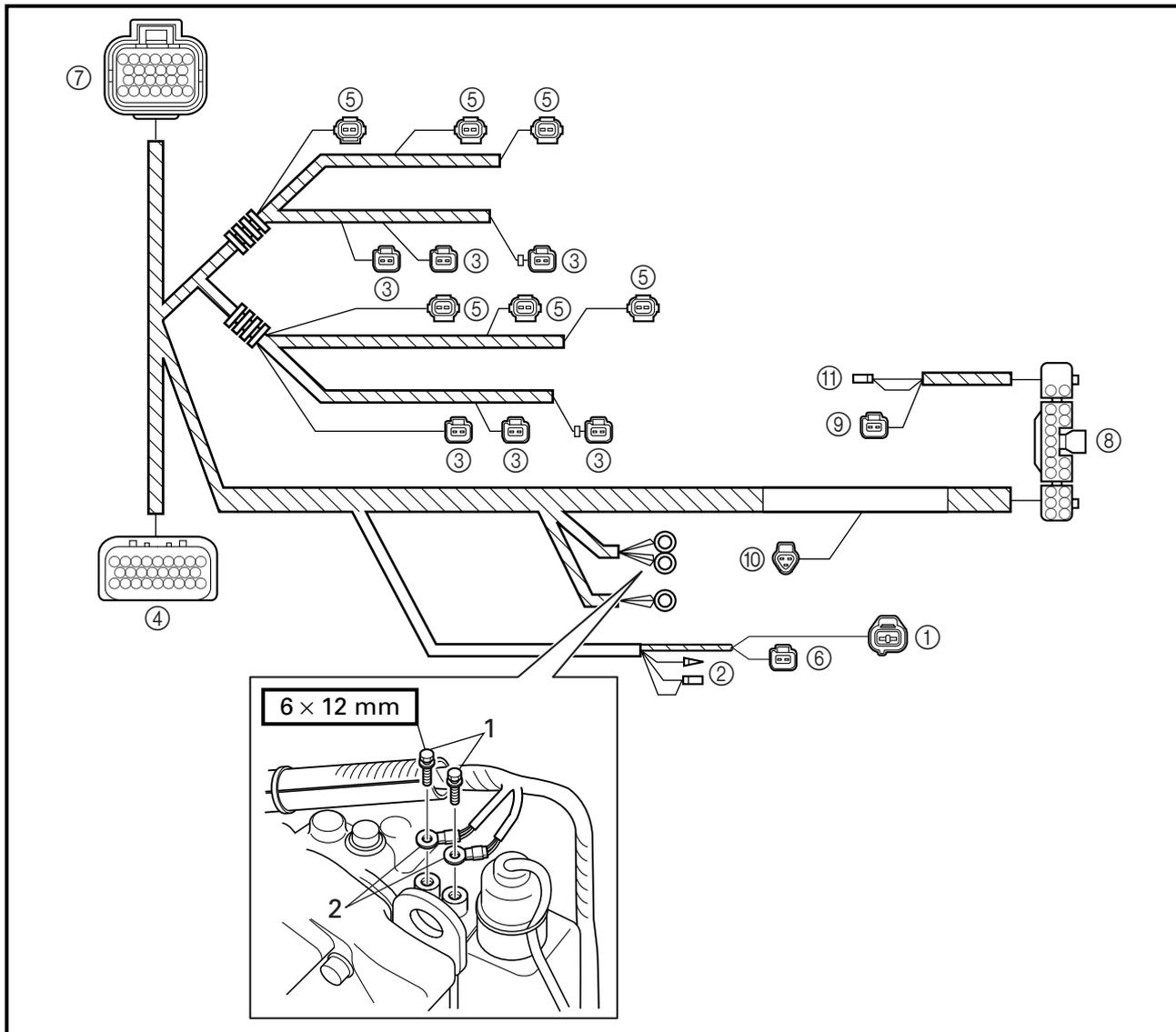
REMOVING/INSTALLING THE SUB WIRE HARNESS



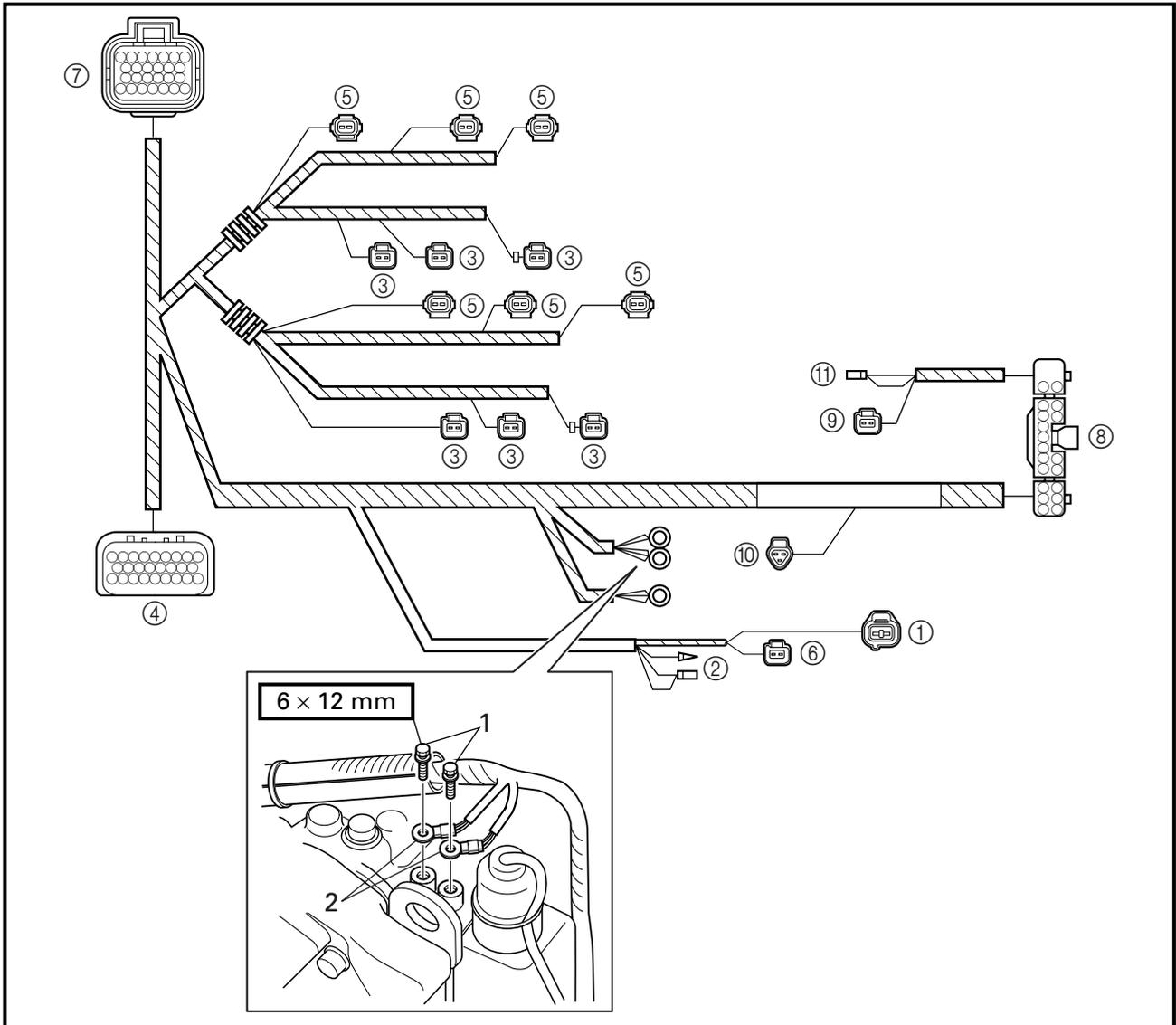
Order	Job/Part	Q'ty	Remarks
1	Throttle position sensor coupler ①, atmospheric pressure sensor coupler ② and intake air temperature sensor coupler ③ Fuel pressure sensor coupler ④	1	Refer to "MEDIUM-PRESSURE FUEL LINE" on page 4-2.  Refer to "HIGH-PRESSURE FUEL LINE ASSEMBLY" on page 4-30.
2	Crank position sensor coupler ⑤ and pulser coil coupler ⑥ Control unit coupler ⑦ Oxygen density sensor coupler	1	Refer to "STATOR ASSEMBLY" on page 5-12. Refer to "CONTROL UNIT" on page 5-14. (green)
	Engine cooling water temperature sensor coupler	1	For installation, reverse the removal procedure.



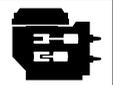
REMOVING/INSTALLING THE INJECTOR WIRE HARNESS



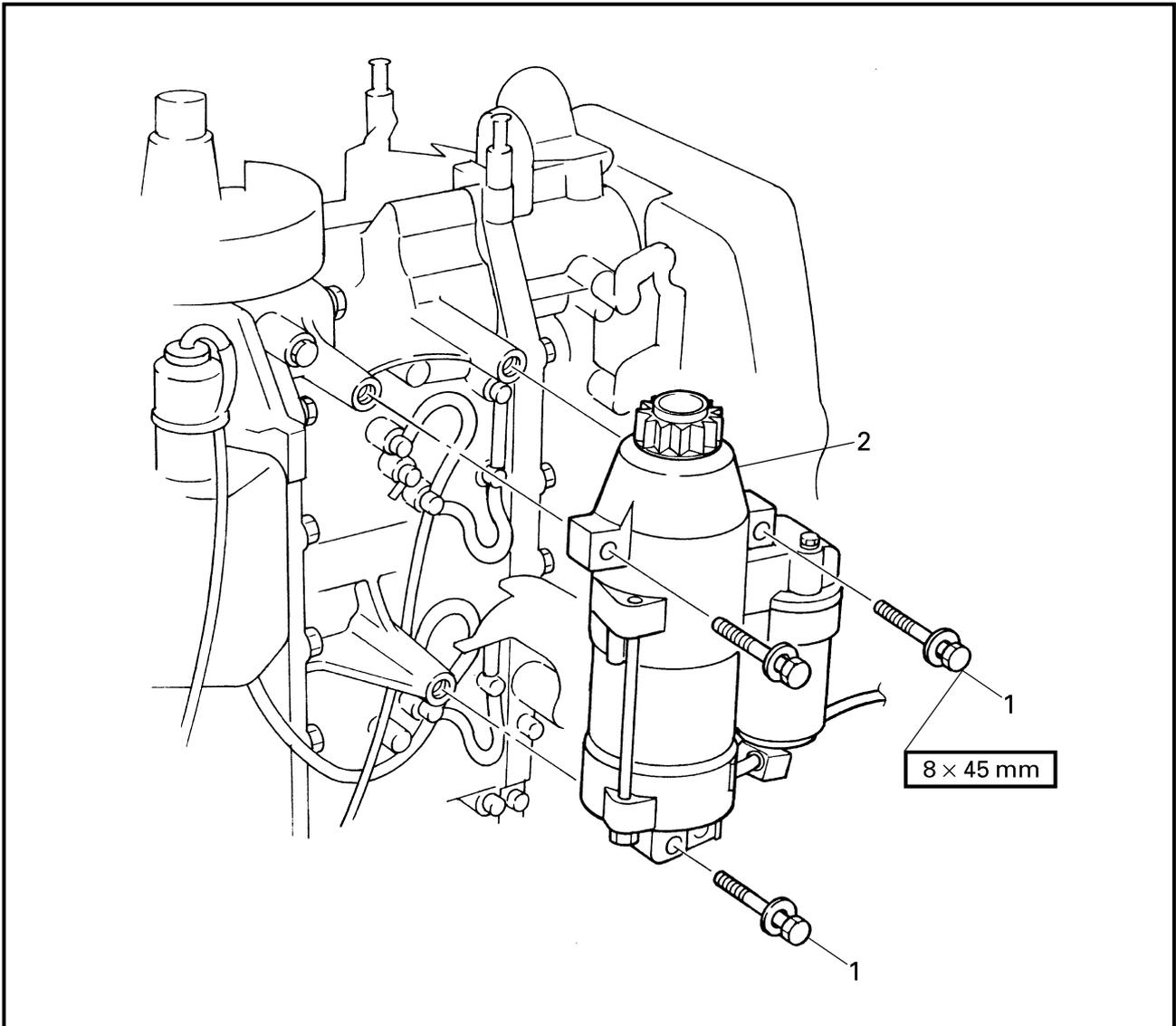
Order	Job/Part	Q'ty	Remarks
	Electric oil pump coupler ① and electric fuel pump connectors ② Ignition coil couplers ③ and injector driver coupler ④ Fuel injector couplers ⑤ Water detection switch coupler ⑥ Control unit coupler ⑦ Fuse holder coupler ⑧		Refer to "MEDIUM-PRESSURE FUEL LINE" on page 4-2. Refer to "INJECTOR DRIVER" on page 4-26. Refer to "HIGH-PRESSURE FUEL LINE ASSEMBLY" on page 4-30. Refer to "LOW-PRESSURE FUEL LINE" on page 4-43. Refer to "CONTROL UNIT" on page 5-14. Refer to "FUSE HOLDER" on page 5-16. Continued on next page.



Order	Job/Part	Q'ty	Remarks
	Oxygen density sensor coupler (blue) ⑨, fuse holder coupler ⑩ and fuse holder connector ⑪		Refer to "JUNCTION BOX ASSEMBLY" on page 5-18.
1	Bolt	2	
2	Ground lead	2	
			For installation, reverse the removal procedure.



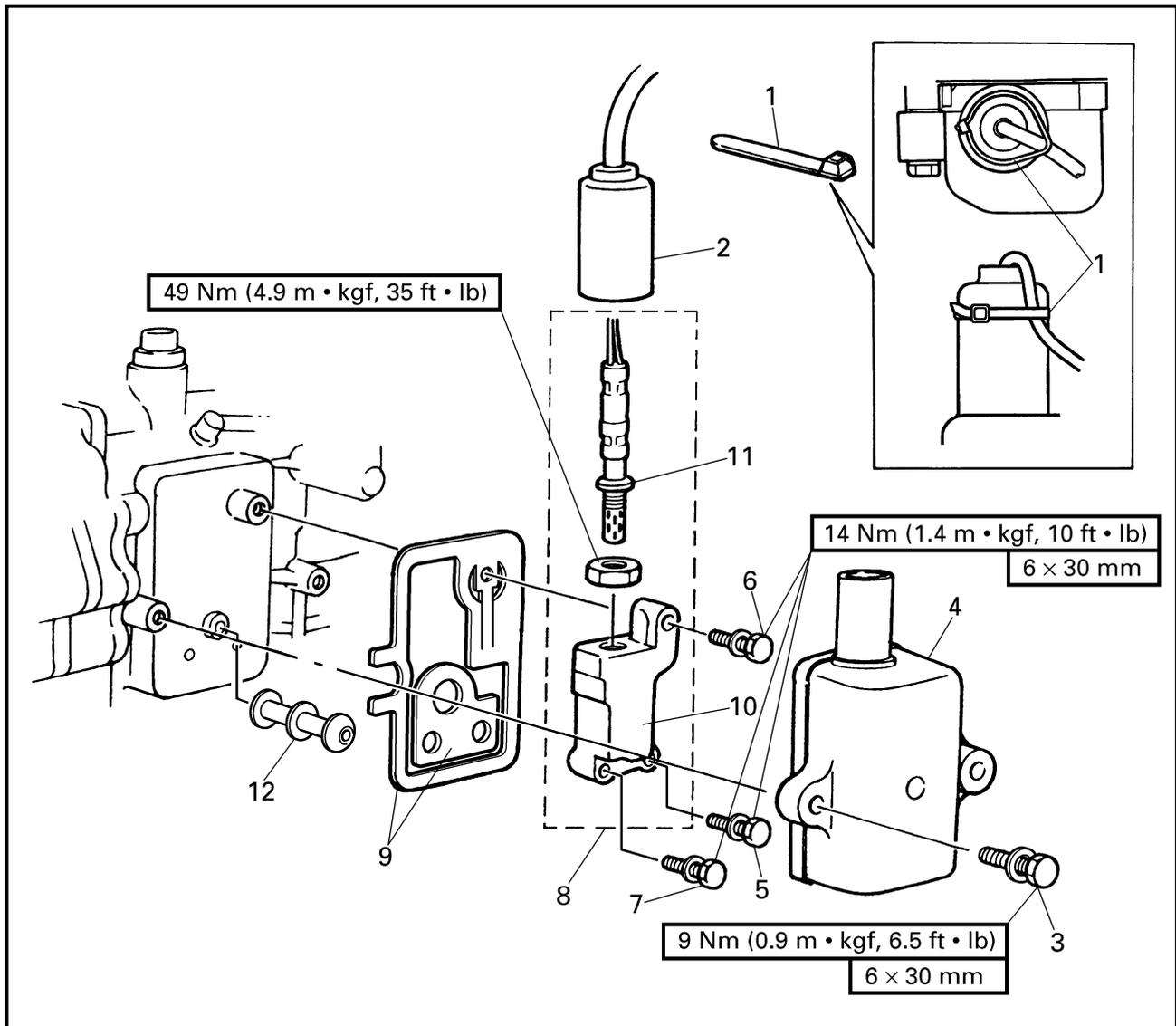
**STARTER MOTOR  
REMOVING/INSTALLING THE STARTER MOTOR**



Order	Job/Part	Q'ty	Remarks
	Positive battery lead Power trim and tilt lead (red) and starter motor lead		Refer to "POWER UNIT" on page 5-4. Refer to "JUNCTION BOX ASSEMBLY" on page 5-18.
1	Bolt	3	
2	Starter motor	1	For installation, reverse the removal procedure.

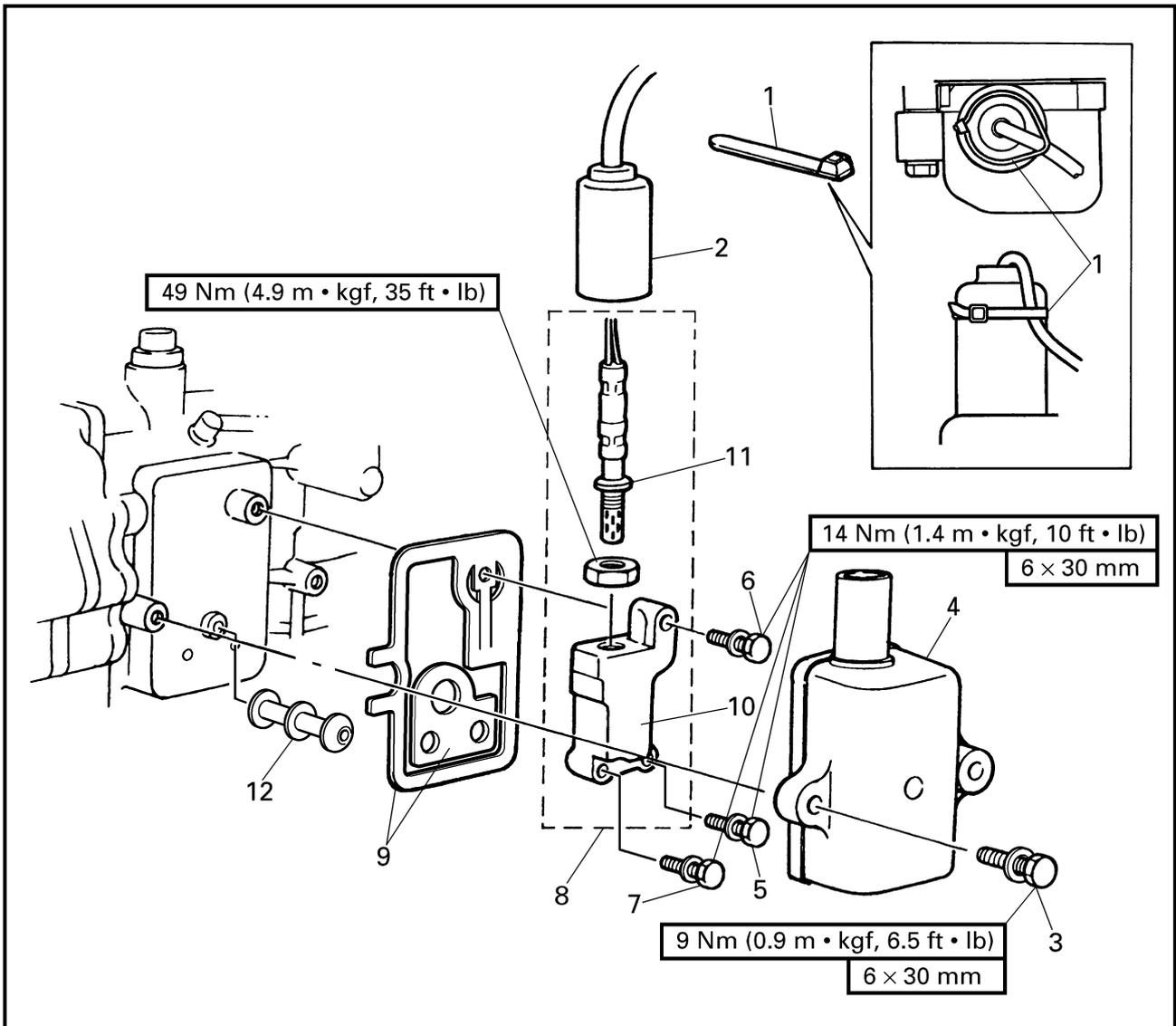


**OXYGEN DENSITY SENSOR  
REMOVING/INSTALLING THE OXYGEN DENSITY SENSOR**

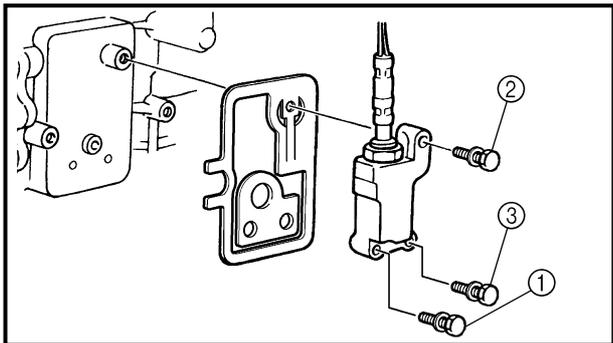


Order	Job/Part	Q'ty	Remarks
1	Plastic locking tie	1	<b>Not reusable</b>
2	Rubber cap	1	
3	Bolt	2	
4	Oxygen density sensor cover	1	
5	Bolt	1	
6	Bolt	1	
7	Bolt	1	

Continued on next page.



Order	Job/Part	Q'ty	Remarks
8	Oxygen density sensor assembly	1	<p><b>Not reusable</b></p> <p>Refer to "CHECKING THE OXYGEN DENSITY SENSOR" on page 8-25.</p> <p>For installation, reverse the removal procedure.</p>
9	Gasket set	1	
10	Oxygen density sensor bracket	1	
11	Oxygen density sensor	1	
12	Oxygen density sensor joint	1	



**INSTALLING THE OXYGEN DENSITY SENSOR**

Install:

- Bolts ① ② ③

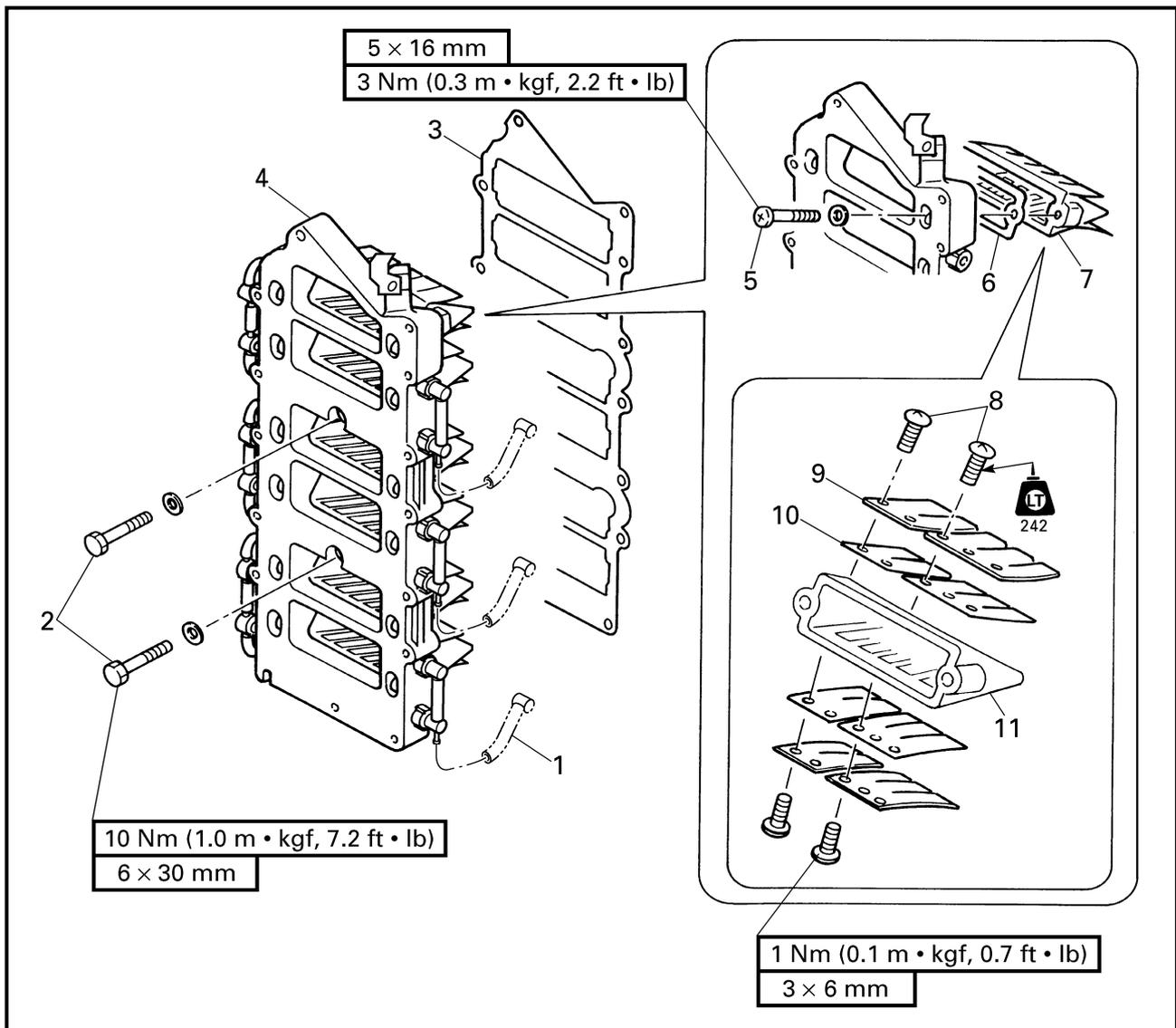


**Bolt**  
**14 Nm (1.4 m • kgf, 10 ft • lb)**

**NOTE:**

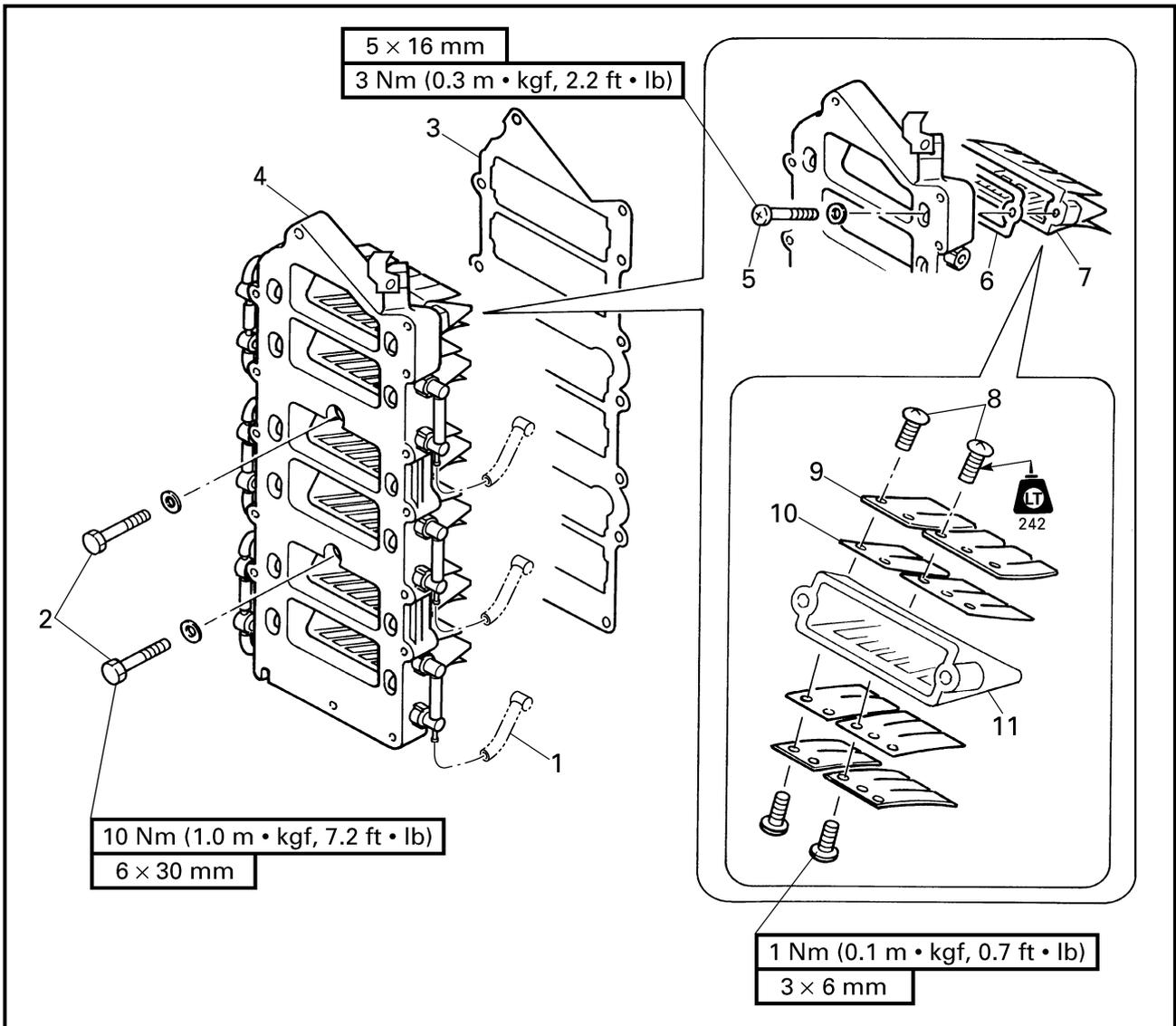
Make sure to tighten bolts ①, ②, and ③ to the specified torque, in numerical order.

**REED VALVES  
REMOVING/INSTALLING THE REED VALVES**



Order	Job/Part	Q'ty	Remarks
	Fuel injection unit		Refer to "MEDIUM-PRESSURE FUEL LINE" on page 4-2.
1	Recirculation hose	6	
2	Bolt	2	
3	Gasket	1	<b>Not reusable</b>
4	Intake manifold	1	
5	Screw	12	
6	Gasket	6	<b>Not reusable</b>
7	Reed valve assembly	6	

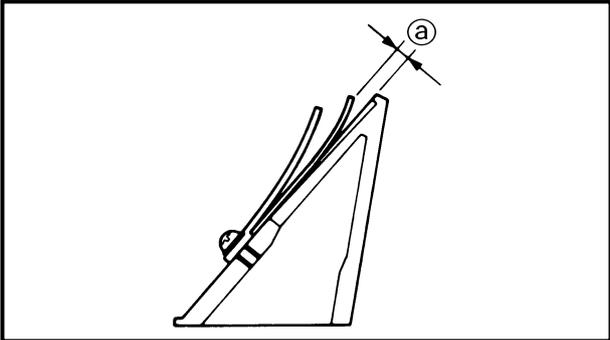
Continued on next page.



Order	Job/Part	Q'ty	Remarks
8	Screw	10	For installation, reverse the removal procedure.
9	Reed valve stopper	4	
10	Metal reed	4	
11	Reed valve seat	1	

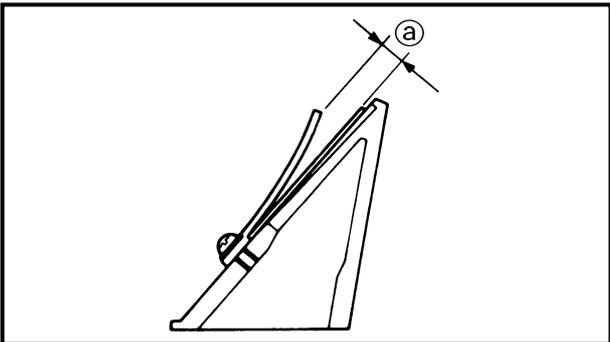
**CHECKING THE REED VALVE ASSEMBLY**

1. Check:
  - Reed valve  
Cracks/damage → Replace.



2. Measure:
  - Warpage limit @  
Out of specification → Replace.

	<b>Warpage limit</b> <b>0.2 mm (0.008 in)</b>
---	--



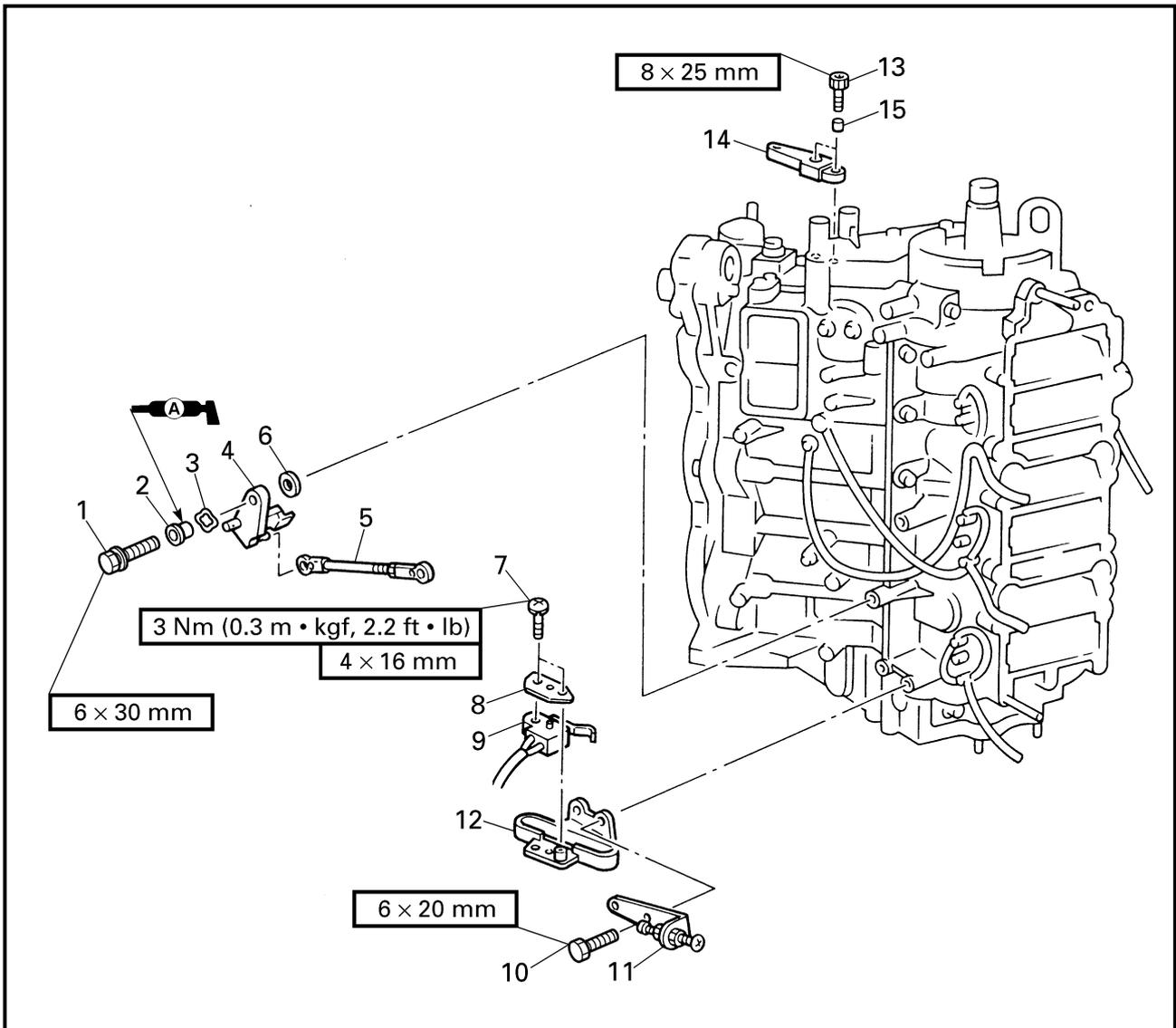
3. Measure:
  - Reed valve stopper height @  
Out of specification → Replace.

	<b>Reed valve stopper height</b> <b>9.0 ± 0.35 mm (0.35 ± 0.01 in)</b>
---	---

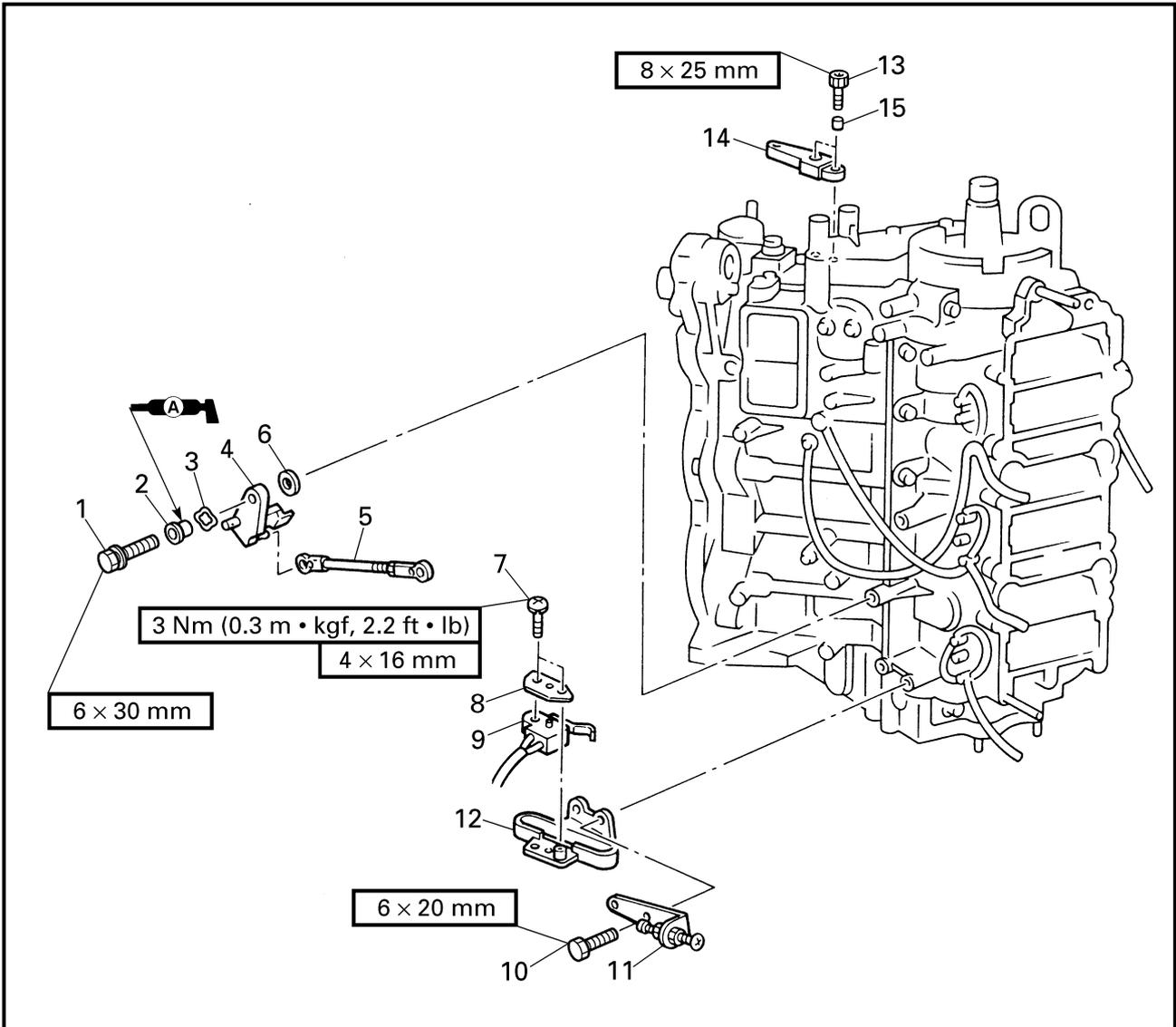
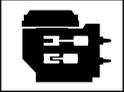


**EXTERNAL FITTINGS**

**REMOVING/INSTALLING THE EXTERNAL FITTINGS**

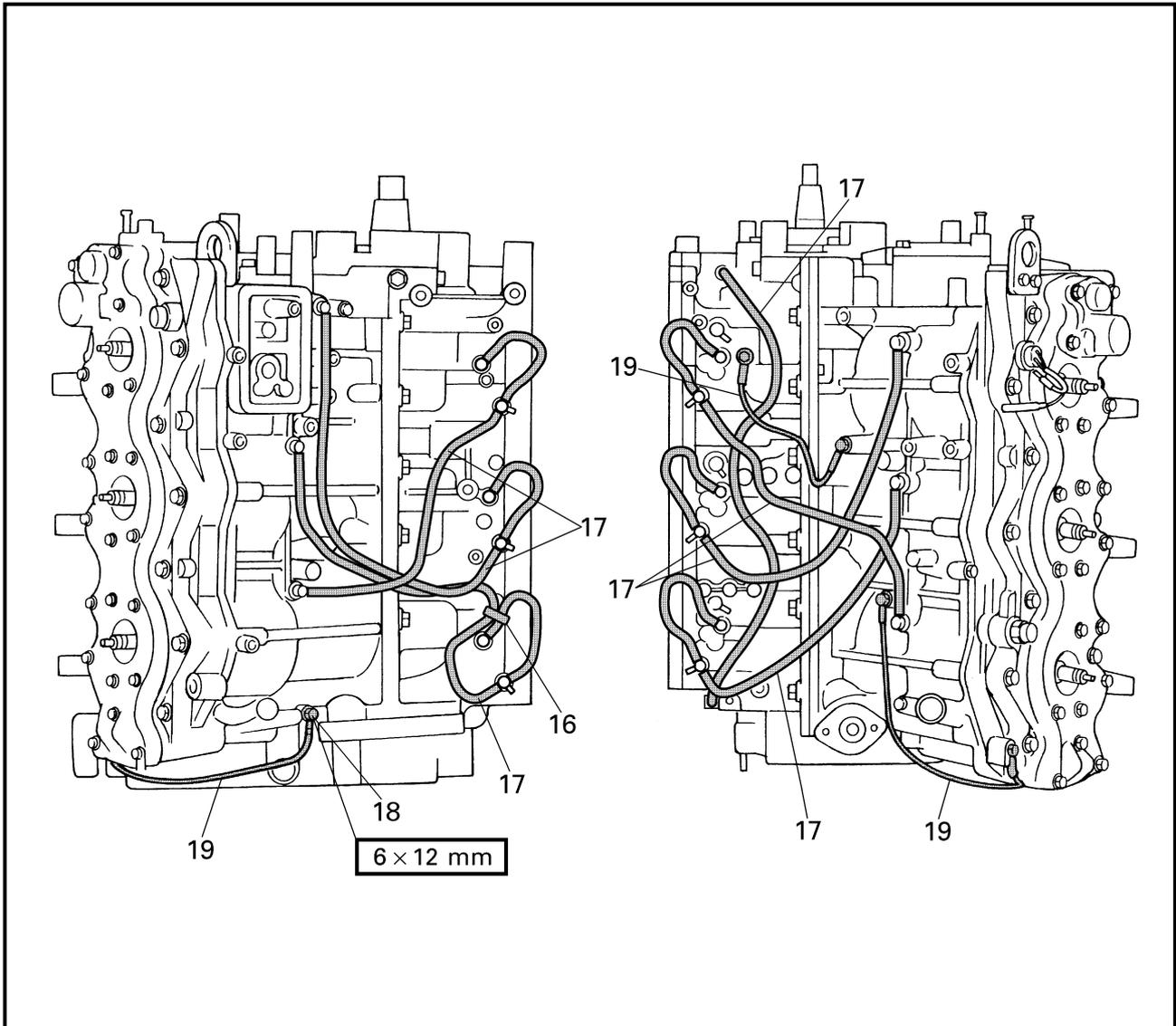


Order	Job/Part	Q'ty	Remarks
	Fuel injection unit		Refer to "MEDIUM-PRESSURE FUEL LINE" on page 4-2.
	High-pressure fuel line assembly		Refer to "HIGH-PRESSURE FUEL LINE ASSEMBLY" on page 4-30.
	Low-pressure fuel line		Refer to "LOW-PRESSURE FUEL LINE" on page 4-43.
	Oil injection system		Refer to "OIL INJECTION SYSTEM" on page 4-51.
	Shift position switch coupler		Refer to "POWER UNIT" on page 5-4.
	Junction box		Refer to "JUNCTION BOX ASSEMBLY" on page 5-18.
			Continued on next page.

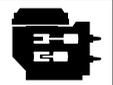


Order	Job/Part	Q'ty	Remarks
	Starter motor		Refer to "STARTER MOTOR" on page 5-28.
1	Bolt	1	
2	Collar	1	
3	Wave washer	1	
4	Throttle control lever	1	
5	Throttle control rod	1	
6	Washer	1	
7	Screw	2	
8	Shift position switch holder	1	
9	Shift position switch	1	

Continued on next page.

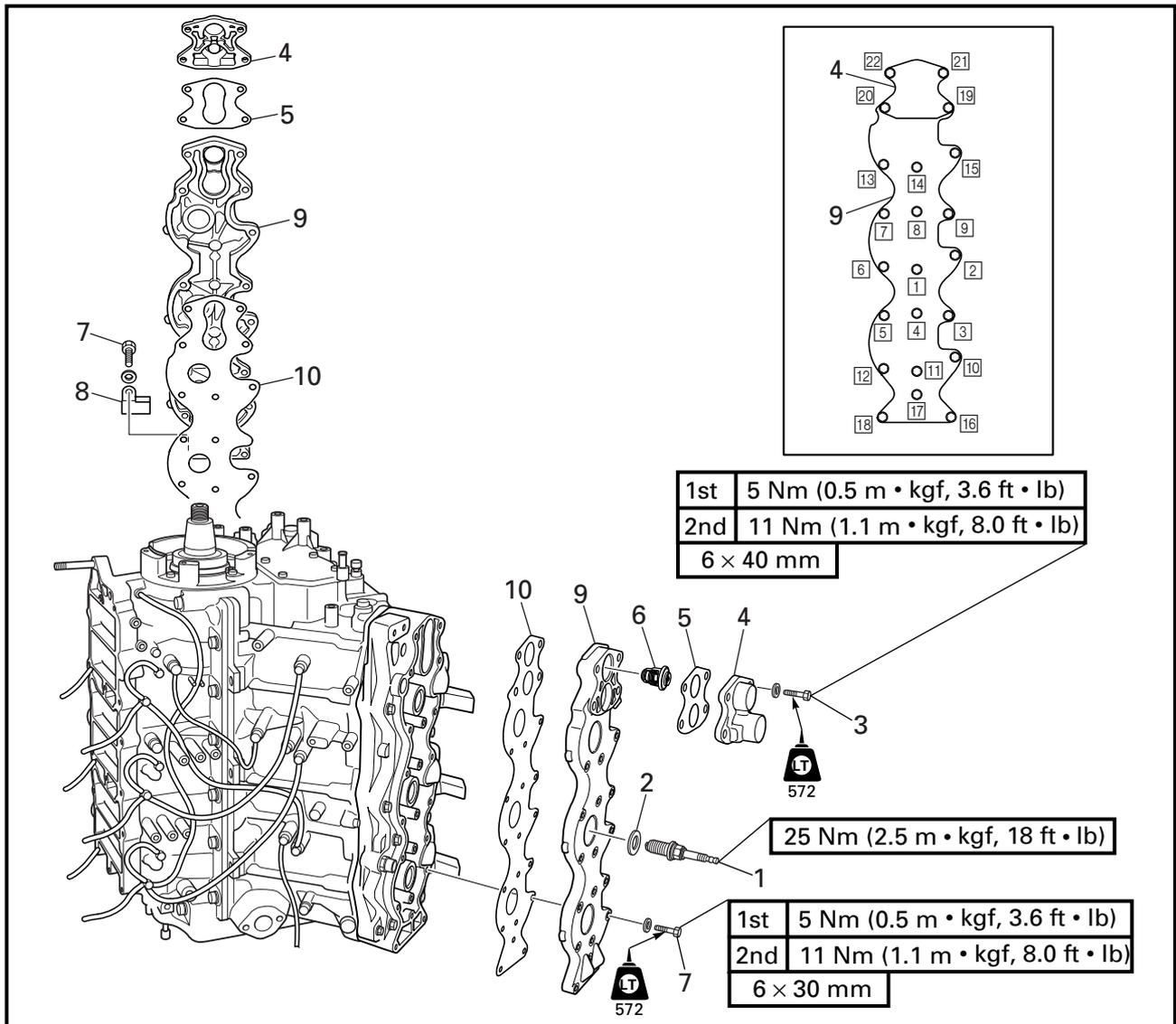


Order	Job/Part	Q'ty	Remarks
10	Bolt	2	
11	Stopper screw assembly	1	
12	Shift rod lever bracket	1	
13	Bolt	1	
14	High-pressure fuel line assembly bracket	2	
15	Collar	2	
16	Hose clamp	1	
17	Recirculation hose	7	
18	Bolt	6	
19	Ground lead	3	
			For installation, reverse the removal procedure.



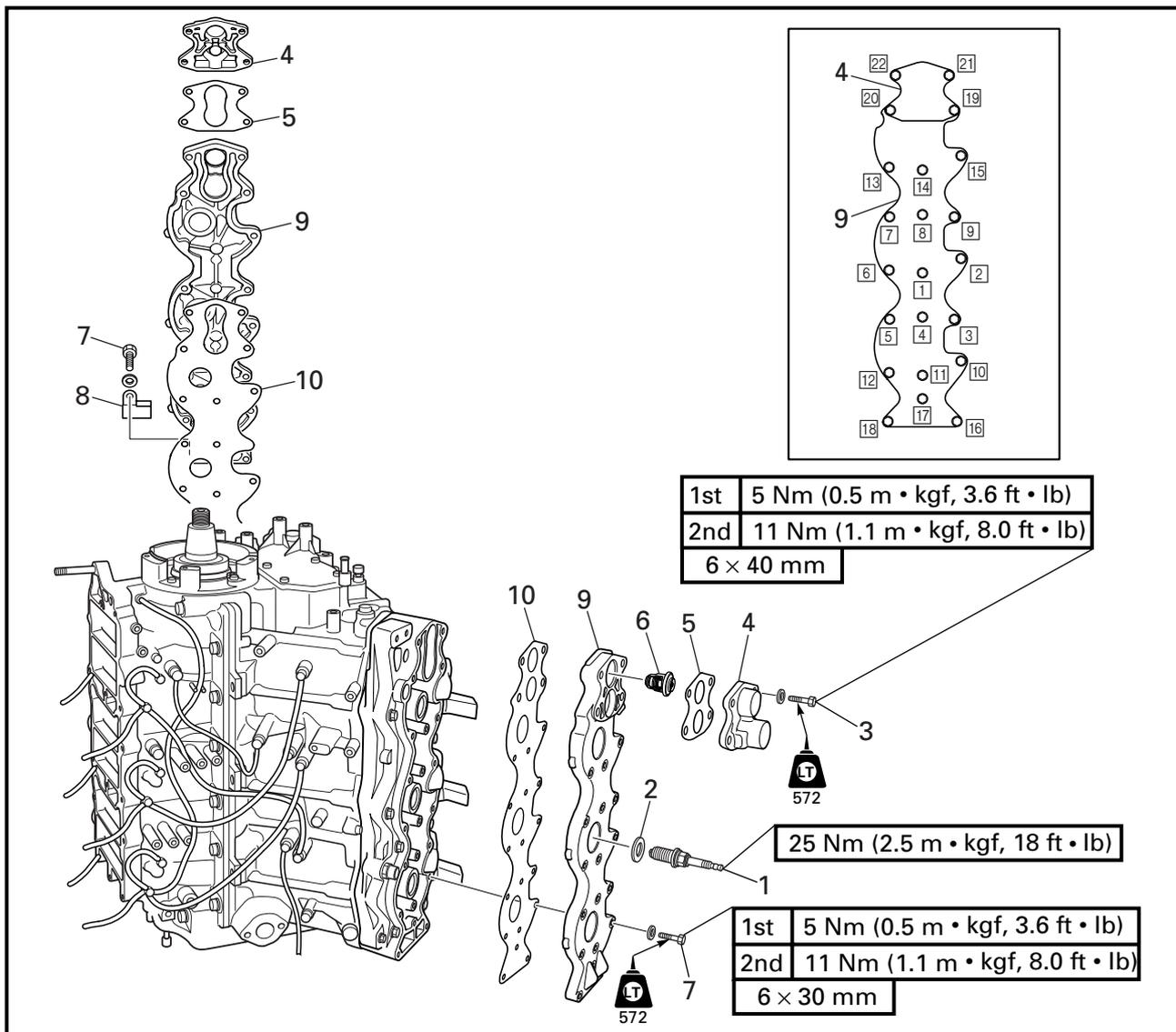
**CYLINDER HEAD COVERS**

**REMOVING/INSTALLING THE CYLINDER HEAD COVERS**

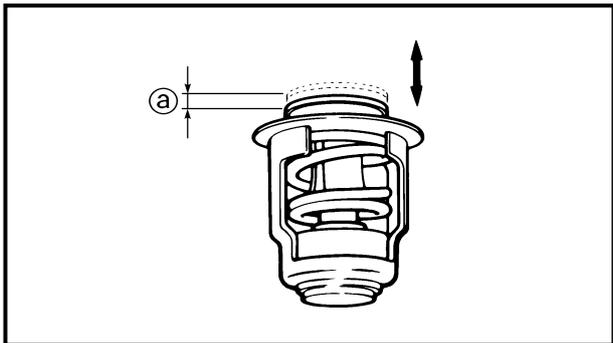
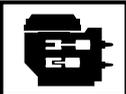


Order	Job/Part	Q'ty	Remarks
	High-pressure fuel line assembly		Refer to "HIGH-PRESSURE FUEL LINE ASSEMBLY" on page 4-30.
1	Spark plug	6	
2	Copper washer	6	
3	Bolt	8	
4	Thermostat cover	2	
5	Gasket	2	<b>Not reusable</b>

Continued on next page.



Order	Job/Part	Q'ty	Remarks
6	Thermostat	2	
7	Bolt	36	
8	Clamp	1	(starboard side)
9	Cylinder head cover	2	
10	Gasket	2	<b>Not reusable</b> For installation, reverse the removal procedure.



**CHECKING THE THERMOSTATS**

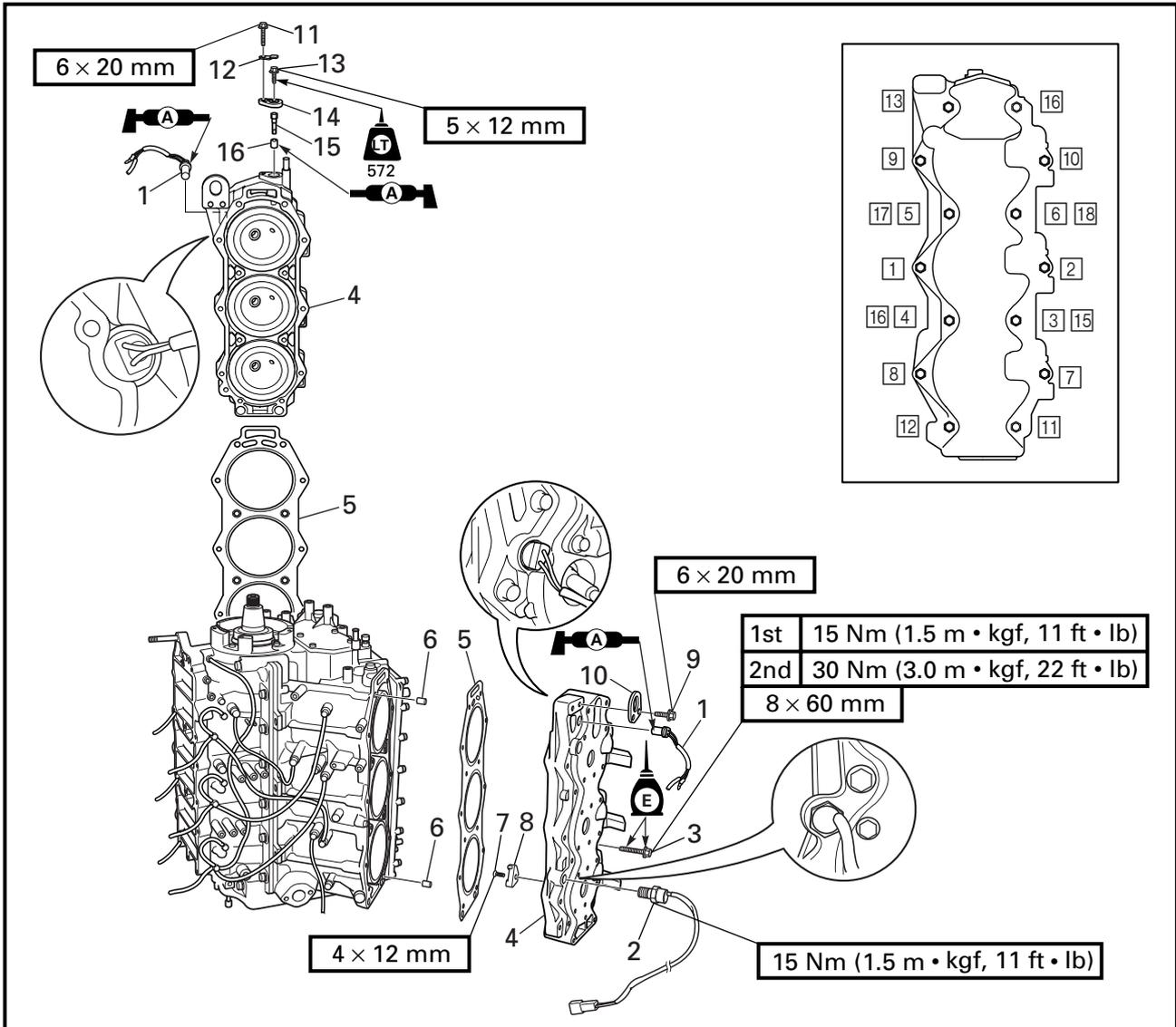
1. Check:
  - Thermostat
  - Damage/valve does not open → Replace.
2. Measure:
  - Thermostat opening temperature
  - Valve lift ①
  - Out of specification → Replace.

	Water temperature	Valve lift
	<b>Below 48 - 52 °C</b> (118 - 126 °F)	<b>0 mm</b> (0 in)
	<b>Above 60 °C</b> (140 °F)	<b>Min. 3 mm</b> (0.12 in)

**Measuring steps**

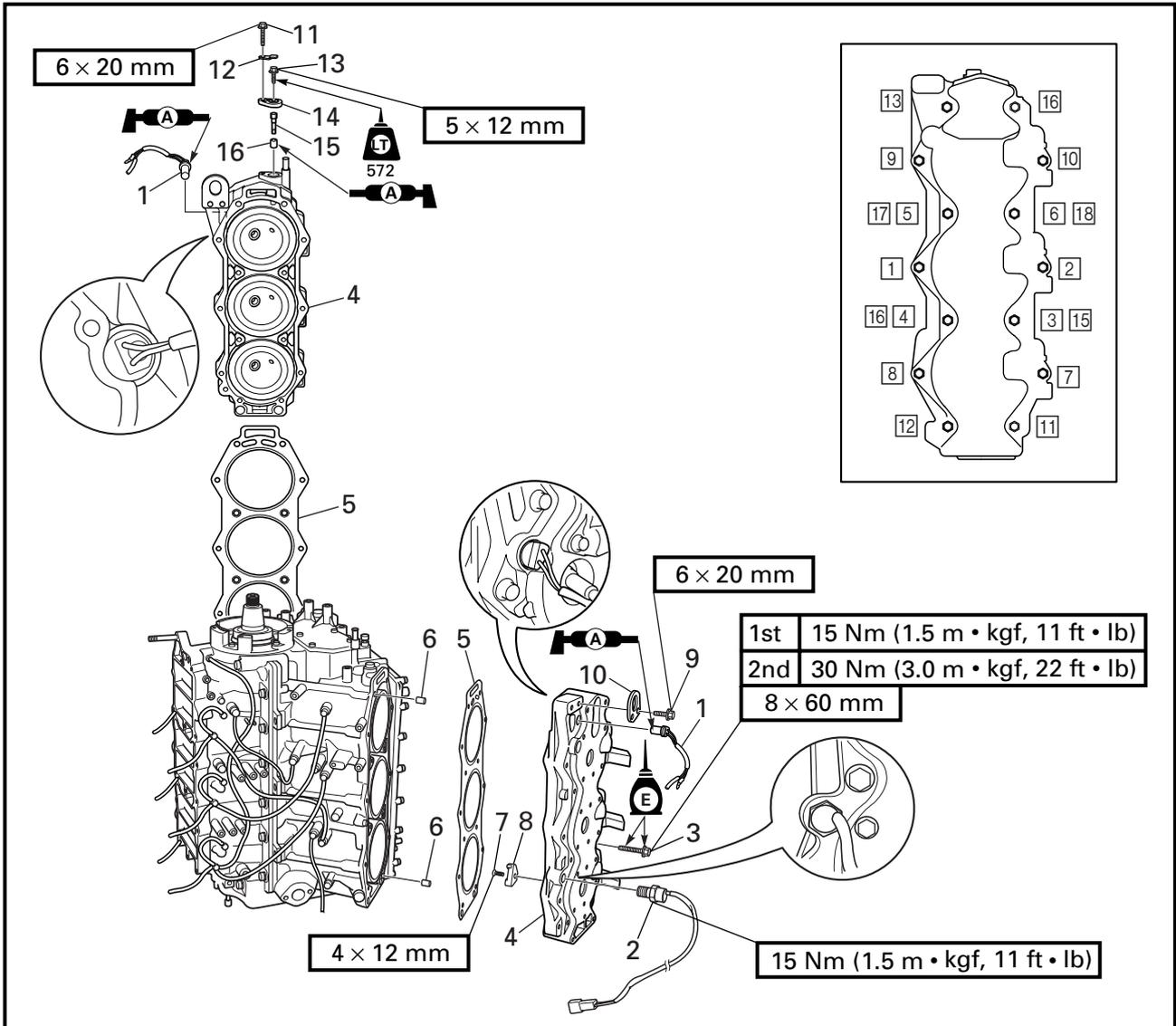
- (1) Suspend the thermostat in a container filled with water.
- (2) Place a thermometer in the water.
- (3) Slowly heat the water.
- (4) While stirring the water, check that the thermostat opens at the specified temperature.

**CYLINDER HEADS  
REMOVING/INSTALLING THE CYLINDER HEADS**

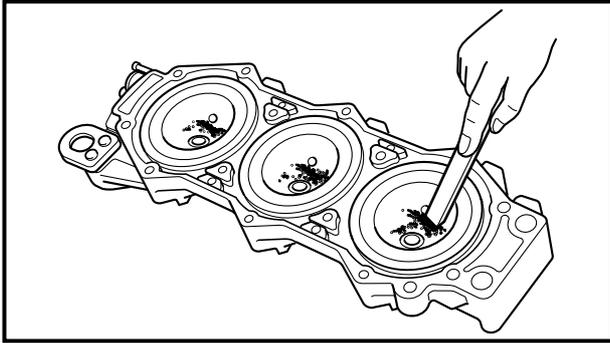


Order	Job/Part	Q'ty	Remarks
	Ground leads		Refer to "EXTERNAL FITTINGS" on page 5-35.
	Cylinder head covers		Refer to "CYLINDER HEAD COVERS" on page 5-38.
1	Thermo switch	2	
2	Engine cooling water temperature sensor	1	
3	Bolt	28	
4	Cylinder head	2	
5	Gasket	2	<b>Not reusable</b>
6	Dowel pin	4	
7	Screw	7	

Continued on next page.



Order	Job/Part	Q'ty	Remarks
8	Anode	7	For installation, reverse the removal procedure.
9	Bolt	4	
10	Engine hanger	2	
11	Bolt	1	
12	Anode cover plate	1	
13	Bolt	1	
14	Anode cover	1	
15	Anode	1	
16	Grommet	1	

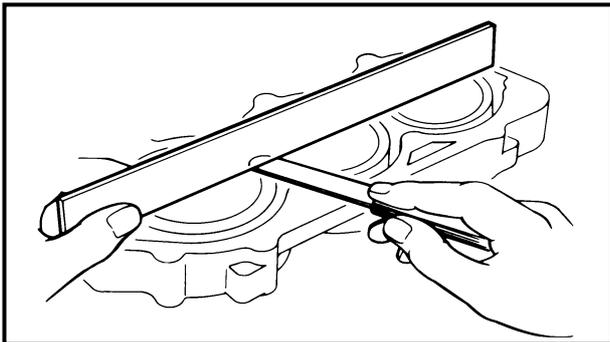


**CHECKING THE CYLINDER HEADS**

1. Check:
  - Combustion chamber  
Carbon deposits → Clean.
  - Water jacket  
Mineral deposits/rust → Clean.

**CAUTION:**

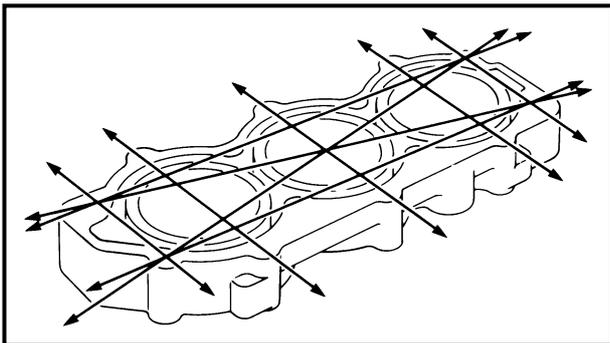
**Do not scratch the contacting surfaces of the cylinder head and cylinder head cover.**



2. Measure:
  - Cylinder head warpage  
(with a straightedge and thickness gauge)  
Out of specification → Resurface or replace.



**Warpage limit**  
**0.1 mm (0.004 in)**

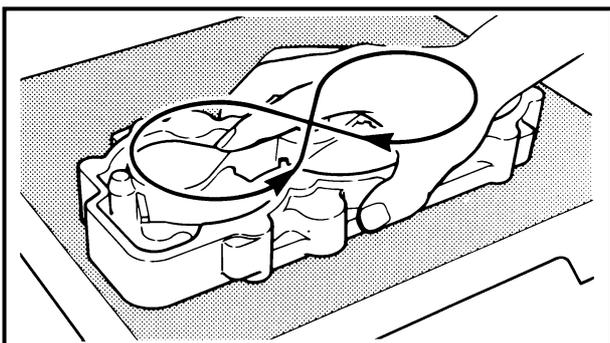


**Resurfacing steps**

- (1) Place a 400 - 600 grit wet sandpaper on the surface plate.
- (2) Resurface the cylinder head by moving it in a figure-eight motion along the sandpaper.

**NOTE:**

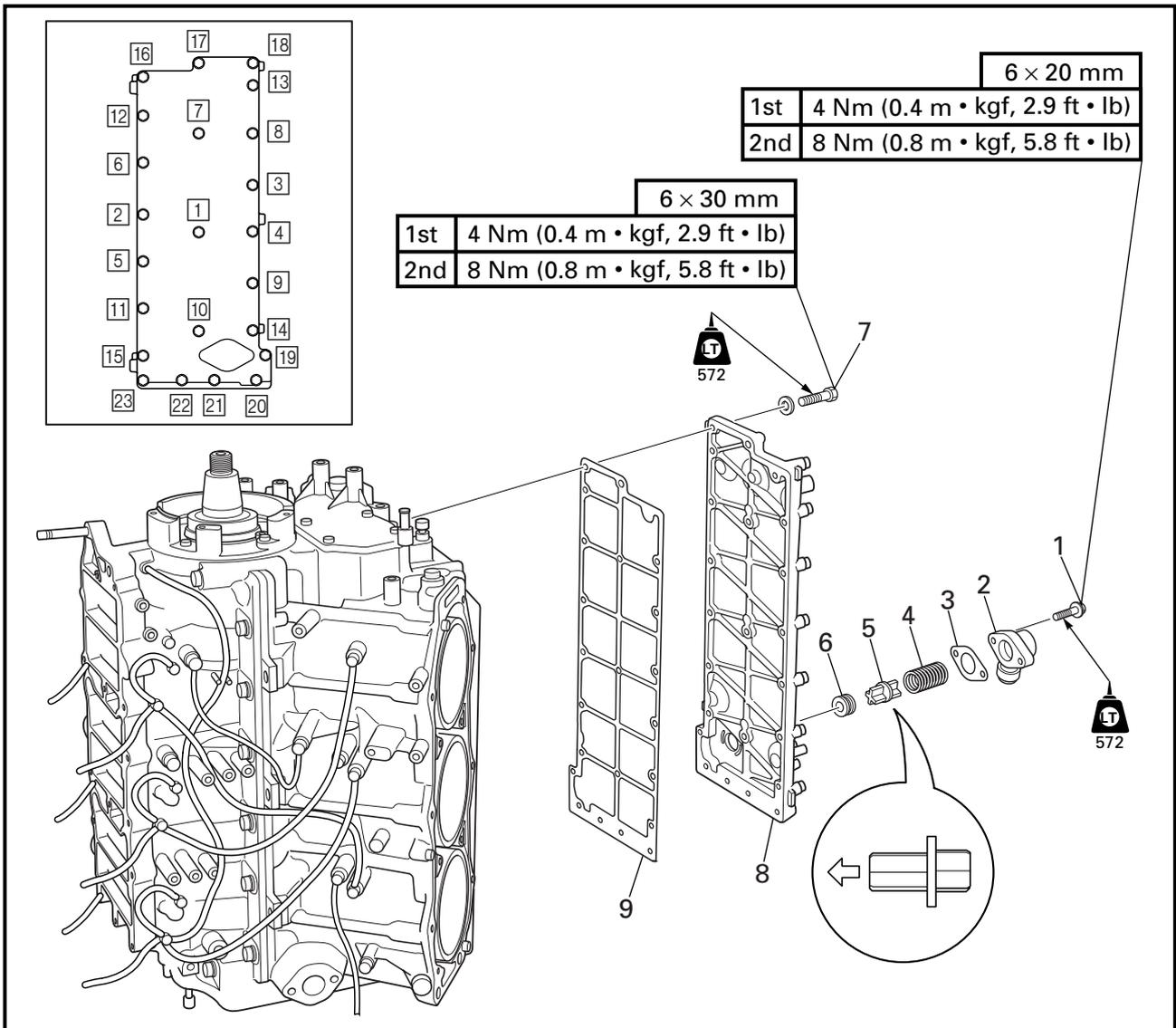
Rotate the cylinder head several times to ensure an even surface.





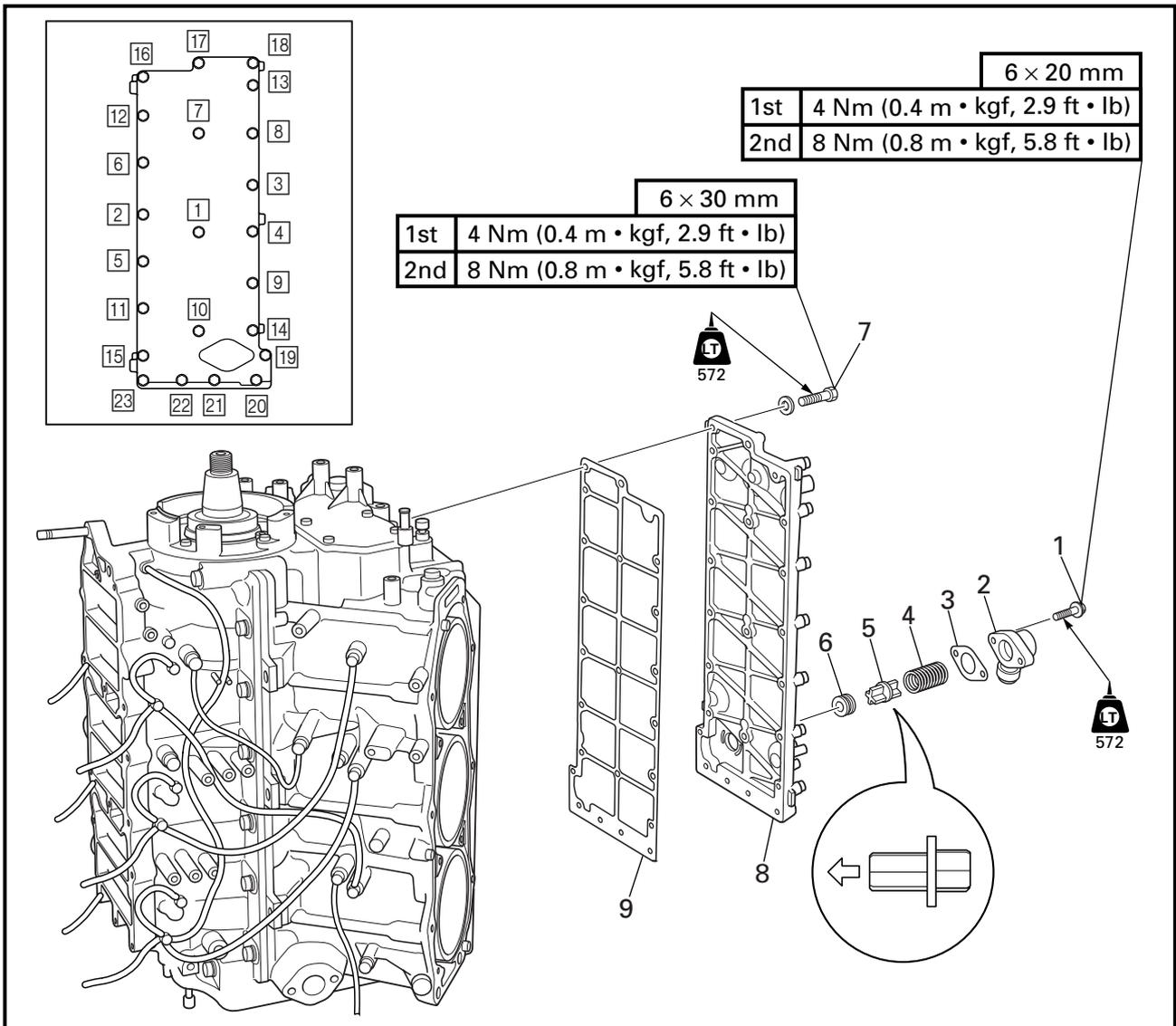
EXHAUST COVERS

REMOVING/INSTALLING THE EXHAUST COVERS

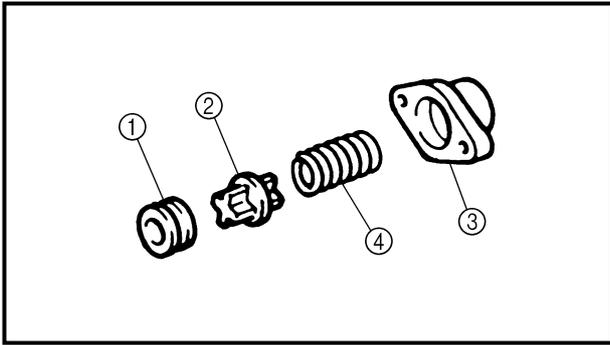
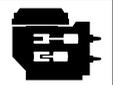


Order	Job/Part	Q'ty	Remarks
	Cooling water hose		Refer to "POWER UNIT" on page 5-4.
	Control unit		Refer to "CONTROL UNIT" on page 5-14.
	Cooling water hose		Refer to "JUNCTION BOX ASSEMBLY" on page 5-18.
1	Bolt	2	
2	Pressure control valve cover	1	
3	Gasket	1	<b>Not reusable</b>
4	Spring	1	

Continued on next page.



Order	Job/Part	Q'ty	Remarks
5	Pressure control valve	1	
6	Pressure control valve seat	1	
7	Bolt	23	
8	Exhaust outer cover	1	
9	Gasket	1	<b>Not reusable</b> For installation, reverse the removal procedure.



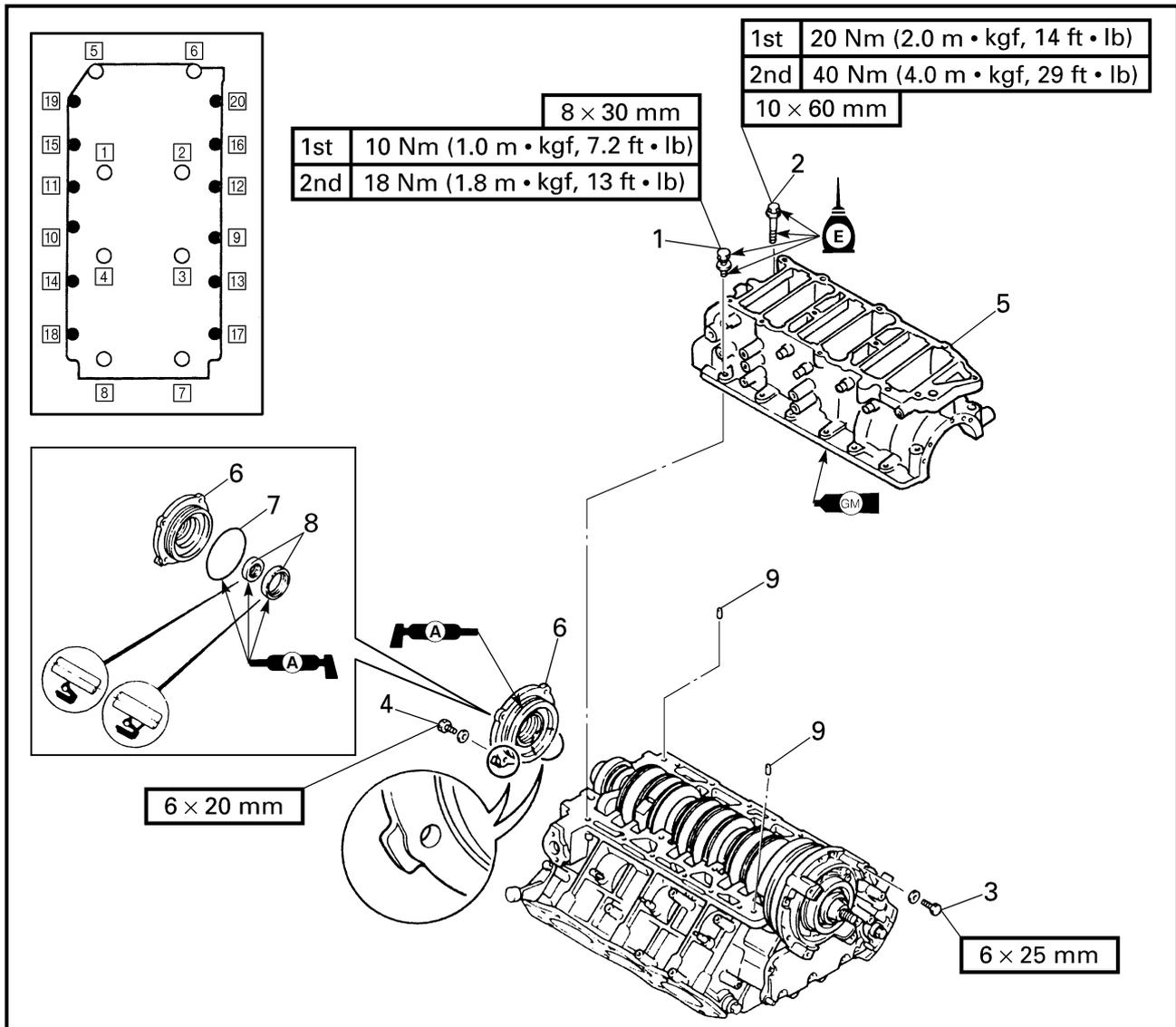
### CHECKING THE PRESSURE CONTROL VALVE

Check:

- Pressure control valve seat ①
- Pressure control valve ②
- Pressure control valve cover ③  
Cracks/damage → Replace any defective parts.
- Spring ④  
Damage/wear → Replace.

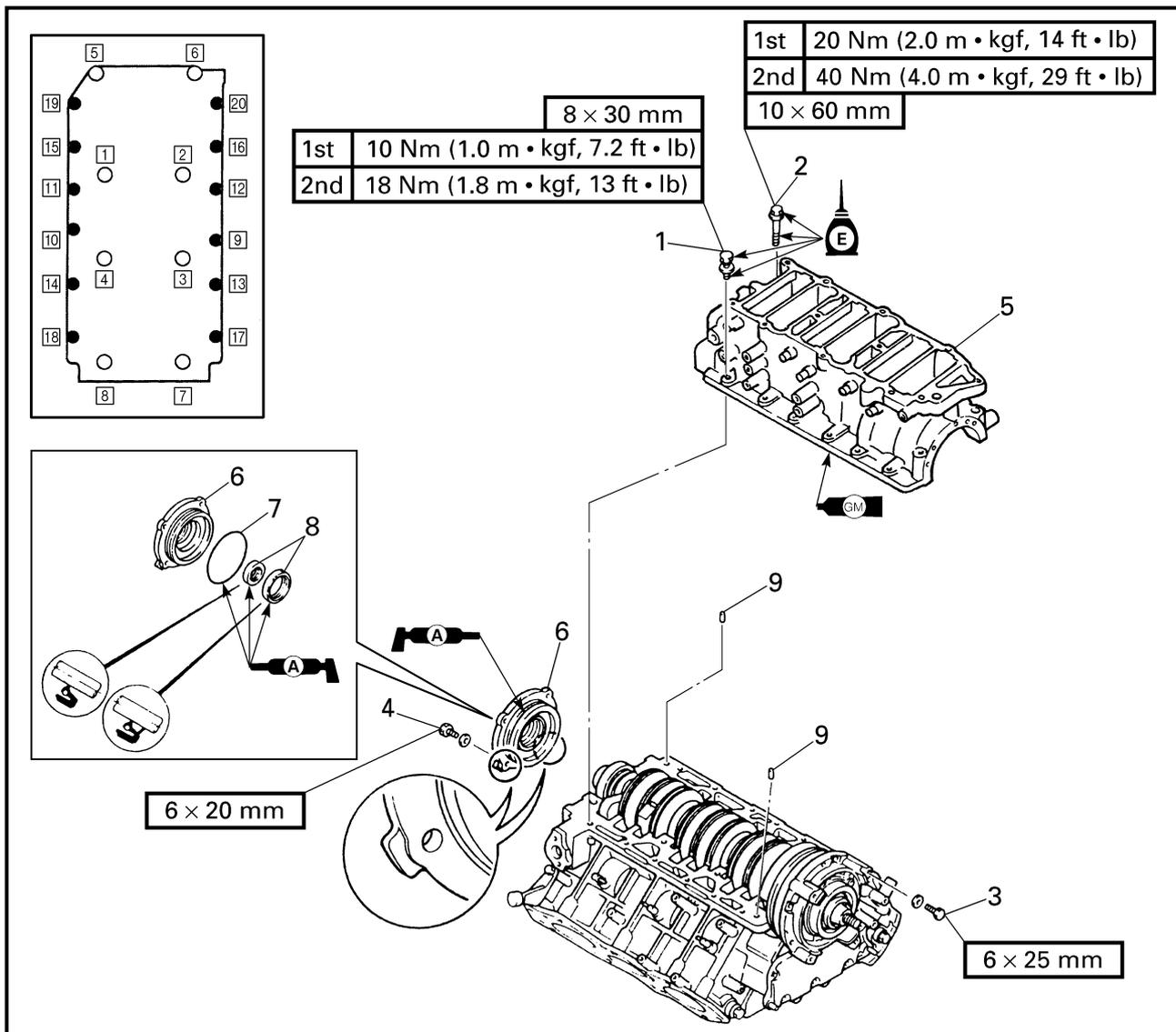


**CRANKCASE**  
**REMOVING/INSTALLING THE CRANKCASE**

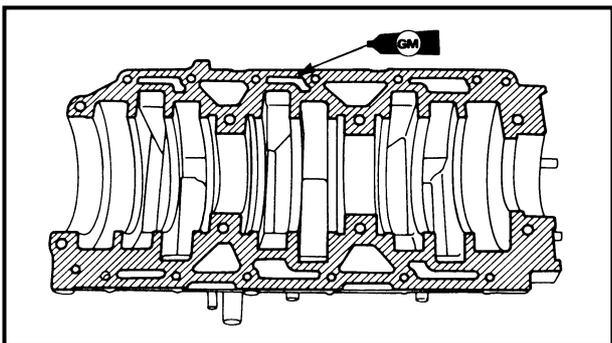
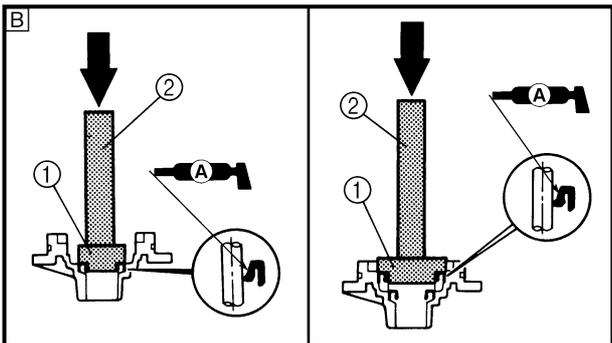
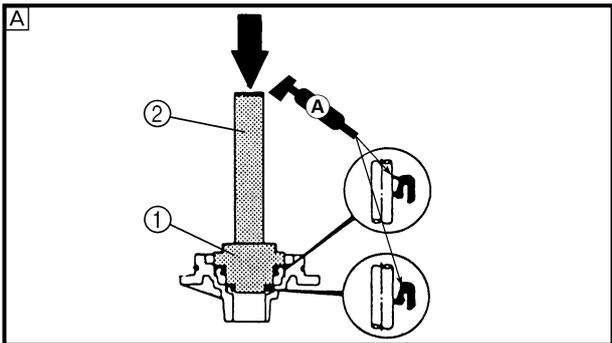


Order	Job/Part	Q'ty	Remarks
	Flywheel magnet assembly		Refer to "FLYWHEEL MAGNET ASSEMBLY" on page 5-1.
	Power unit		Refer to "POWER UNIT" on page 5-4.
	Pulser coil assembly		Refer to "STATOR ASSEMBLY" on page 5-12.
	Intake manifold		Refer to "REED VALVES" on page 5-32.
	External fittings		Refer to "EXTERNAL FITTINGS" on page 5-35.
1	Bolt	12	
2	Bolt	8	

Continued on next page.



Order	Job/Part	Q'ty	Remarks
3	Bolt	4	
4	Bolt	4	
5	Crankcase	1	
6	Oil seal housing	1	
7	O-ring	1	
8	Oil seal	2	
9	Dowel pin	2	
			For installation, reverse the removal procedure.



**ASSEMBLING THE OIL SEAL HOUSING**

- Install:
- Oil seal

	<b>Bearing/oil seal attachment ....</b> ①
	<b>YB-06195 / 90890-06637</b> <b>90890-06631</b>
	<b>Driver rod ..... ②</b>
	<b>YB-06071 / 90890-06606</b>

- A** For USA and Canada
- B** For worldwide

**INSTALLING THE CRANKCASE**

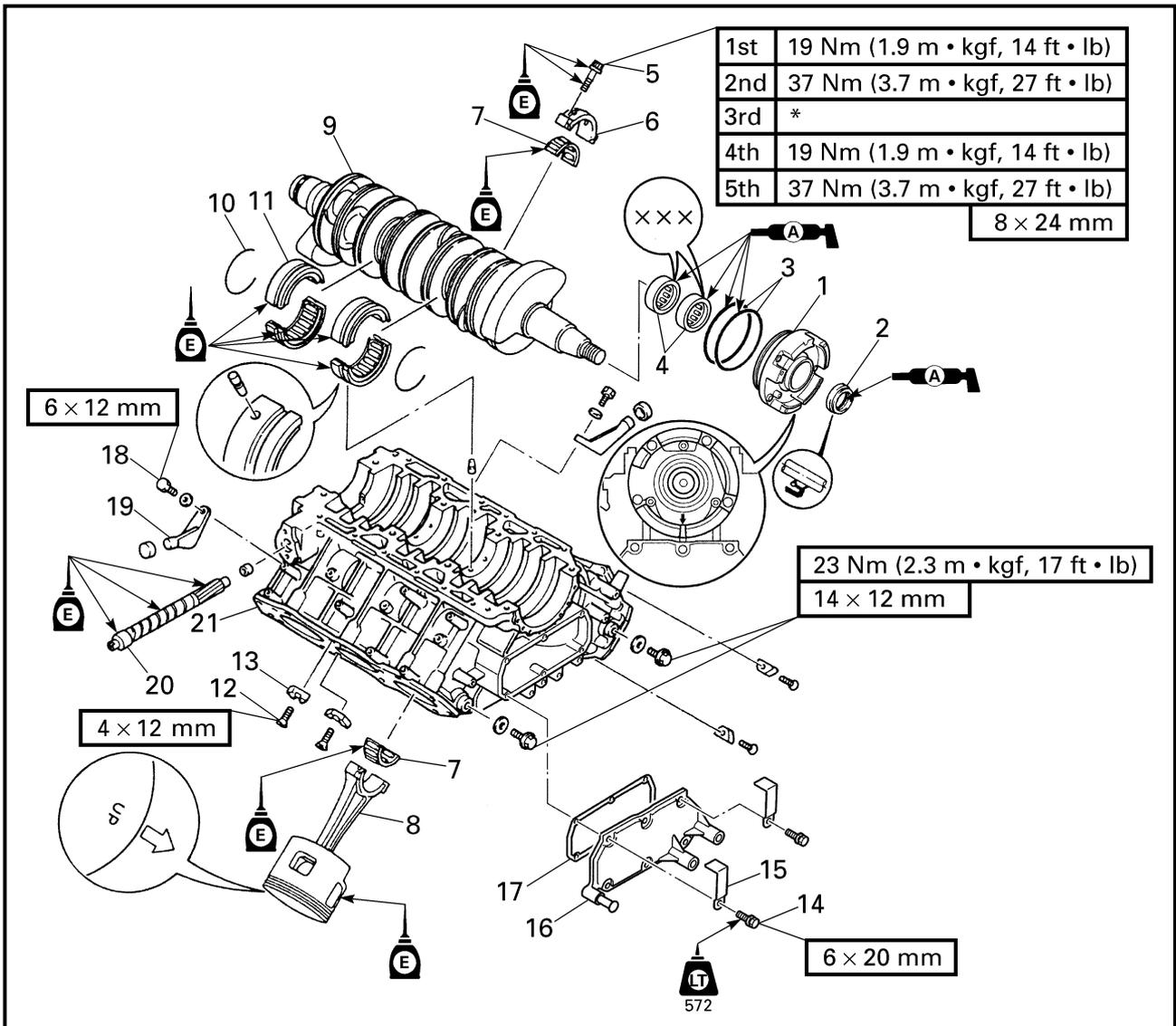
- Apply:
- Gasket Maker®  
(onto the crankcase mating surfaces)

- NOTE:** \_\_\_\_\_
- Clean the mating surfaces of the crankcase and cylinder body before applying Gasket Maker®.
  - Do not allow any sealant to overflow from the mating surfaces.



CYLINDER BODY ASSEMBLY

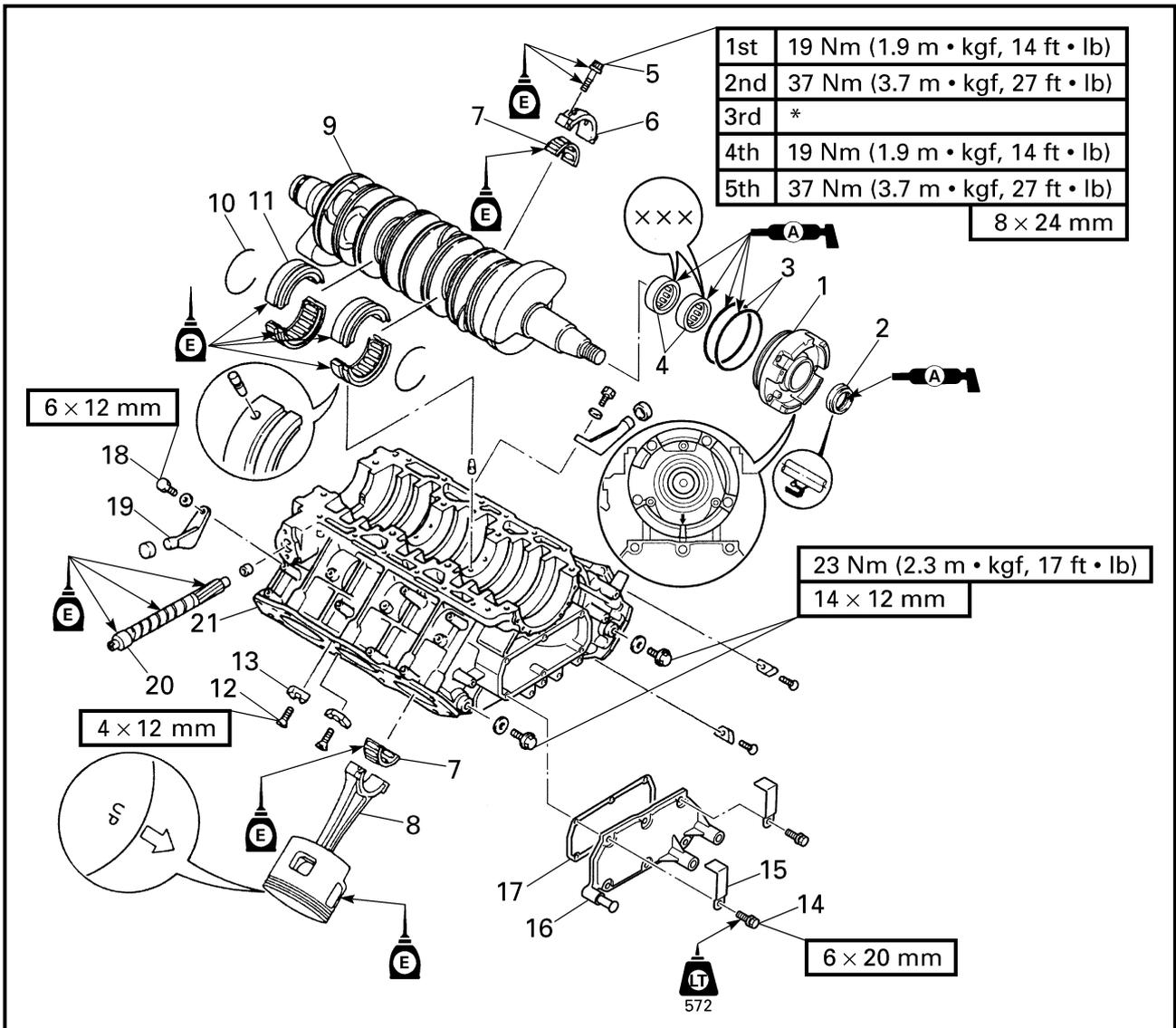
DISASSEMBLING/ASSEMBLING THE CYLINDER BODY ASSEMBLY



Order	Job/Part	Q'ty	Remarks
	Cylinder heads		Refer to "CYLINDER HEAD COVERS" on page 5-38.
	Crankcase		Refer to "CRANKCASE" on page 5-47.
1	Upper bearing housing	1	
2	Oil seal	1	
3	O-ring	2	
4	Needle bearing	2	
5	Connecting rod bolt	12	
6	Connecting rod cap	6	

Continued on next page.

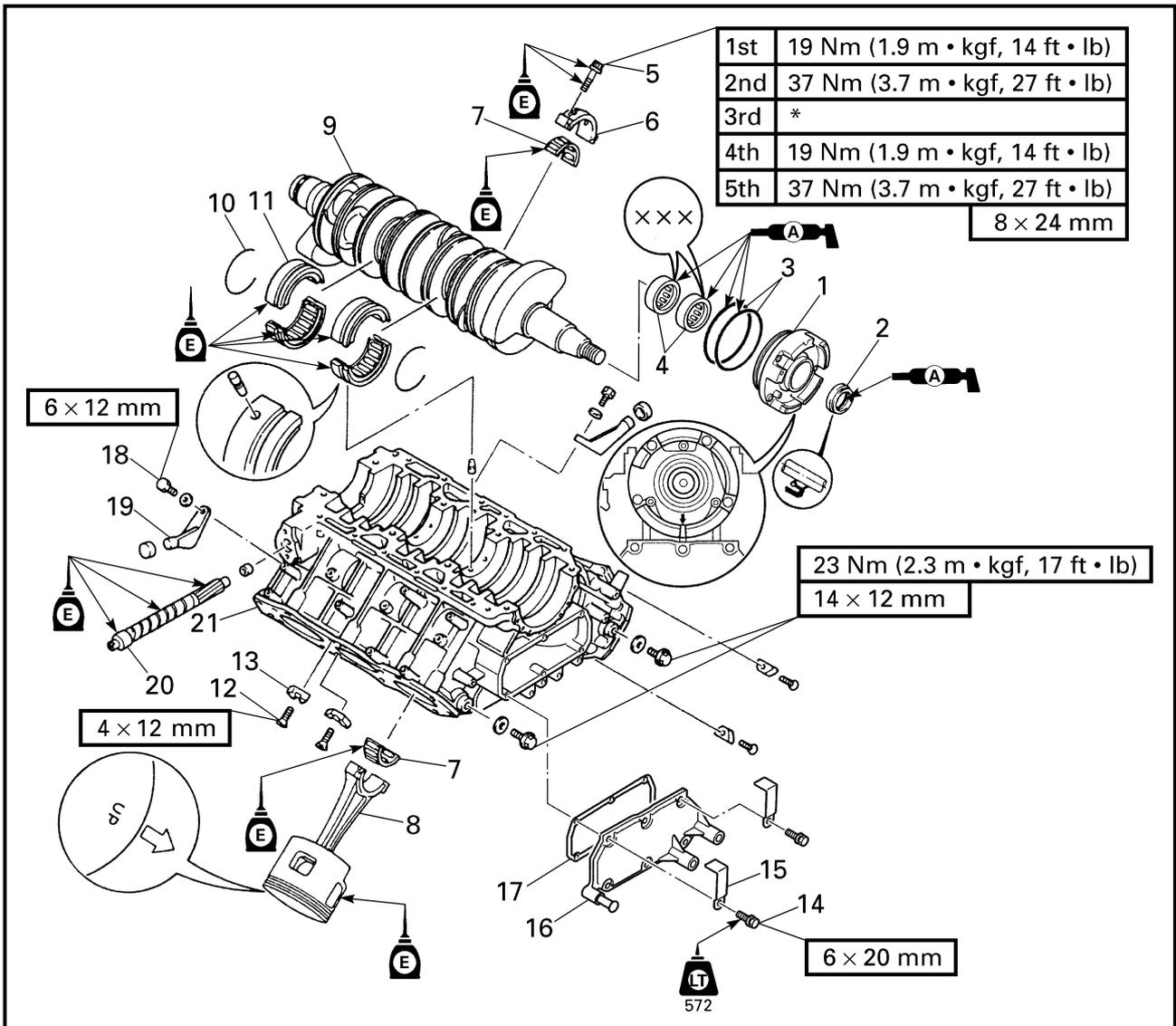
\*: Loosen



Order	Job/Part	Q'ty	Remarks
7	Big-end bearing	6	
8	Piston/connecting rod assembly	6	
9	Crankshaft assembly	1	
10	Clip	2	
11	Main journal bearing	2	
12	Screw	8	
13	Anode	8	
14	Bolt	6	
15	Lead holder	2	

Continued on next page.

\*: Loosen

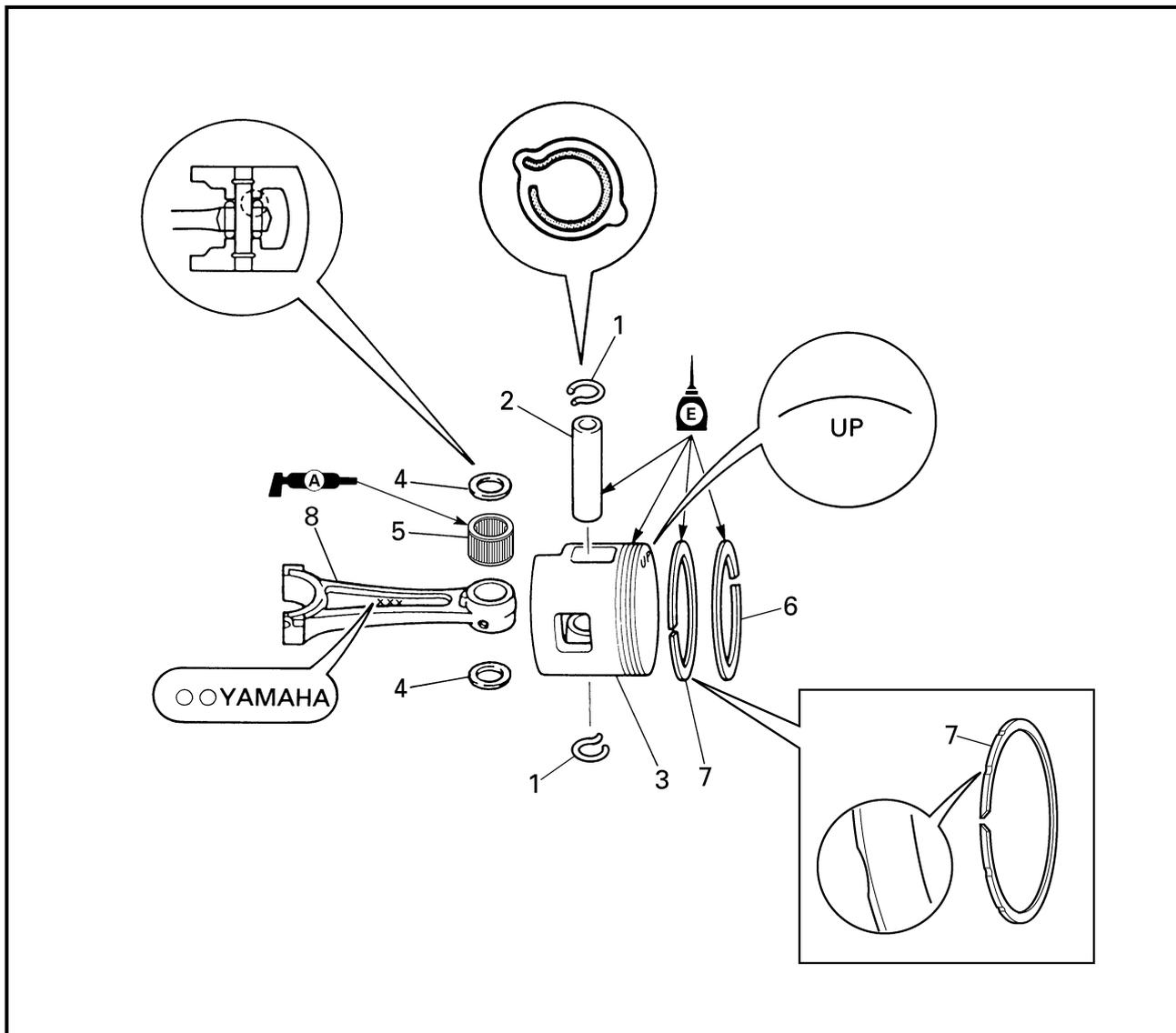


Order	Job/Part	Q'ty	Remarks
16	Cylinder cover	1	<p><b>Not reusable</b></p> <p>For assembly, reverse the disassembly procedure.</p>
17	Gasket	1	
18	Bolt	4	
19	Damper bracket	2	
20	Oil pump driven gear	1	
21	Cylinder body	1	

\*: Loosen

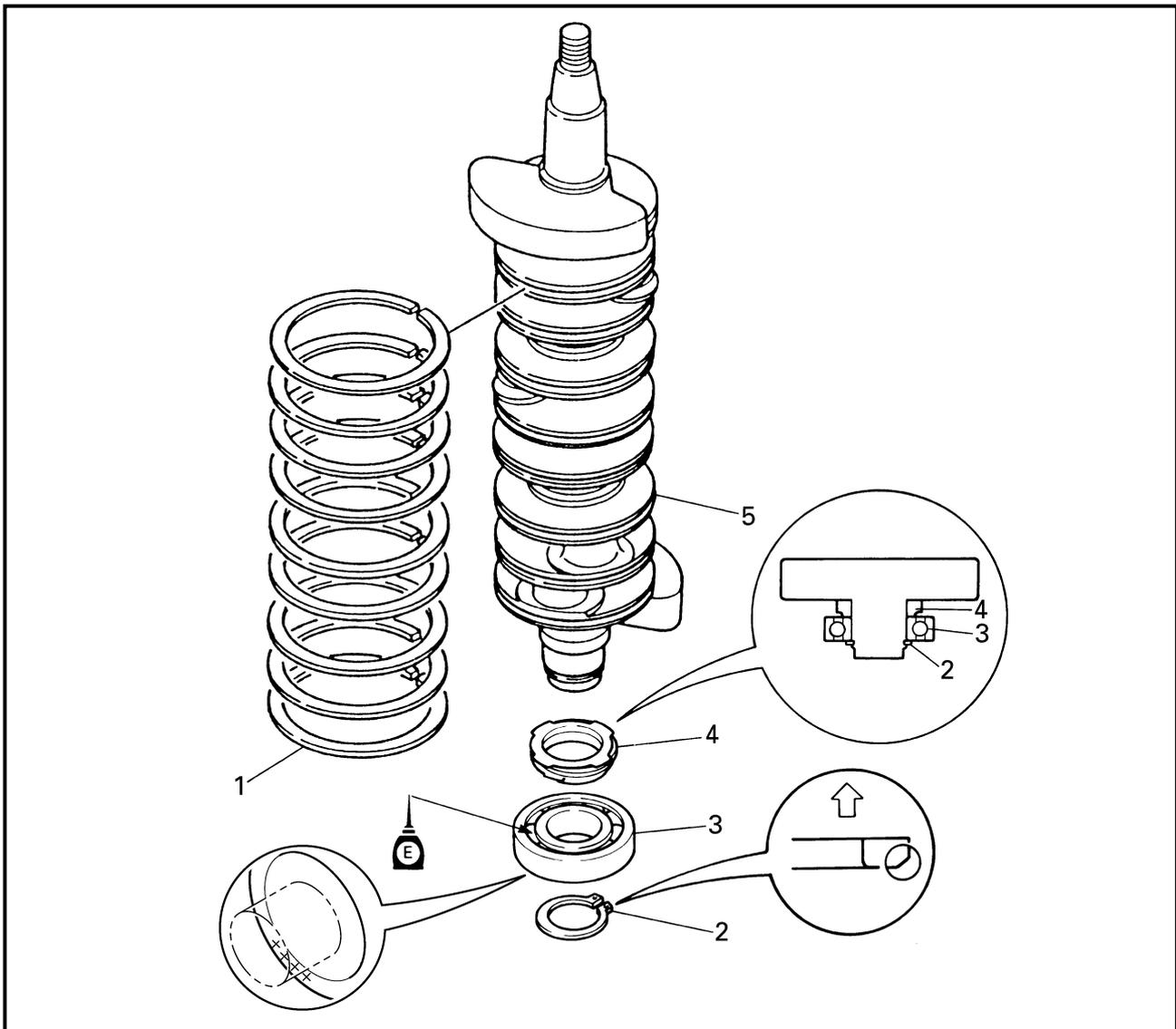


DISASSEMBLING/ASSEMBLING THE PISTON AND CONNECTING ROD ASSEMBLIES

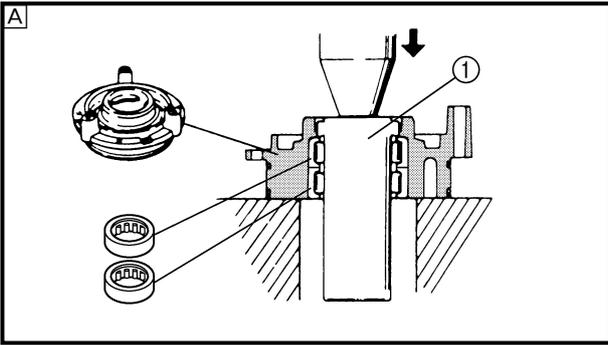
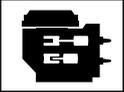


Order	Job/Part	Q'ty	Remarks
1	Piston pin clip	12	<b>Not reusable</b>
2	Piston pin	6	
3	Piston	6	
4	Washer	12	
5	Small-end bearing	6	
6	Top piston ring	6	
7	2nd piston ring	6	
8	Connecting rod	6	
			For assembly, reverse the disassembly procedure.

**DISASSEMBLING/ASSEMBLING THE CRANKSHAFT ASSEMBLY**



Order	Job/Part	Q'ty	Remarks
1	Labyrinth ring	9	
2	Circlip	1	
3	Ball bearing	1	
4	Oil pump drive gear	1	
5	Crankshaft	1	
			For assembly, reverse the disassembly procedure.



**DISASSEMBLING THE UPPER BEARING HOUSING**

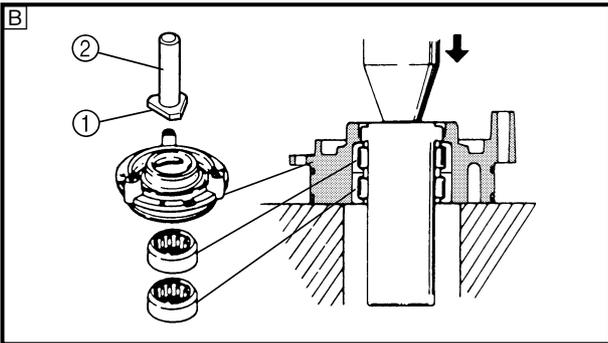
Remove:

- Needle bearing

	<b>Needle bearing attachment.....</b> ①
	<b>YB-06205 / 90890-06663</b>
	<b>Driver rod .....</b> ②
	<b>90890-06606</b>

**A** For USA and Canada

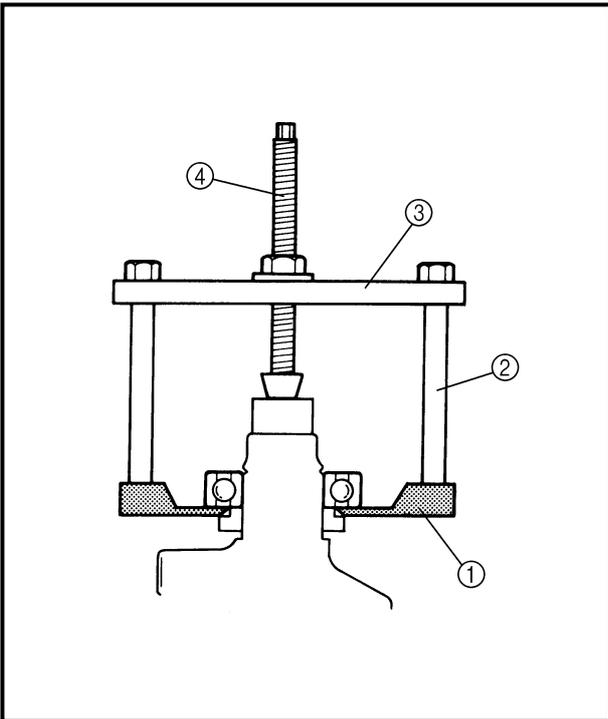
**B** For worldwide



**REMOVING THE BEARING AND OIL PUMP DRIVE GEAR**

Remove:

- Bearing
- Oil pump drive gear



	<b>Bearing separator .....</b> ①
	<b>YB-06219 / 90890-06534</b>
	<b>Guide plate stand .....</b> ②
	<b>90890-06538</b>
	<b>Guide plate.....</b> ③
	<b>90890-06501</b>
	<b>Bearing puller.....</b> ④
	<b>90890-06535</b>



**CHECKING THE CYLINDER BODY**

1. Check:
  - Cylinder sleeves  
Cracks/score marks → Replace.
  - Cylinder body water jacket  
Mineral deposits/rust → Clean.

**CAUTION:**

**Do not scratch the contacting surfaces of the crankcase and cylinder head.**

2. Check:
  - Exhaust passages  
Cracks/damage → Replace.  
Carbon deposits → Clean.

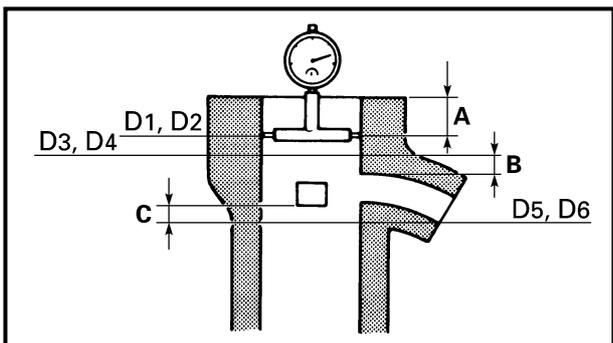
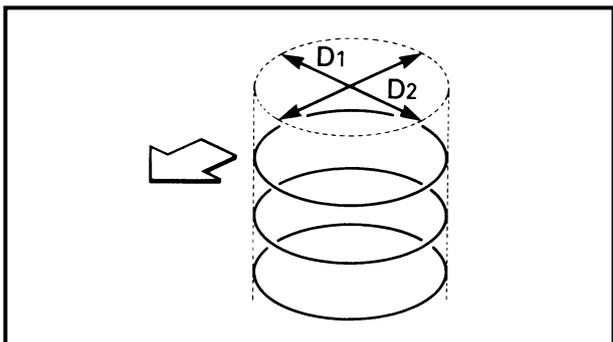
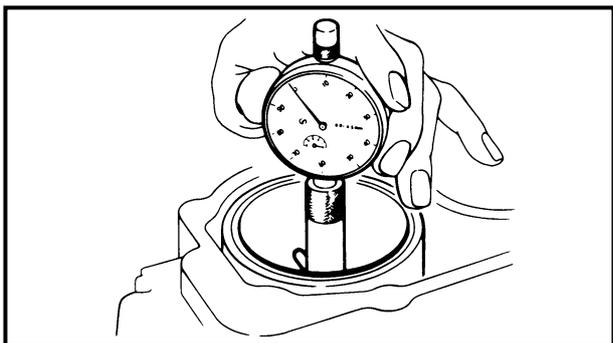
**CAUTION:**

**Do not scratch the contacting surfaces of the cylinder and exhaust inner cover.**

3. Measure:
  - Cylinder bore diameter "D"  
(with a cylinder bore gauge)  
Out of specification → Replace.

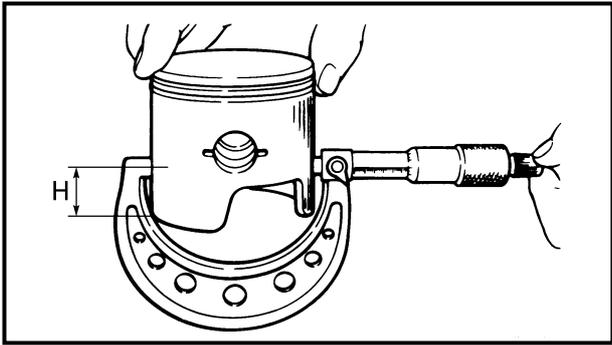
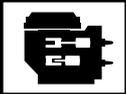
**NOTE:**

Measure the cylinder bore diameter at three positions for both D<sub>1</sub> and D<sub>2</sub>. Then, average the measurements.



	Standard	Wear limit
Cylinder bore diameter "D"	90.00 - 90.02 mm (3.543 - 3.544 in)	90.1 mm (3.55 in)
Taper limit T	—	0.08 mm (0.003 in)
Out of round limit R	—	0.05 mm (0.002 in)
$T = (\text{maximum } D_1 \text{ or } D_2) - (\text{minimum } D_5 \text{ or } D_6)$ $R = \text{Maximum } (D_1 - D_2) \text{ or } (D_3 - D_4) \text{ or } (D_5 - D_6)$		

- A: 10 mm (0.4 in) below the top of the cylinder
- B: 5 mm (0.2 in) above the exhaust port
- C: 5 mm (0.2 in) below the scavenging port



**CHECKING THE PISTONS**

Measure:

- Piston diameter (with a micrometer)
- Out of specification → Replace.

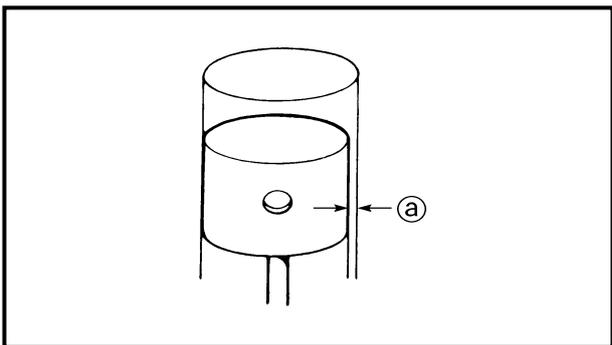
	Measuring point "H"	Piston diameter
Standard	10 mm (0.4 in)	89.845 - 89.869 mm (3.5372 - 3.5381 in)

	<b>Oversize piston diameter</b> 1st oversize* 90.11 mm (3.548 in) 2nd oversize 90.36 mm (3.557 in)	
---	--	--

\*: Except for USA

**NOTE:**

When measuring the piston diameter, position the micrometer in relation to the piston pin hole as shown.



**CALCULATING THE PISTON-TO-CYLINDER CLEARANCE**

Calculate:

- Piston-to-cylinder clearance (a)
- Out of specification → Replace the piston and piston rings, the cylinder or both.

Piston-to-cylinder clearance	=	Cylinder bore diameter	-	Piston diameter
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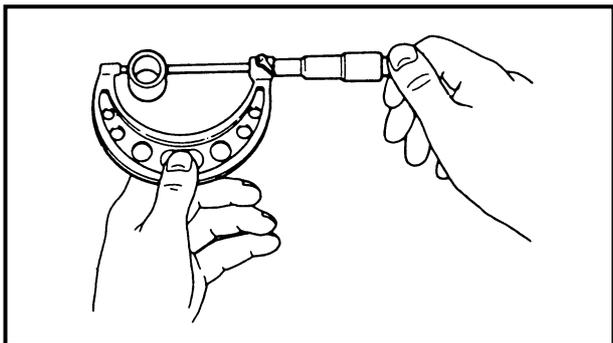
	<b>Piston-to-cylinder clearance</b> 0.150 - 0.156 mm (0.0059 - 0.0061 in)
---	---



## CHECKING THE PISTON PINS AND SMALL-END BEARINGS

### 1. Check:

- Piston pin
  - Small-end bearing
- Heat discoloration → Replace.  
Damage/scratches → Replace.

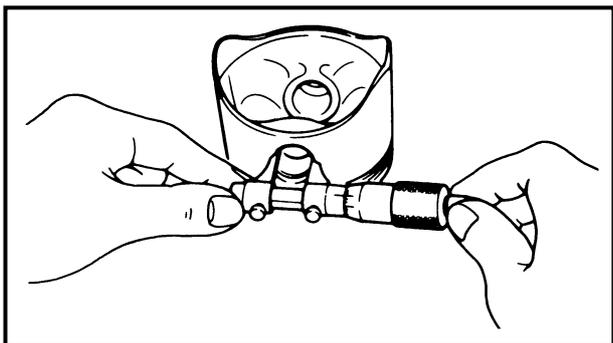


### 2. Measure:

- Piston pin diameter  
(with a micrometer)
- Out of specification → Replace.



**Piston pin diameter**  
**23.065 - 23.070 mm**  
**(0.9081 - 0.9083 in)**



### 3. Measure:

- Piston pin boss diameter  
(with a micrometer)
- Out of specification → Replace.

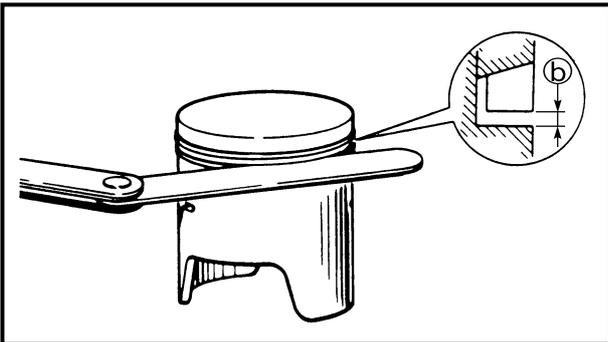
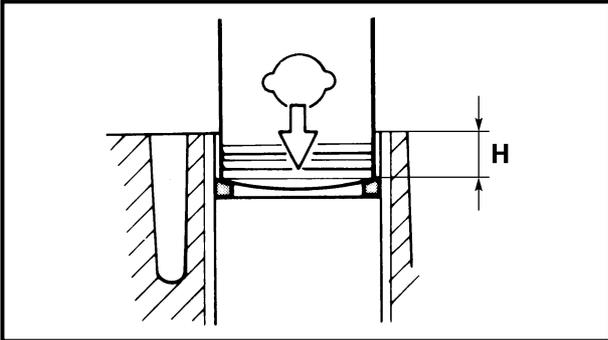
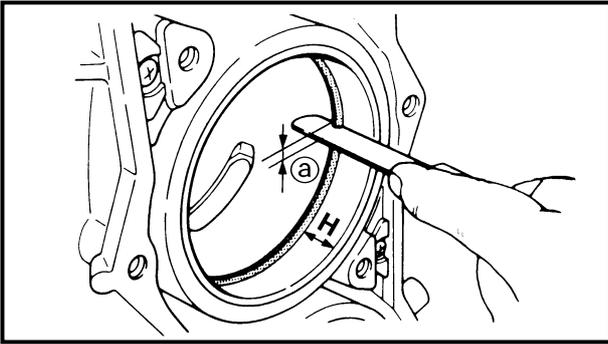


**Piston pin boss diameter**  
**23.074 - 23.085 mm**  
**(0.9084 - 0.9089 in)**

## CHECKING THE PISTON RINGS

### NOTE:

- Before checking the piston rings, be sure to check the cylinder body.
- Piston rings should always be replaced as a set (per piston).



1. Measure:

- Piston ring end gap **a**  
(with a thickness gauge)  
Out of specification → Replace.



**Piston ring end gap**  
0.30 - 0.40 mm (0.012 - 0.016 in)  
**Piston ring end gap limit**  
0.60 mm (0.024 in)  
**Measuring point "H"**  
20 mm (0.8 in)

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

Push the piston ring into the cylinder with the piston crown.

2. Measure:

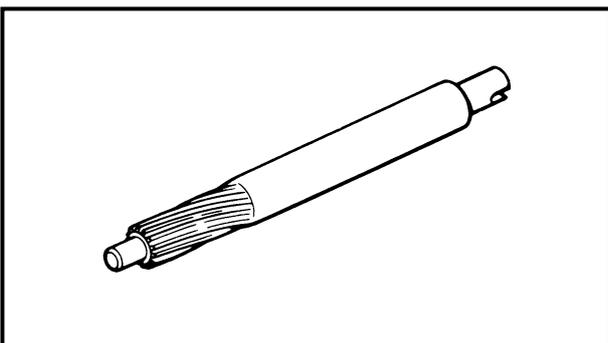
- Piston ring side clearance **b**  
(with a thickness gauge)  
Out of specification → Replace the piston and piston rings as a set.



**Piston ring side clearance**  
0.02 - 0.06 mm (0.001 - 0.002 in)

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

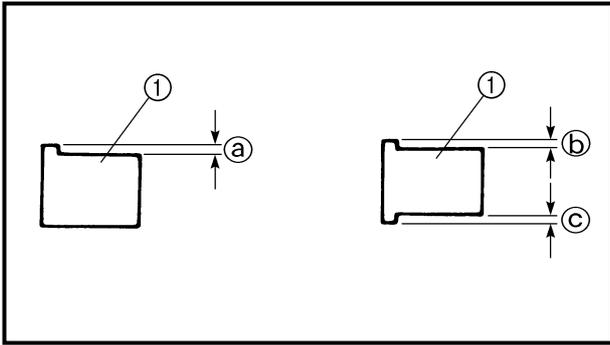
When measuring the piston ring side clearance, the outside of the piston ring should be flush with the piston wall.



**CHECKING THE OIL PUMP DRIVEN GEAR**

Check:

- Oil pump driven gear  
Cracks/pitting/wear → Replace.

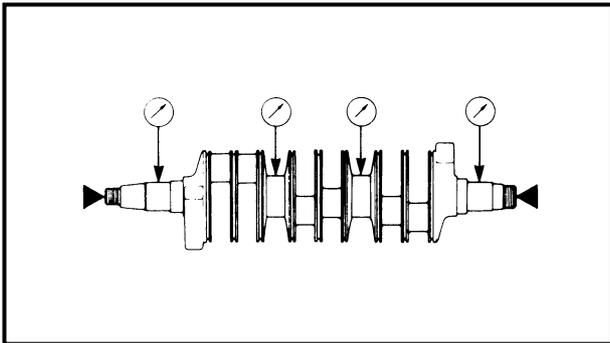


**CHECKING THE LABYRINTH RINGS**

1. Check:
  - Labyrinth ring ①  
Cracks/damage/wear → Replace.
2. Measure:
  - Labyrinth ring wear ② or ③ + ④  
Out of specification → Replace.



**Labyrinth ring wear limit**  
0.10 mm (0.004 in)

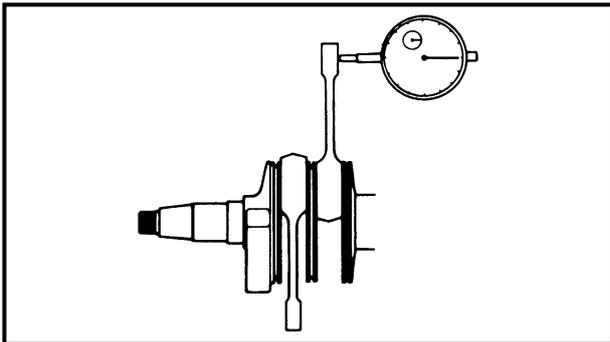


**CHECKING THE CRANKSHAFT**

1. Measure:
  - Crankshaft runout  
(with V-blocks and a dial gauge)  
Out of specification → Replace.



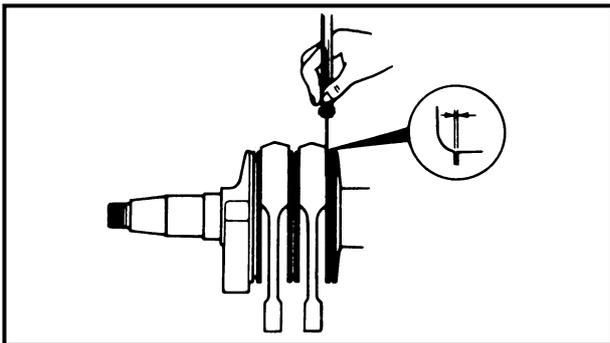
**Runout limit**  
0.05 mm (0.002 in)



2. Measure:
  - Small-end axial play  
Out of specification → Replace the connecting rod.



**Small-end axial play limit**  
2.0 mm (0.08 in)

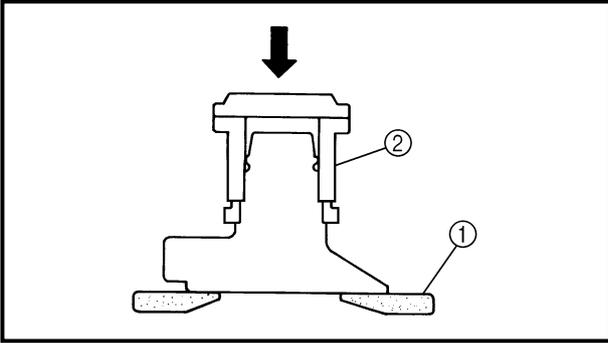


3. Measure:
  - Big-end side clearance  
Out of specification → Replace the connecting rod.



**Big-end side clearance**  
0.12 - 0.26 mm (0.005 - 0.010 in)

4. Check:
  - Crankshaft bearing  
Pitting/rumbling → Replace.
5. Check:
  - Oil pump drive gear  
Cracks/pitting/wear → Replace.



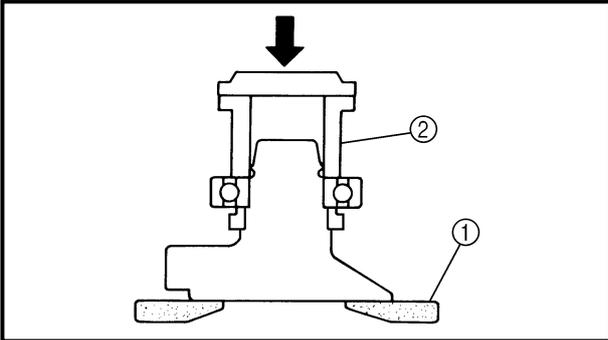
**INSTALLING THE OIL PUMP DRIVE GEAR**

Install:

- Oil pump drive gear



- Bearing separator ..... ①  
YB-06219 / 90890-06534
- Bearing/oil seal attachment .... ②  
90890-06661  
90890-06622



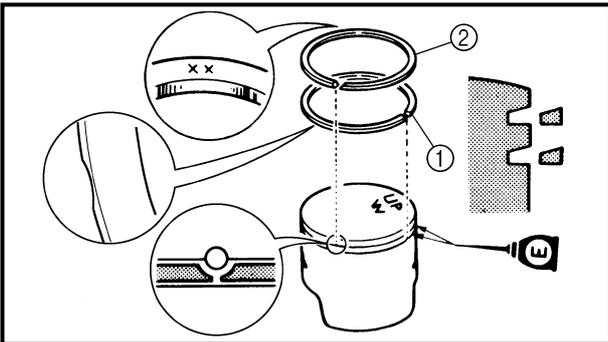
**INSTALLING THE BEARING**

Install:

- Bearing



- Bearing separator ..... ①  
YB-06219 / 90890-06534
- Bearing/oil seal attachment .... ②  
90890-06662  
90890-06622



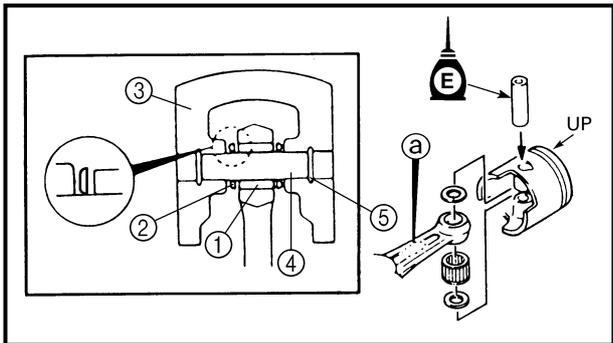
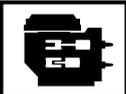
**INSTALLING THE PISTON RINGS AND PISTON**

1. Install:

- 2nd piston ring ①
- Top piston ring ②

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

- Align each piston ring end gap with its respective locating pin.
- After installing the piston rings, check that they move smoothly.



**2. Install:**

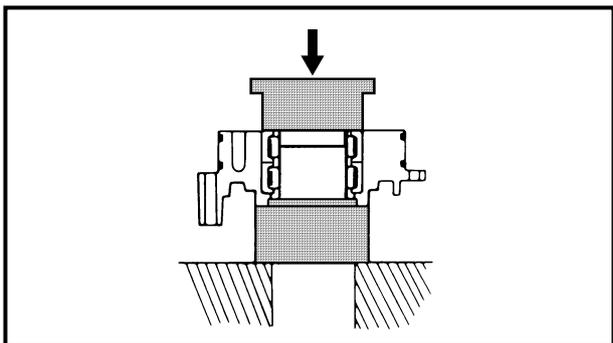
- Small-end bearing ①
- Washers ②
- Piston ③
- Piston pin ④
- Piston pin clips ⑤

**CAUTION:**

The washers must be installed with their convex sides facing towards the piston.

**NOTE:**

The embossed YAMAHA mark (a) on the connecting rod must face the same direction as the "UP" mark on the piston.

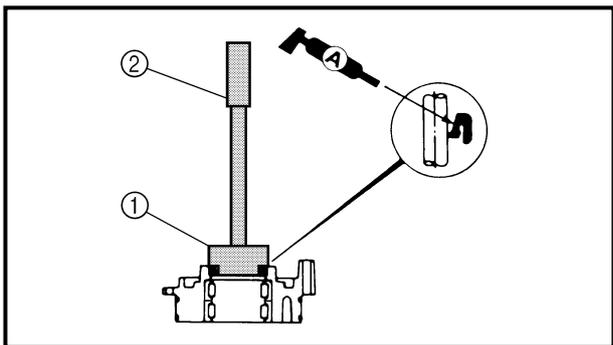


**ASSEMBLING THE UPPER BEARING HOUSING**

**1. Install:**

- Needle bearing

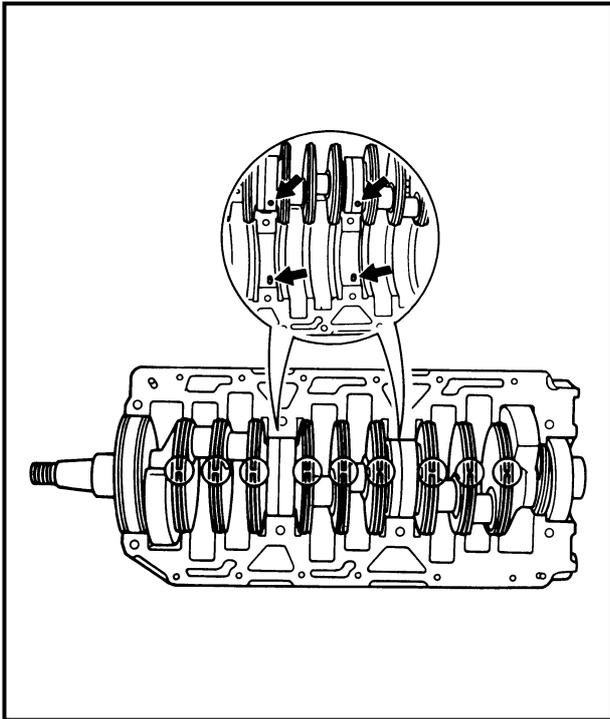
	<b>Needle bearing attachment</b> 90890-06661
--	---



**2. Install:**

- Oil seal

	<b>Bearing/oil seal attachment .... ①</b> 90890-06654
	<b>Driver rod ..... ②</b> 90890-06652



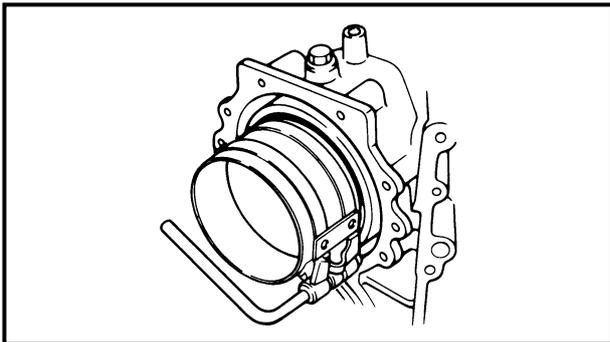
**INSTALLING THE CRANKSHAFT ASSEMBLY**

Install:

- Cylinder body
- Crankshaft assembly

**NOTE:**

- Align the crankshaft labyrinth ring end gaps with their respective locating pins.
- Install the bearing locating pins into the cylinder body.



**INSTALLING THE PISTON AND CONNECTING ROD ASSEMBLIES**

Install:

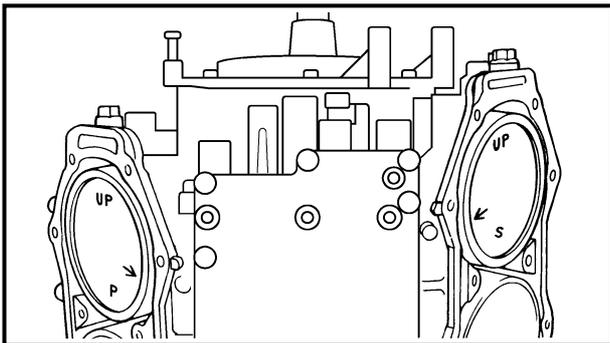
- Piston and connecting rod assembly



**Piston ring compressor**  
YU-33294 / 90890-06530

**NOTE:**

- Before installing the piston and connecting rod assemblies, lubricate the cylinder walls with 2-stroke outboard engine oil.
- Reinstall the piston and connecting rod assemblies in their original cylinders.
- Install the piston and connecting rod assemblies with the "S" mark in the starboard side cylinders, and those with the "P" mark in the port side cylinders.
- The "UP" mark on the piston crown must face towards the flywheel.







## CHAPTER 6

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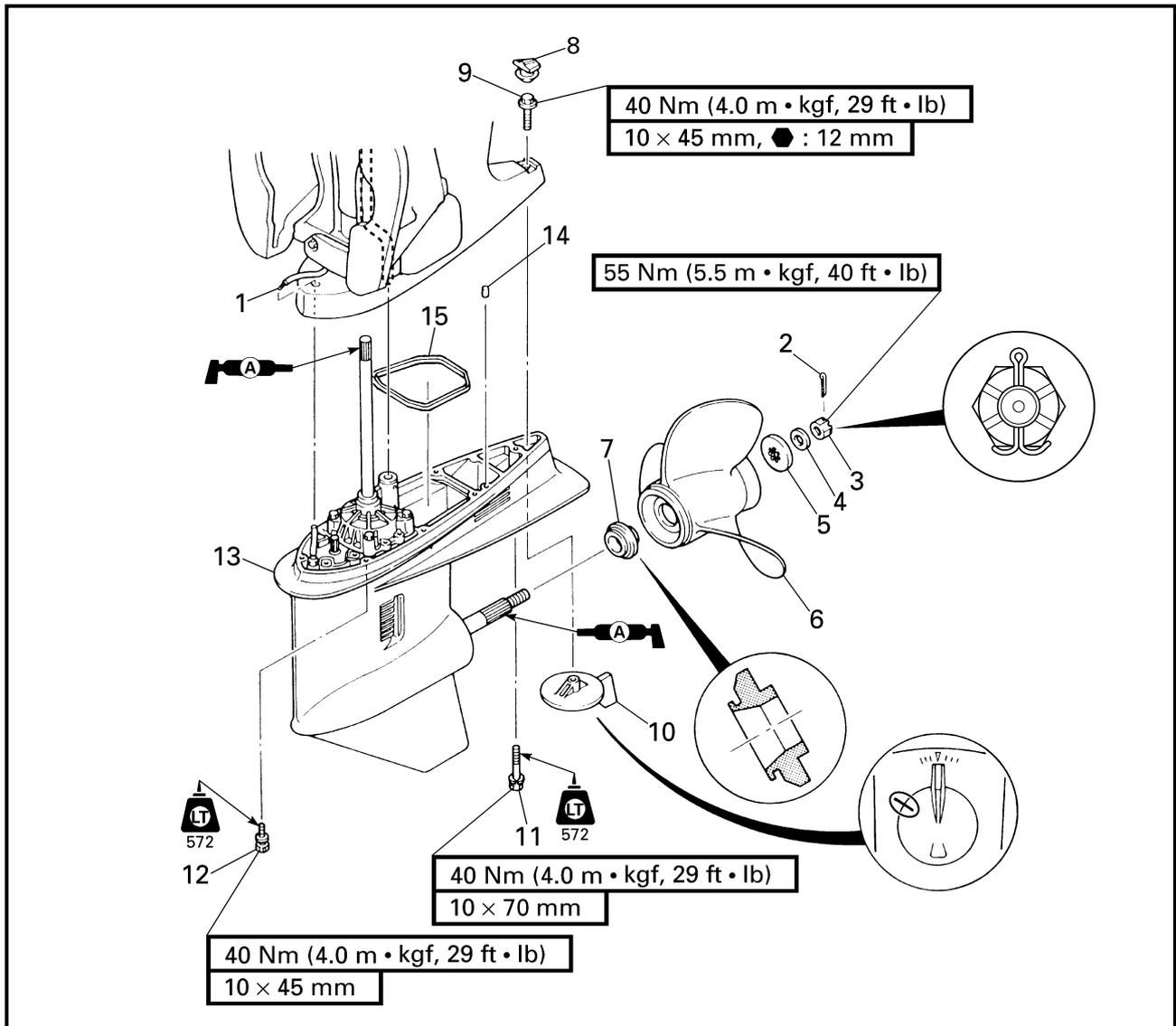



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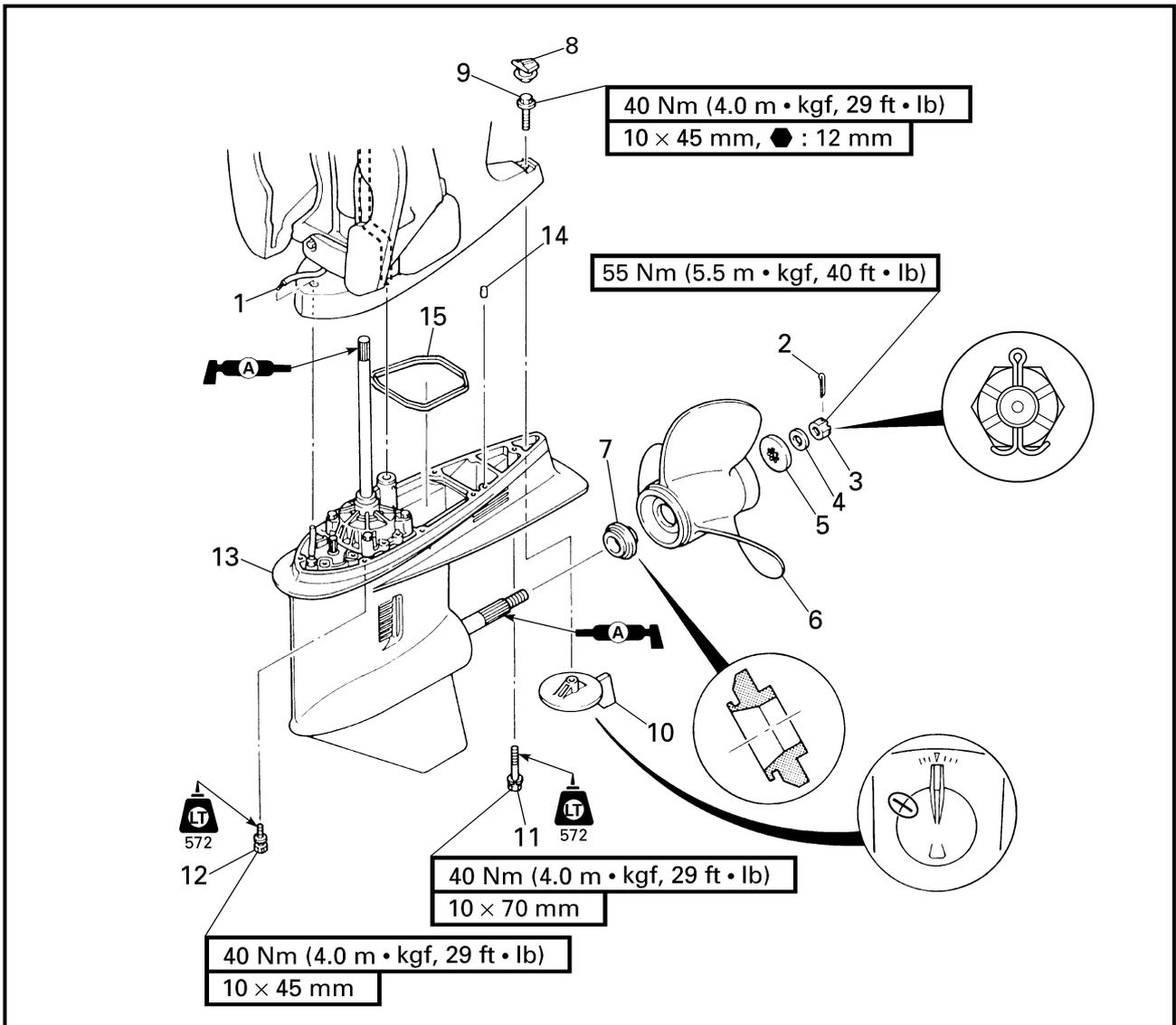


**LOWER UNIT (REGULAR ROTATION MODELS)  
REMOVING/INSTALLING THE LOWER UNIT**

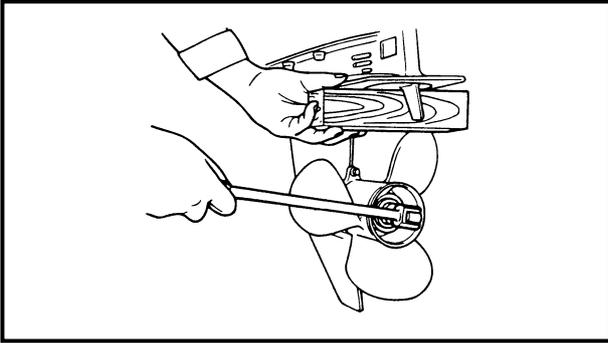


Order	Job/Part	Q'ty	Remarks
1	Speedometer hose	1	
2	Cotter pin	1	
3	Propeller nut	1	
4	Washer	1	
5	Washer	1	
6	Propeller	1	
7	Spacer	1	
8	Cap	1	

Continued on next page.



Order	Job/Part	Q'ty	Remarks
9	Bolt	1	
10	Trim tab	1	
11	Bolt	1	
12	Bolt	6	
13	Lower unit	1	
14	Dowel pin	2	
15	Exhaust seal	1	
			For installation, reverse the removal procedure.



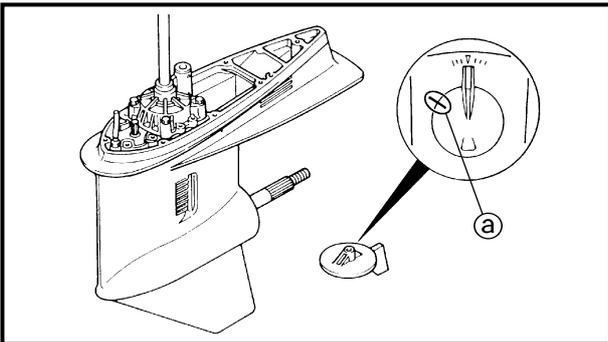
### REMOVING THE PROPELLER

Remove:

- Propeller nut

#### ⚠ WARNING

Do not hold the propeller with your hands when removing or installing it. Be sure to remove the battery leads from the batteries and the lanyard engine stop switch. Put a block of wood between the cavitation plate and propeller to keep the propeller from turning.



### REMOVING THE TRIM TAB

Remove:

- Trim tab

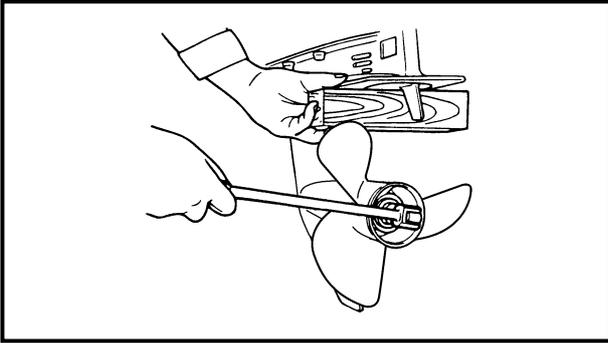
#### NOTE:

Mark the original position (a) for proper installation.

### CHECKING THE PROPELLER

Check:

- Blades
  - Splines
- Cracks/damage/wear → Replace.



## INSTALLING THE PROPELLER

Install:

- Propeller nut



**Propeller nut**  
55 Nm (5.5 m • kgf, 40 ft • lb)

### **⚠ WARNING**

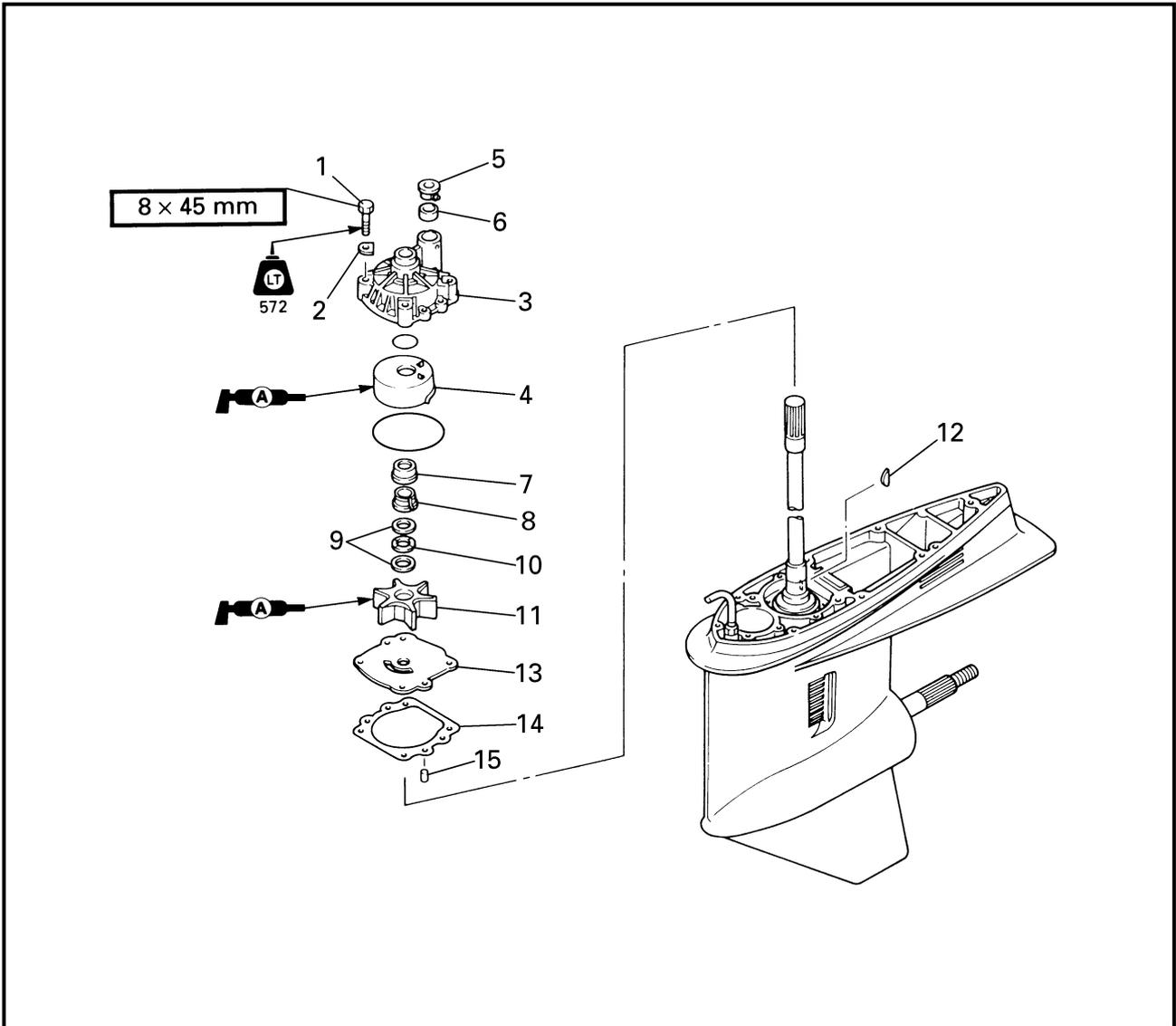
Do not hold the propeller with your hands when removing or installing it. Be sure to remove the battery leads from the batteries and the lanyard engine stop switch. Put a block of wood between the cavitation plate and propeller to keep the propeller from turning.

### **NOTE:**

If the groove in the propeller nut is not aligned with the cotter pin hole, tighten the nut further until they are aligned.

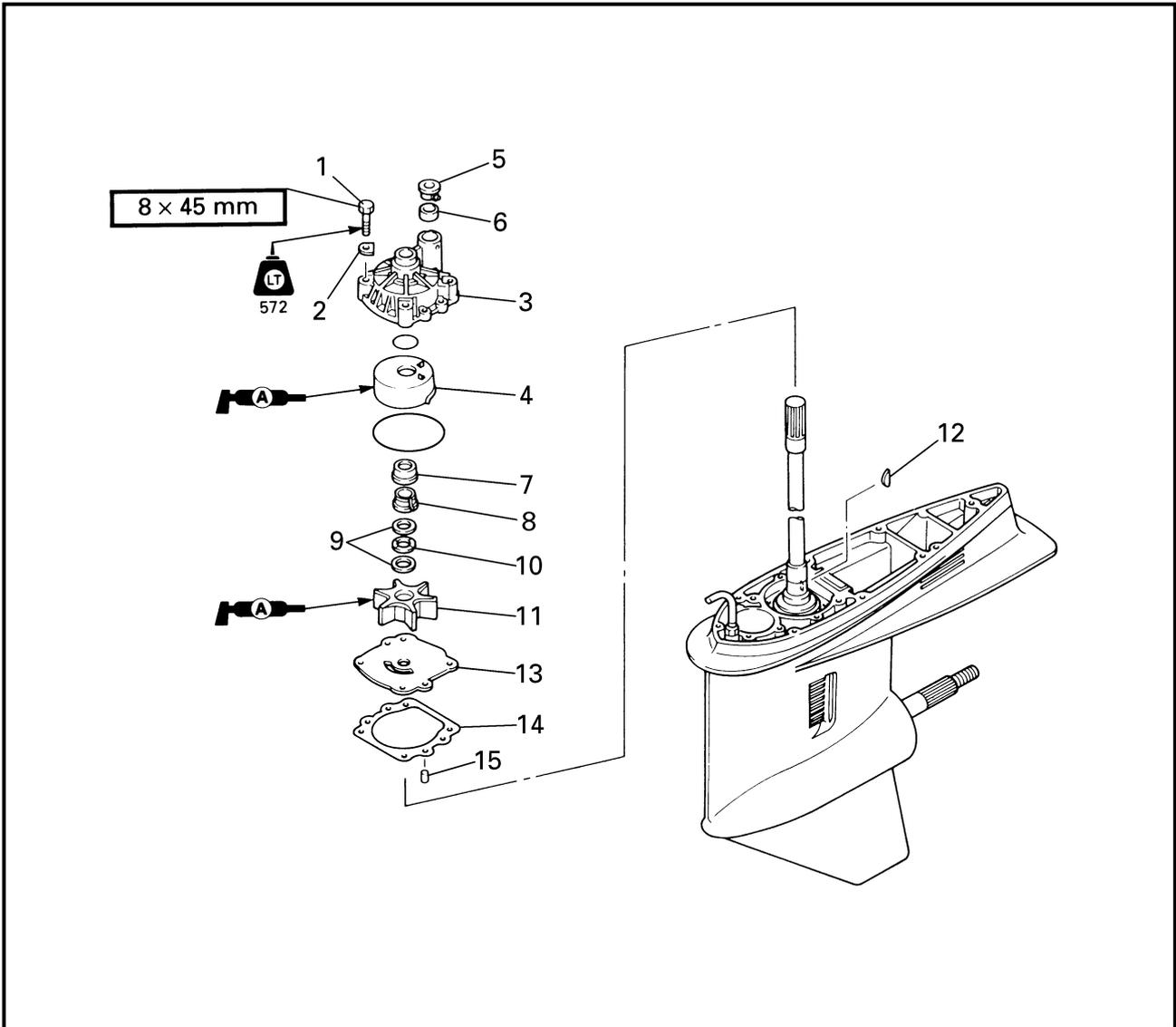


**WATER PUMP (REGULAR ROTATION MODELS)  
REMOVING/INSTALLING THE WATER PUMP**



Order	Job/Part	Q'ty	Remarks
	Lower unit		Refer to "LOWER UNIT (REGULAR ROTATION MODELS)" on page 6-1.
1	Bolt	4	
2	Plate washer	4	
3	Impeller housing	1	
4	Impeller housing cup	1	
5	Grommet	1	
6	Spacer	1	
7	Collar	1	

Continued on next page.



Order	Job/Part	Q'ty	Remarks
8	Spacer	1	
9	Washer	2	
10	Wave washer	1	
11	Impeller	1	
12	Woodruff key	1	
13	Impeller plate	1	
14	Gasket	1	<b>Not reusable</b>
15	Dowel pin	2	

For installation, reverse the removal procedure.



**CHECKING THE IMPELLER HOUSING**

Check:

- Impeller housing  
Cracks/damage → Replace.

**CHECKING THE IMPELLER AND IMPELLER HOUSING CUP**

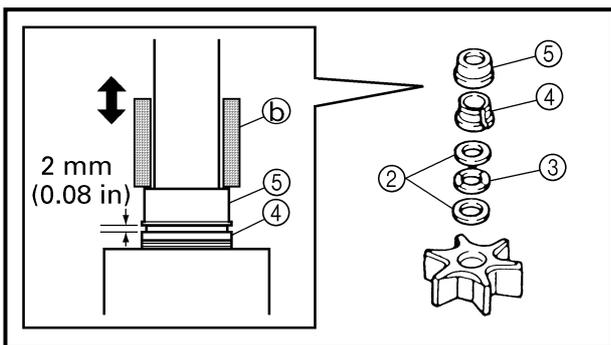
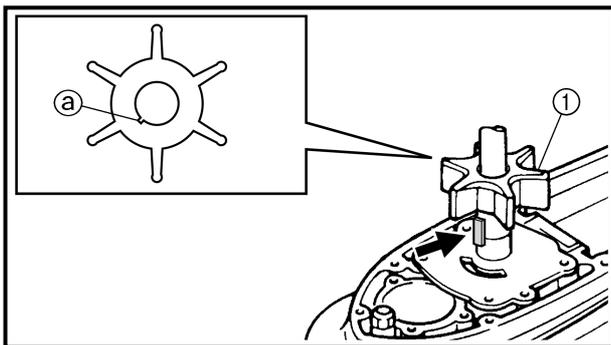
Check:

- Impeller
- Impeller housing cup  
Cracks/damage → Replace any defective parts.

**CHECKING THE WOODRUFF KEY**

Check:

- Woodruff key  
Damage/wear → Replace.



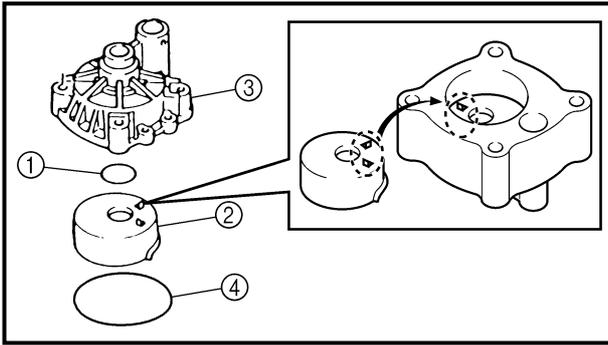
**INSTALLING THE IMPELLER AND IMPELLER HOUSING**

1. Install:

- Impeller ①
- Washers ②
- Wave washer ③
- Spacer ④
- Collar ⑤

**NOTE:**

- Make sure that the slit ① in the impeller is aligned with the woodruff key.
- The collar and spacer should fit together firmly.
- Install the collar with some appropriate tool inside diameter  $\varnothing 23 - 23.5$  mm ② that fits over the drive shaft as shown.

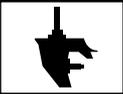


## 2. Install:

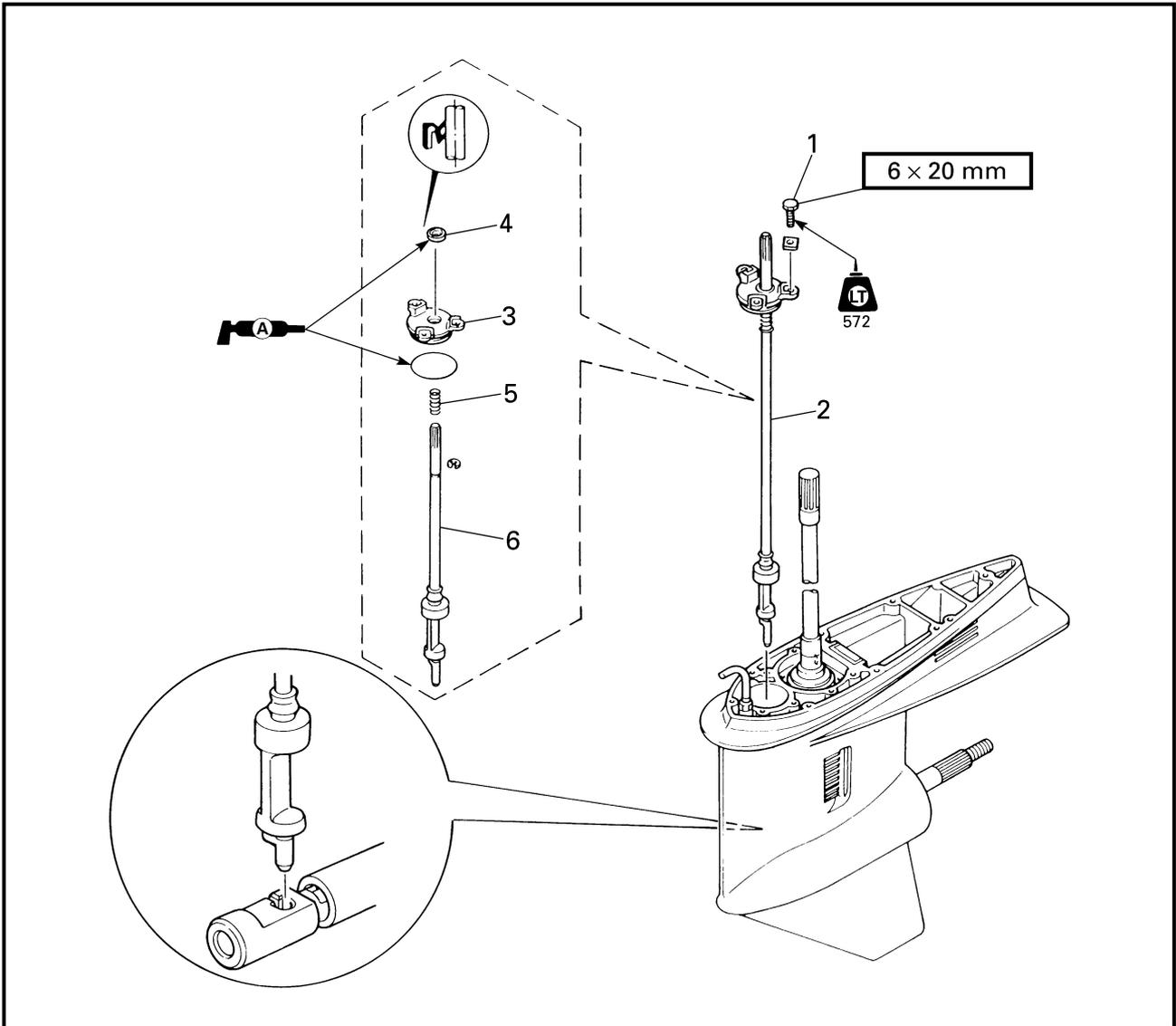
- O-ring ①
- Impeller housing cup ②
- Impeller housing ③
- O-ring ④

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

- When installing the impeller housing cup, align its projection with the hole in the impeller housing.
- When installing the water pump housing, turn the drive shaft clockwise.



**SHIFT ROD ASSEMBLY (REGULAR ROTATION MODELS)  
REMOVING/INSTALLING THE SHIFT ROD ASSEMBLY**



Order	Job/Part	Q'ty	Remarks
	Impeller plate		Refer to "WATER PUMP (REGULAR ROTATION MODELS)" on page 6-5.
1	Bolt (with plate washer)	3	
2	Shift rod assembly	1	
3	Oil seal housing	1	
4	Oil seal	1	
5	Spring	1	
6	Shift rod	1	
			For installation, reverse the removal procedure.



## SHIFT ROD ASSEMBLY (REGULAR ROTATION MODELS)

E

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### REMOVING THE SHIFT ROD ASSEMBLY

Remove:

- Shift rod assembly

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

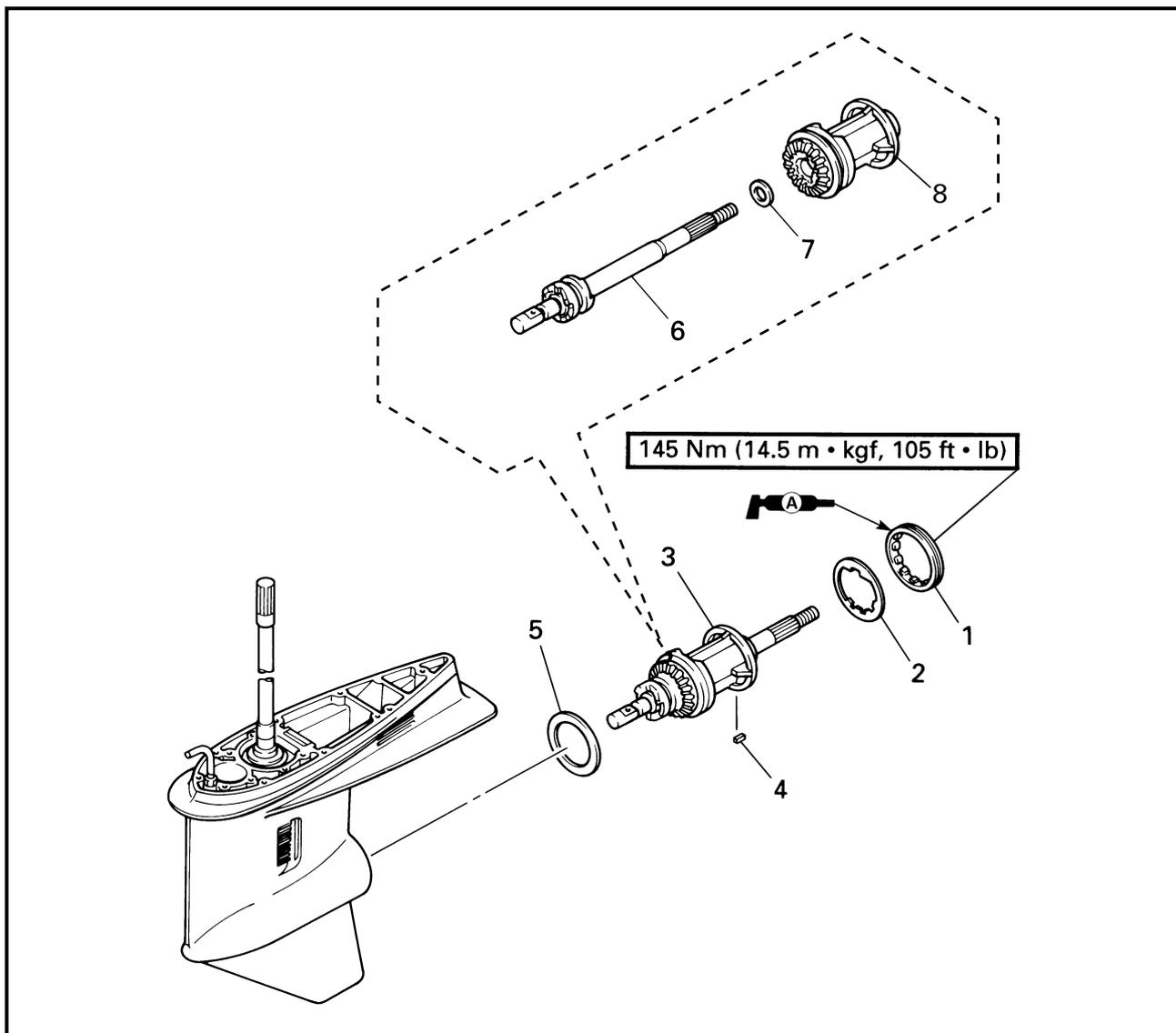
Remove the shift rod assembly when the shift rod is in the neutral position.

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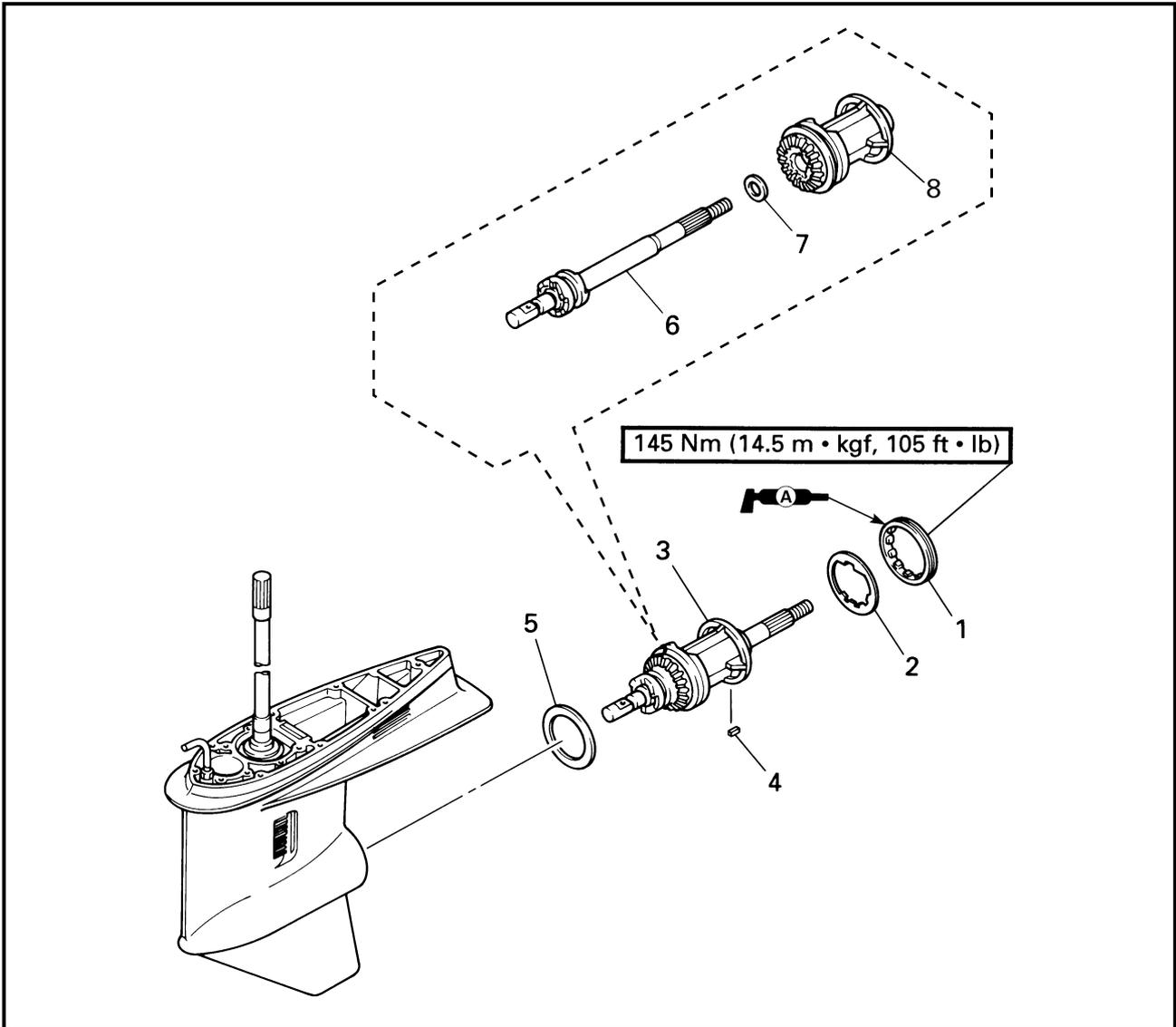
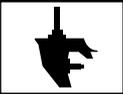
**PROPELLER SHAFT HOUSING ASSEMBLY  
(REGULAR ROTATION MODELS)**

**REMOVING/INSTALLING THE PROPELLER SHAFT HOUSING ASSEMBLY**



Order	Job/Part	Q'ty	Remarks
	Gear oil		Refer to "CHANGING AND CHECKING THE GEAR OIL" on page 3-17.
	Shift rod assembly		Refer to "SHIFT ROD ASSEMBLY (REGULAR ROTATION MODELS)" on page 6-9.
1	Ring nut	1	
2	Claw washer	1	
3	Propeller shaft housing assembly	1	
4	Straight key	1	

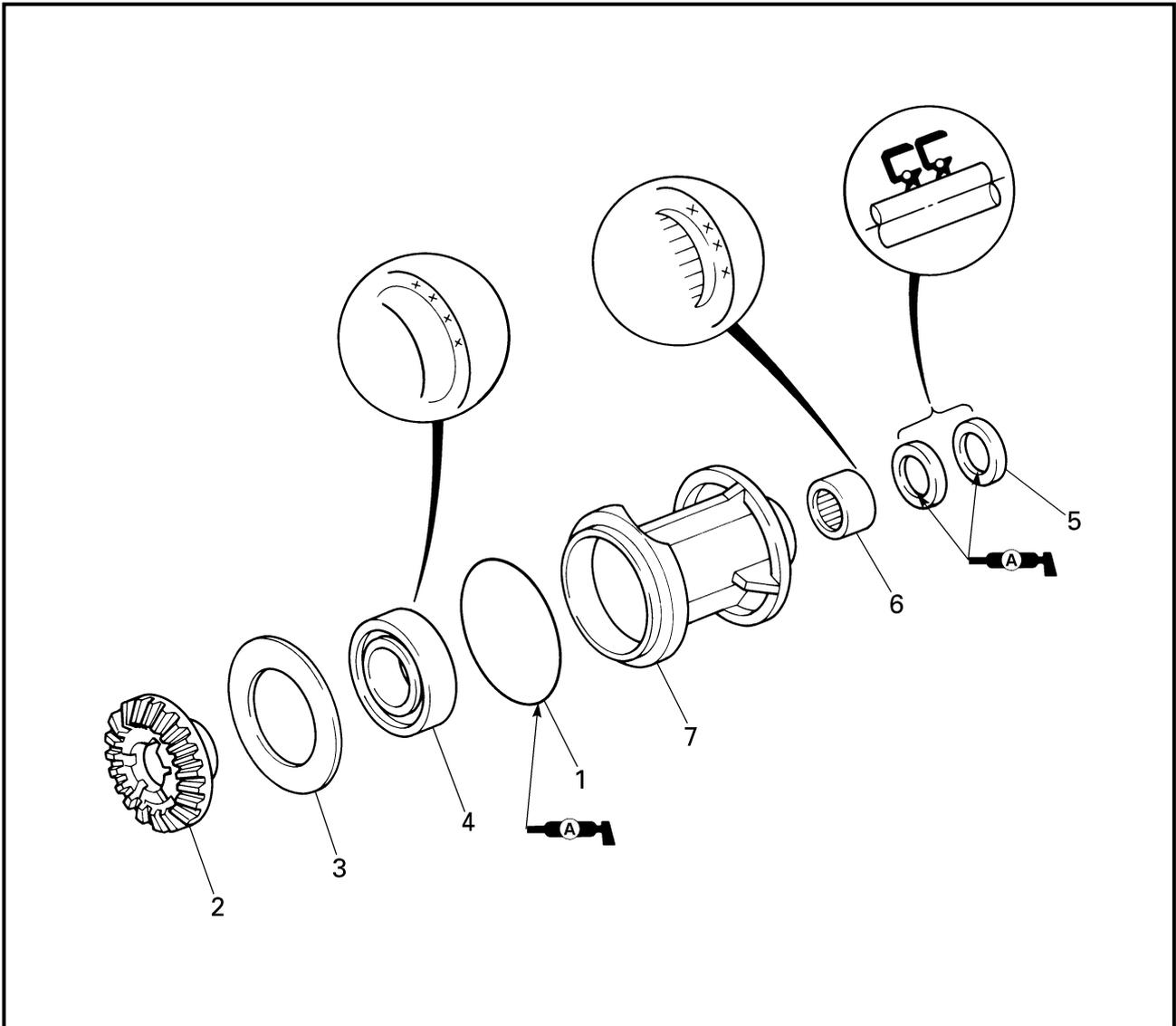
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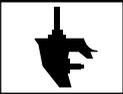
Order	Job/Part	Q'ty	Remarks
5	Reverse gear shim	*	For installation, reverse the removal procedure.
6	Propeller shaft assembly	1	
7	Washer	1	
8	Propeller shaft housing	1	

\*: As required

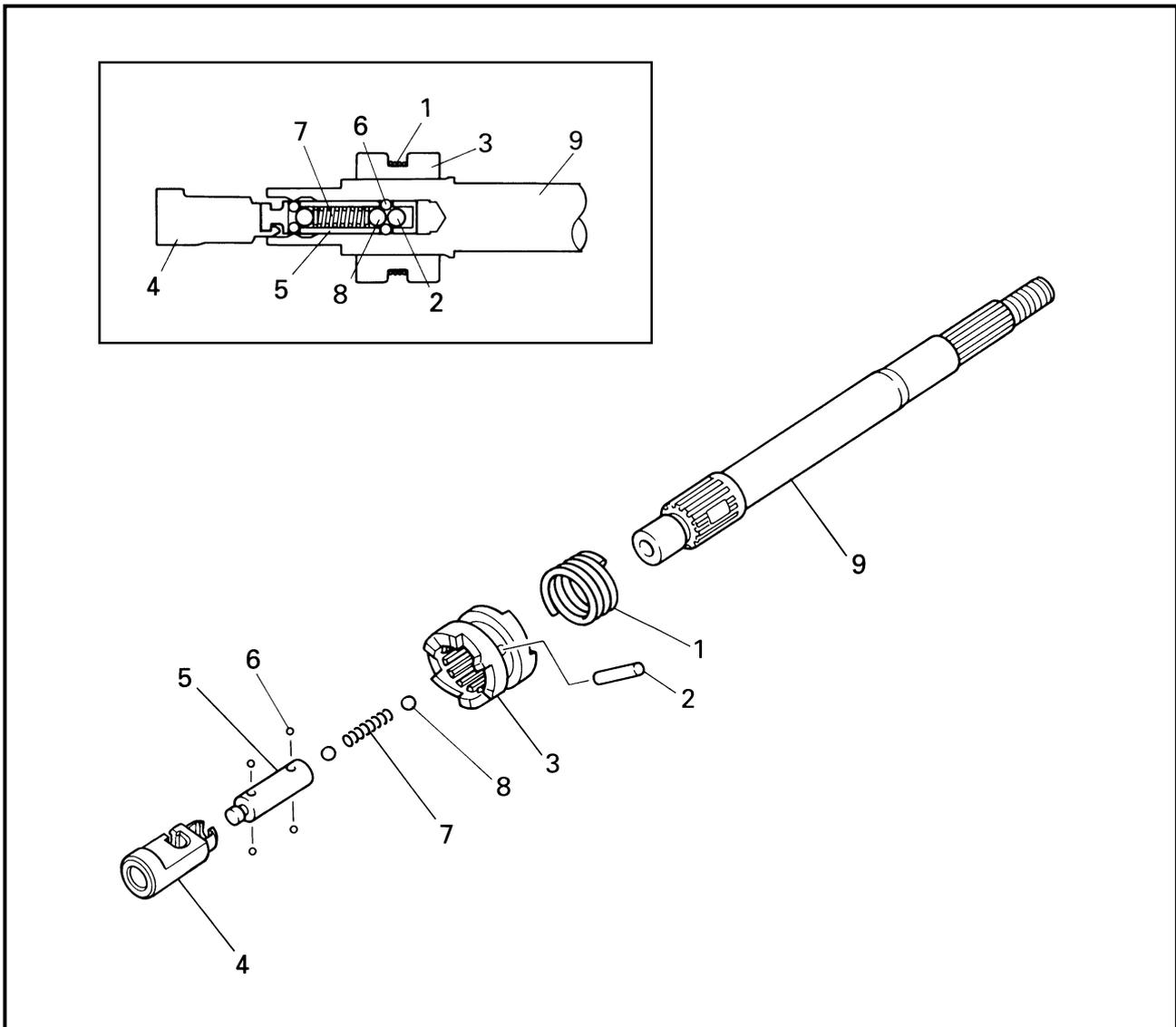
**DISASSEMBLING/ASSEMBLING THE PROPELLER SHAFT HOUSING**



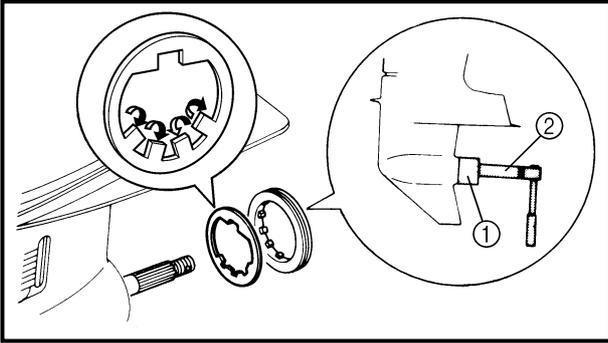
Order	Job/Part	Q'ty	Remarks
1	O-ring	1	
2	Reverse gear	1	
3	Thrust washer	1	
4	Ball bearing	1	
5	Oil seal	2	
6	Needle bearing	1	
7	Propeller shaft housing	1	
			For assembly, reverse the disassembly procedure.



DISASSEMBLING/ASSEMBLING THE PROPELLER SHAFT ASSEMBLY



Order	Job/Part	Q'ty	Remarks
1	Spring	1	For assembly, reverse the disassembly procedure.
2	Pin	1	
3	Dog clutch	1	
4	Shift rod joint	1	
5	Shift rod joint slider	1	
6	Ball	4	
7	Spring	1	
8	Ball	2	
9	Propeller shaft	1	

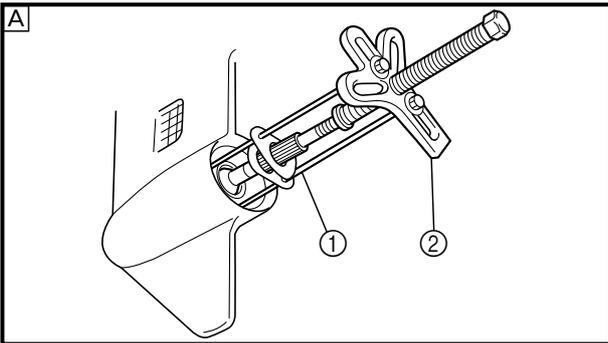


**REMOVING THE PROPELLER SHAFT HOUSING ASSEMBLY**

1. Straighten:
  - Claw washer tabs
2. Remove:
  - Ring nut
  - Claw washer



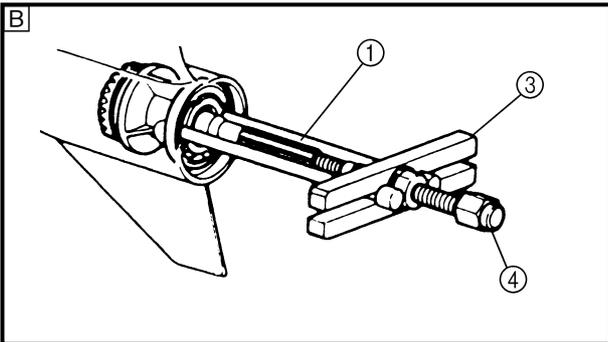
**Ring nut wrench** ..... ①  
**YB-34447 / 90890-06512**  
**Ring nut wrench extension** ..... ②  
**90890-06513**



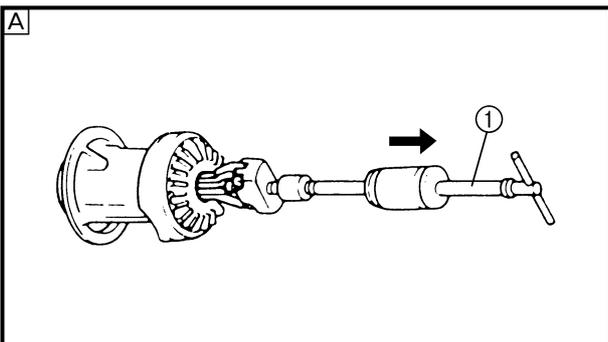
3. Remove:
  - Propeller shaft housing assembly
  - Straight key
  - Reverse gear shim(s)



**Propeller shaft housing puller** . ①  
**YB-06207 / 90890-06502**  
**Universal puller**..... ②  
**YB-06117**  
**Guide plate**..... ③  
**90890-06501**  
**Center bolt** ..... ④  
**90890-06504**



- A** For USA and Canada  
**B** For worldwide

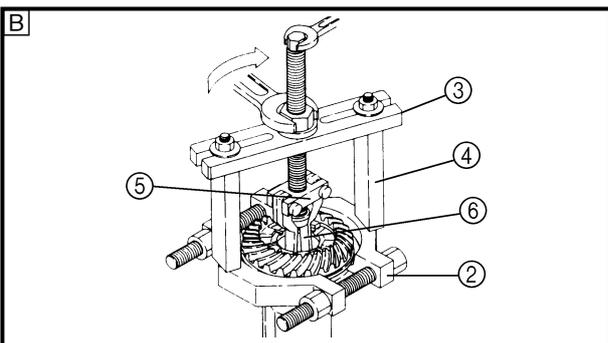


**DISASSEMBLING THE PROPELLER SHAFT HOUSING**

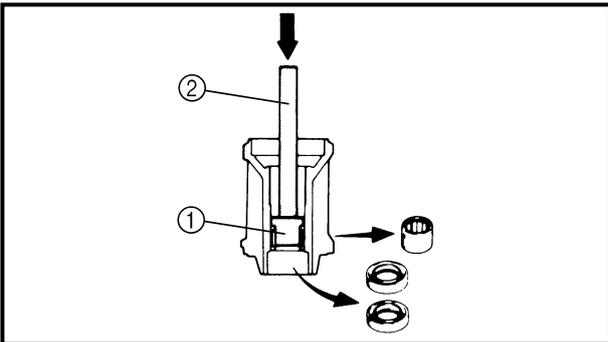
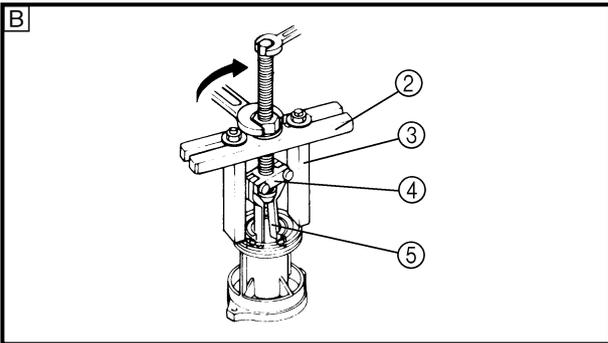
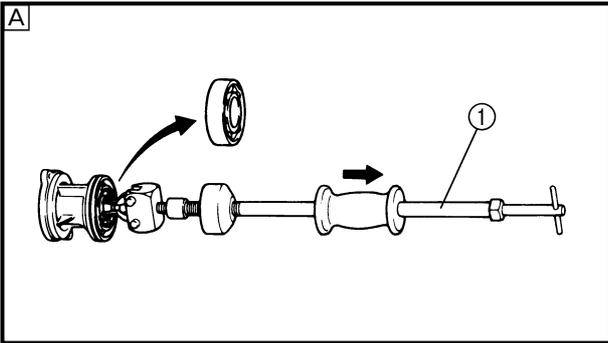
1. Remove:
  - Reverse gear



**Slide hammer**..... ①  
**YB-06096**  
**Bearing separator** ..... ②  
**90890-06534**  
**Guide plate**..... ③  
**90890-06501**  
**Guide plate stand** ..... ④  
**90890-06538**  
**Bearing puller**..... ⑤  
**90890-06535**  
**Small universal claws** ..... ⑥  
**90890-06536**



- A** For USA and Canada  
**B** For worldwide



2. Remove:
- Ball bearing

	<b>Slide hammer</b> ..... ① YB-06096
	<b>Guide plate</b> ..... ② 90890-06501
	<b>Guide plate stand</b> ..... ③ 90890-06538
	<b>Bearing puller</b> ..... ④ 90890-06535
	<b>Small universal claws</b> ..... ⑤ 90890-06536

- A** For USA and Canada  
**B** For worldwide

3. Remove:
- Oil seals
  - Needle bearing

	<b>Bearing/oil seal attachment</b> .... ① YB-06196 / 90890-06610
	<b>Driver rod</b> ..... ② YB-06071 / 90890-06652

**CHECKING THE REVERSE GEAR**

- Check:
- Teeth
  - Dogs
- Wear/damage → Replace the reverse gear.

**CHECKING THE BEARINGS**

- Check:
- Bearings
- Pitting/rumbling → Replace.

**CHECKING THE PROPELLER SHAFT HOUSING**

- Check:
- Propeller shaft housing
- Cracks/damage → Replace.



**CHECKING THE DOG CLUTCH**

Check:

- Dog clutch  
Damage/wear → Replace.

**CHECKING THE PROPELLER SHAFT**

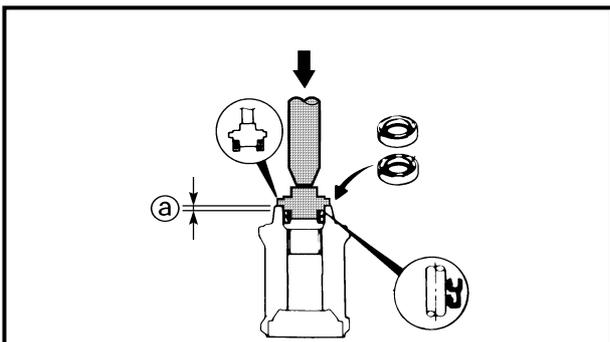
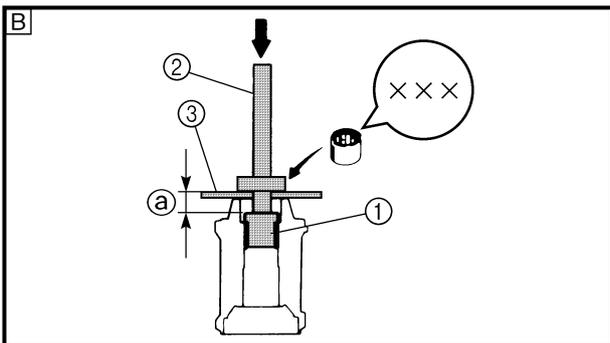
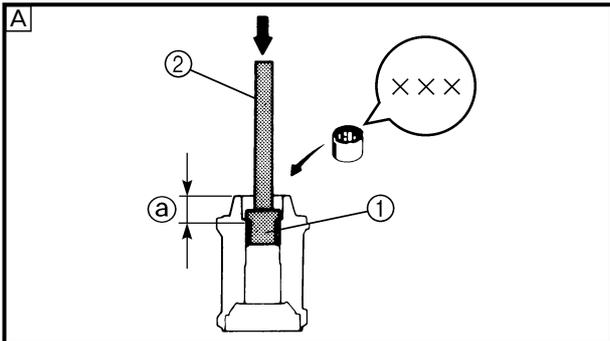
Check:

- Propeller shaft  
Damage/wear → Replace.

**ASSEMBLING THE PROPELLER  
SHAFT HOUSING**

1. Install:

- Needle bearing



	<b>Needle bearing installation position @</b> 24.75 - 25.25 mm (0.974 - 0.994 in)
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	<b>Bearing/oil seal attachment .... ①</b> YB-06196 / 90890-06610
	<b>Driver rod ..... ②</b> YB-06071 / 90890-06604
	<b>Bearing/oil seal depth plate .... ③</b> 90890-06603

- A For USA and Canada
- B For worldwide

2. Install:

- Oil seals

	<b>Oil seal installation position @</b> 4.75 - 5.25 mm (0.187 - 0.207 in)
--	--

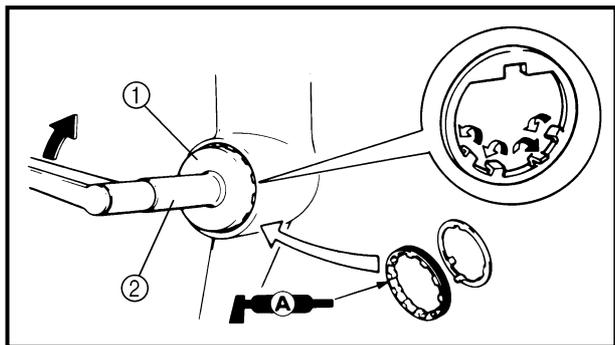
	<b>Bearing/oil seal attachment</b> YB-06195 / 90890-06633
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**LOWR**



## PROPELLER SHAFT HOUSING ASSEMBLY (REGULAR ROTATION MODELS)

E



### INSTALLING THE PROPELLER SHAFT HOUSING ASSEMBLY

Install:

- Reverse gear shim(s)
- Propeller shaft housing assembly
- Straight key
- Claw washer
- Ring nut



**Ring nut wrench** ..... ①  
**YB-34447 / 90890-06512**

**Ring nut wrench extension** ..... ②  
**90890-06513**



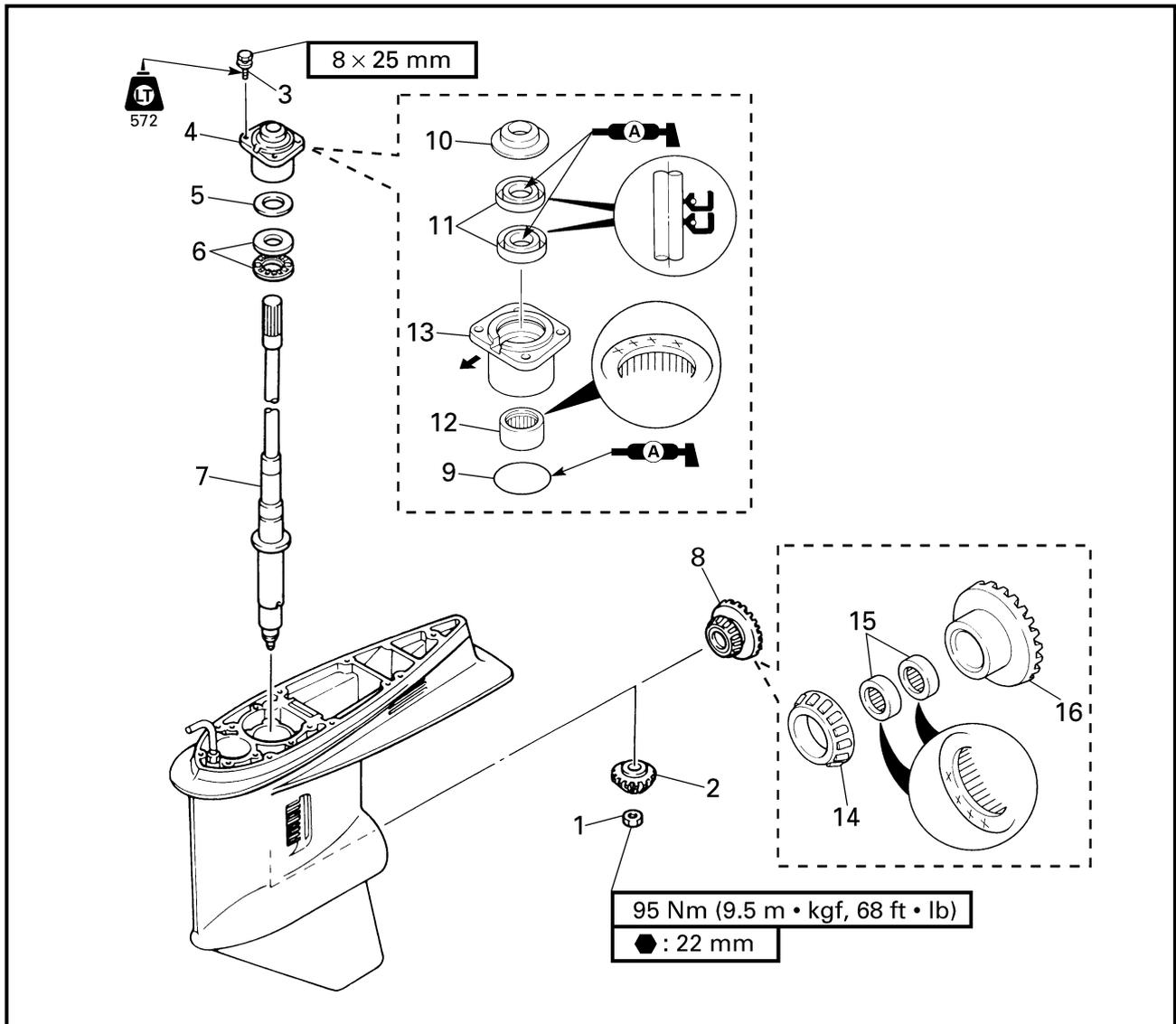
**Ring nut**  
**145 Nm (14.5 m • kgf, 105 ft • lb)**

#### NOTE:

To secure the ring nut, bend one claw washer tab into the slot in the ring nut and the other tabs toward the propeller shaft housing assembly.



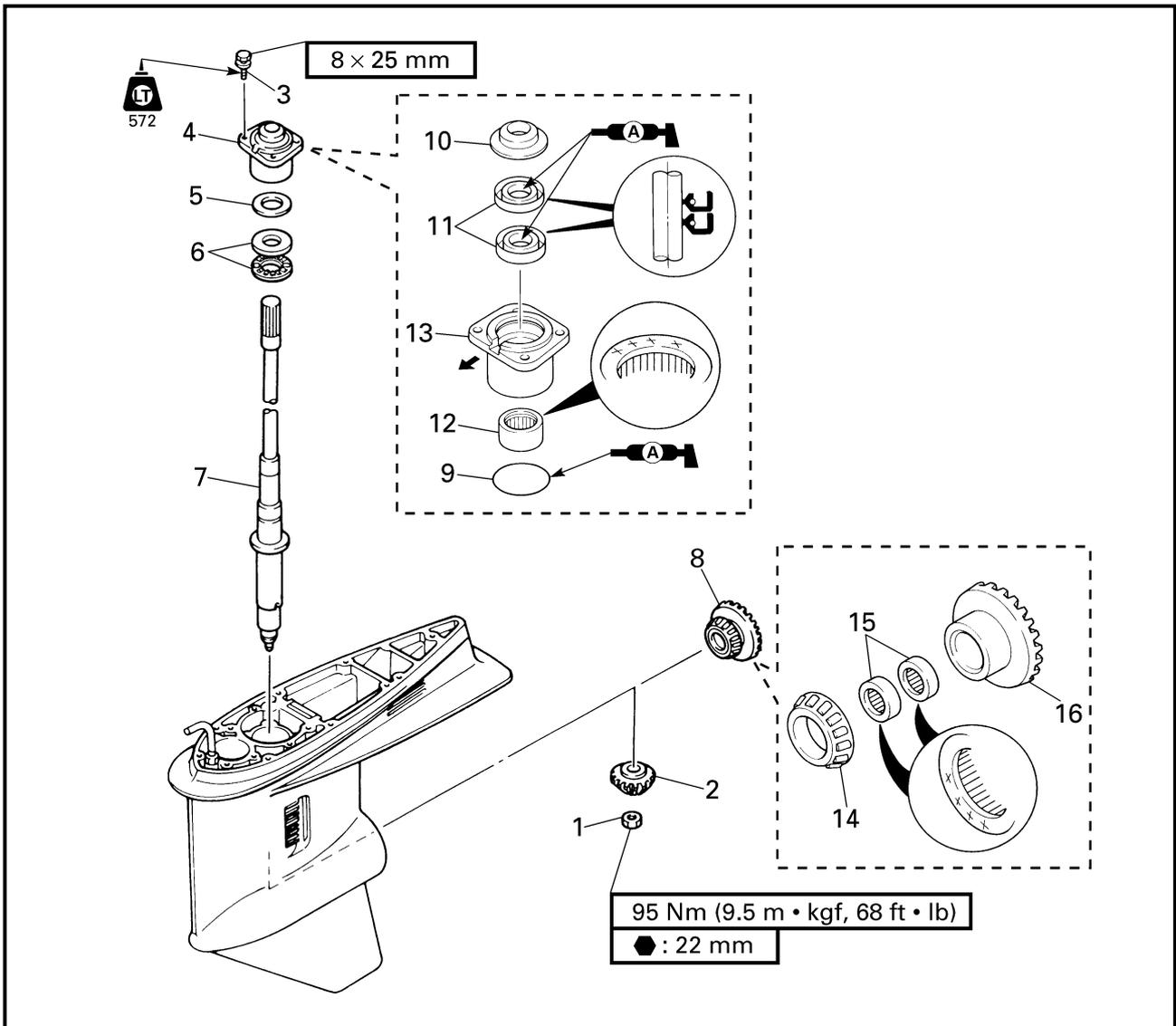
**DRIVE SHAFT (REGULAR ROTATION MODELS)  
REMOVING/INSTALLING THE DRIVE SHAFT**



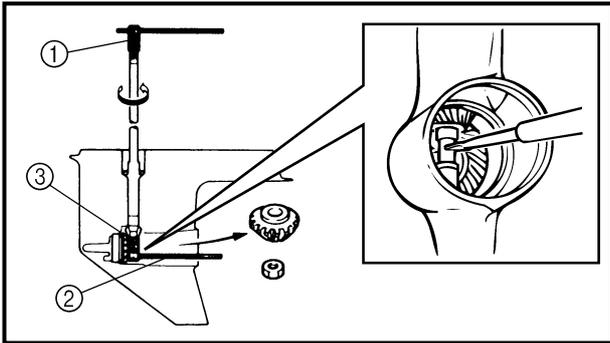
Order	Job/Part	Q'ty	Remarks
	Propeller shaft housing assembly		Refer to "PROPELLER SHAFT HOUSING ASSEMBLY (REGULAR ROTATION MODELS)" on page 6-11.
1	Pinion nut	1	
2	Pinion	1	
3	Bolt	4	
4	Drive shaft housing assembly	1	
5	Pinion shim	*	
6	Thrust bearing	1	
7	Drive shaft	1	

Continued on next page.

\*: As required



Order	Job/Part	Q'ty	Remarks
8	Forward gear assembly	1	
9	O-ring	1	
10	Oil seal cover	1	
11	Oil seal	2	
12	Needle bearing	1	
13	Drive shaft housing	1	
14	Tapered roller bearing	1	<b>Not reusable</b>
15	Needle bearing	2	
16	Forward gear	1	
			For installation, reverse the removal procedure.

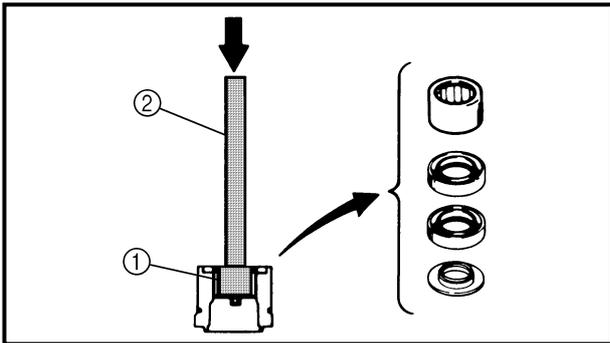


**REMOVING THE PINION**

Remove:

- Pinion nut
- Pinion

	<b>Drive shaft holder</b> ..... ① <b>YB-06201 / 90890-06520</b>
	<b>Pinion nut holder</b> ..... ② <b>90890-06505</b>
	<b>Pinion nut holder attachment</b> . ③ <b>90890-06508</b>

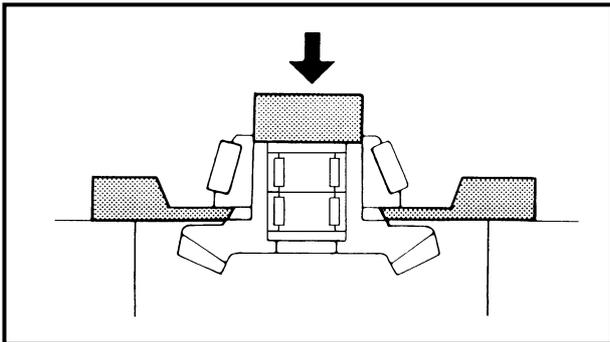


**DISASSEMBLING THE DRIVE SHAFT HOUSING ASSEMBLY**

Remove:

- Oil seals
- Needle bearing

	<b>Bearing/oil seal attachment</b> .... ① <b>YB-06196 / 90890-06610</b>
	<b>Driver rod</b> ..... ② <b>YB-06071 / 90890-06652</b>

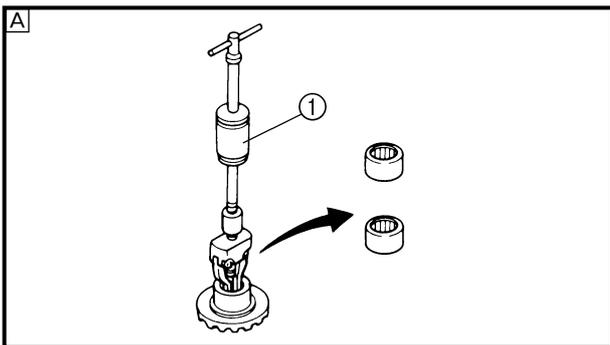


**DISASSEMBLING THE FORWARD GEAR ASSEMBLY**

1. Remove:

- Tapered roller bearing

	<b>Bearing separator</b> <b>YB-06219 / 90890-06534</b>
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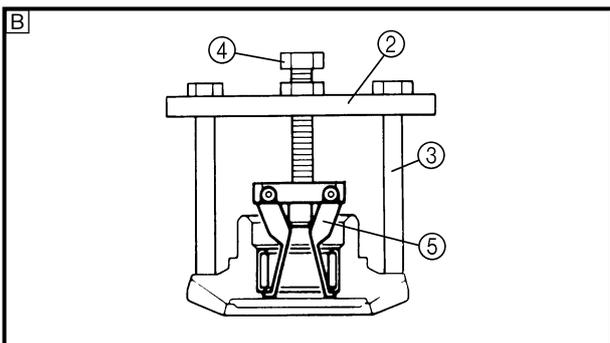


**CAUTION:** \_\_\_\_\_

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

2. Remove:

- Needle bearings



	<b>Slide hammer</b> ..... ① <b>YB-06096</b>
	<b>Guide plate</b> ..... ② <b>90890-06501</b>
	<b>Guide plate stand</b> ..... ③ <b>90890-06538</b>
	<b>Bearing puller</b> ..... ④ <b>90890-06535</b>
	<b>Small universal claws</b> ..... ⑤ <b>90890-06536</b>

**A** For USA and Canada

**B** For worldwide



**CHECKING THE PINION**

Check:

- Teeth

Damage/wear → Replace.

**CHECKING THE DRIVE SHAFT**

Check:

- Drive shaft

Damage/wear → Replace.

**CHECKING THE DRIVE SHAFT HOUSING**

Check:

- Drive shaft housing

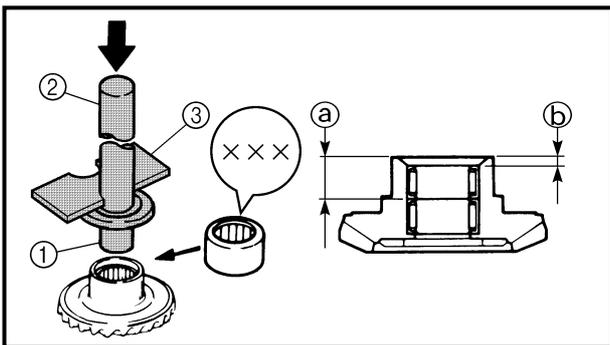
Cracks/damage → Replace.

**CHECKING THE BEARINGS**

Check:

- Bearings

Pitting/rumbling → Replace.



**ASSEMBLING THE FORWARD GEAR ASSEMBLY**

1. Install:

- Needle bearings

	<p><b>Needle bearing installation position ①</b>                  21.0 - 21.4 mm (0.827 - 0.843 in)  <b>Needle bearing installation position ②</b>                  4.5 - 4.9 mm (0.177 - 0.193 in)</p>
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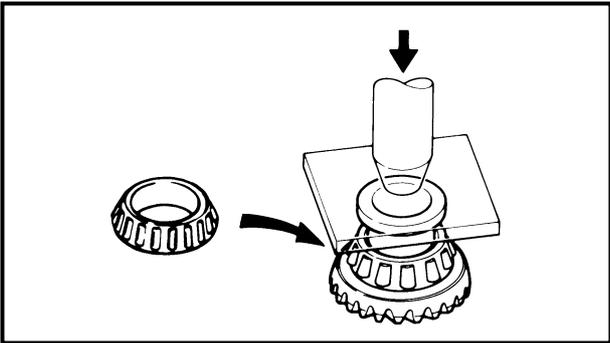
	<p><b>Bearing/oil seal attachment .... ①</b>                  YB-06200 / 90890-06612  <b>Driver rod ..... ②</b>                  YB-06071 / 90890-06604  <b>Bearing/oil seal depth plate .... ③</b>                  90890-06603</p>
--	--

LOWR



# DRIVE SHAFT (REGULAR ROTATION MODELS)

E

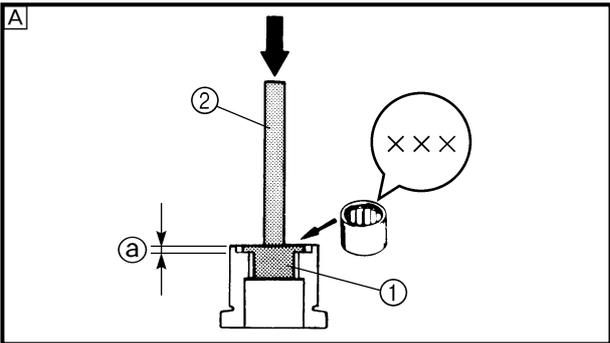


2. Install:

- Tapered roller bearing



**Bearing/oil seal attachment**  
90890-06659



## ASSEMBLING THE DRIVE SHAFT HOUSING ASSEMBLY

1. Install:

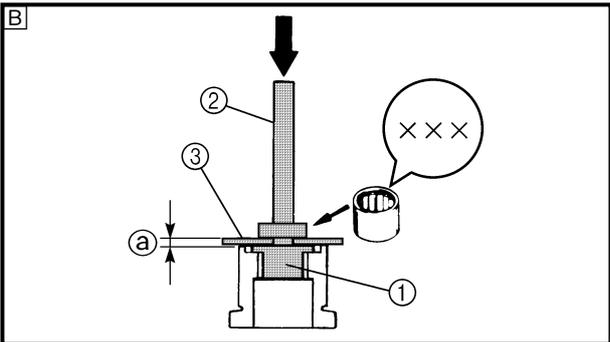
- Needle bearing



**Position ①**  
5.75 - 6.25 mm (0.226 - 0.246 in)

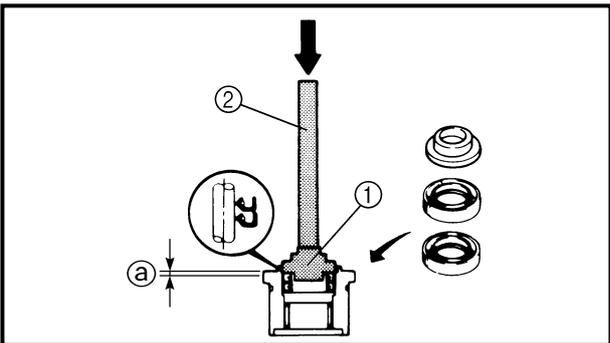


**Bearing/oil seal attachment .... ①**  
YB-06196 / 90890-06610  
**Driver rod ..... ②**  
YB-06071 / 90890-06604  
**Bearing/oil seal depth plate .... ③**  
90890-06603



A For USA and Canada

B For worldwide



2. Install:

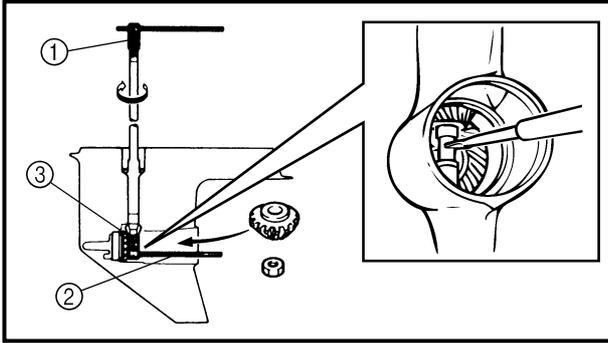
- Oil seals



**Oil seal installation position ①**  
0.25 - 0.75 mm (0.010 - 0.030 in)



**Bearing/oil seal attachment .... ①**  
YB-06195 / 90890-06633  
**Driver rod ..... ②**  
YB-06071 / 90890-06652



**INSTALLING THE PINION**

Install:

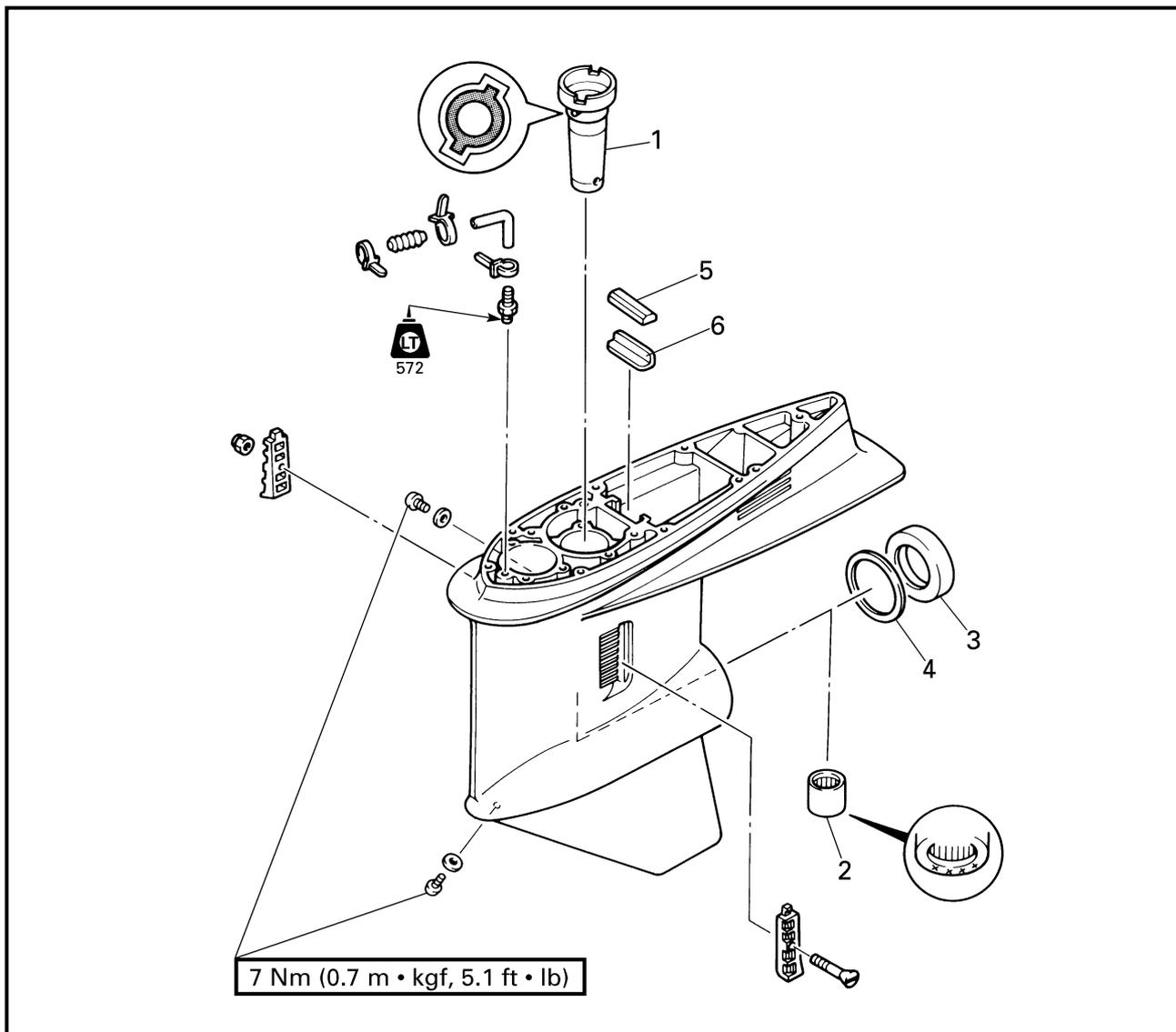
- Pinion
- Pinion nut

	<b>Drive shaft holder</b> ..... ① <b>YB-06201 / 90890-06520</b>
	<b>Pinion nut holder</b> ..... ② <b>90890-06505</b>
	<b>Pinion nut holder attachment</b> . ③ <b>90890-06508</b>

	<b>Pinion nut</b> <b>95 Nm (9.5 m • kgf, 68 ft • lb)</b>
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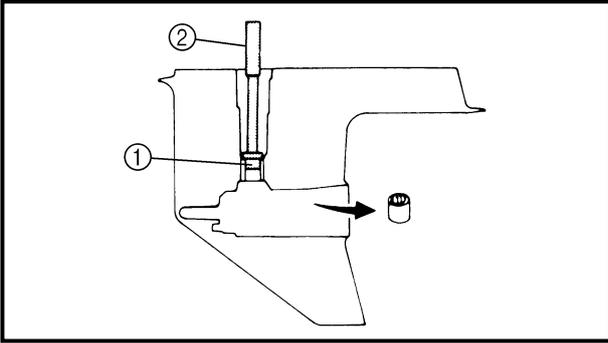


**LOWER CASE ASSEMBLY (REGULAR ROTATION MODELS)  
DISASSEMBLING/ASSEMBLING THE LOWER CASE ASSEMBLY**



Order	Job/Part	Q'ty	Remarks
	Forward gear		Refer to "DRIVE SHAFT (REGULAR ROTATION MODELS)" on page 6-19.
1	Drive shaft sleeve	1	
2	Needle bearing	1	
3	Tapered roller bearing outer race	1	
4	Forward gear shim	*	
5	Water seal	1	
6	Water seal seat	1	
			For assembly, reverse the disassembly procedure.

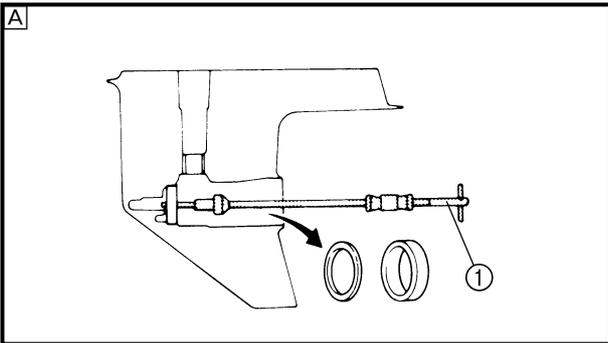
\*: As required



**DISASSEMBLING THE LOWER CASE ASSEMBLY**

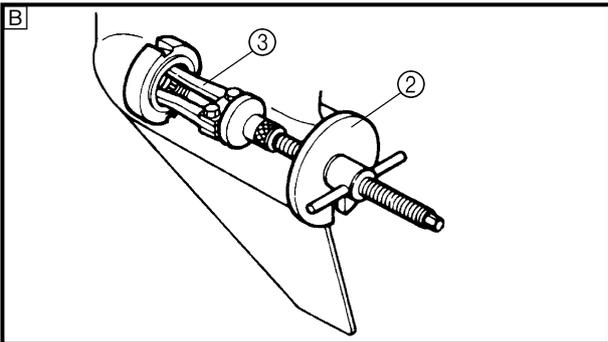
1. Remove:
- Needle bearing

	<b>Bearing/oil seal attachment ....</b> ①
	<b>YB-06194 / 90890-06636</b>
	<b>Driver rod .....</b> ②
	<b>YB-06071 / 90890-06605</b>



2. Remove:
- Tapered roller bearing outer race
  - Forward gear shim(s)

	<b>Slide hammer.....</b> ①
	<b>YB-06096</b>
	<b>Bearing puller.....</b> ②
	<b>90890-06523</b>
	<b>Large universal claws.....</b> ③
	<b>90890-06532</b>



- A** For USA and Canada  
**B** For worldwide

**CHECKING THE DRIVE SHAFT SLEEVE**

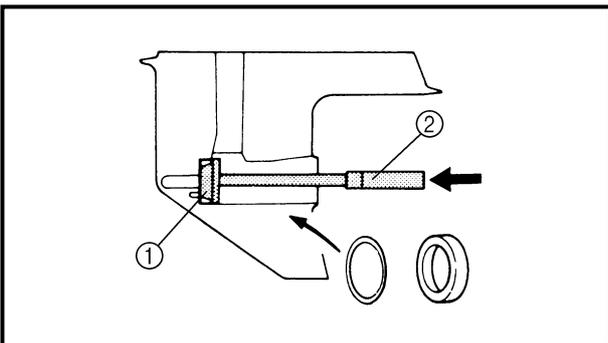
- Check:
- Drive shaft sleeve
- Damage/wear → Replace.

**CHECKING THE NEEDLE BEARING**

- Check:
- Needle bearing
- Pitting/rumbling → Replace.

**ASSEMBLING THE LOWER CASE ASSEMBLY**

1. Install:
- Forward gear shim(s)
  - Tapered roller bearing outer race



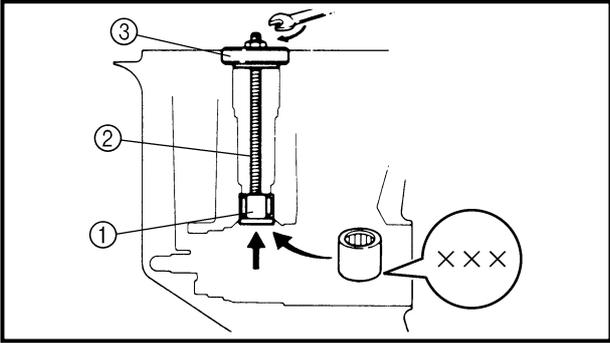
	<b>Bearing/oil seal attachment ....</b> ①
	<b>YB-06258 / 90890-06619</b>
	<b>Driver rod .....</b> ②
	<b>YB-06071 / 90890-06605</b>

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**LOWER CASE ASSEMBLY  
(REGULAR ROTATION MODELS)**

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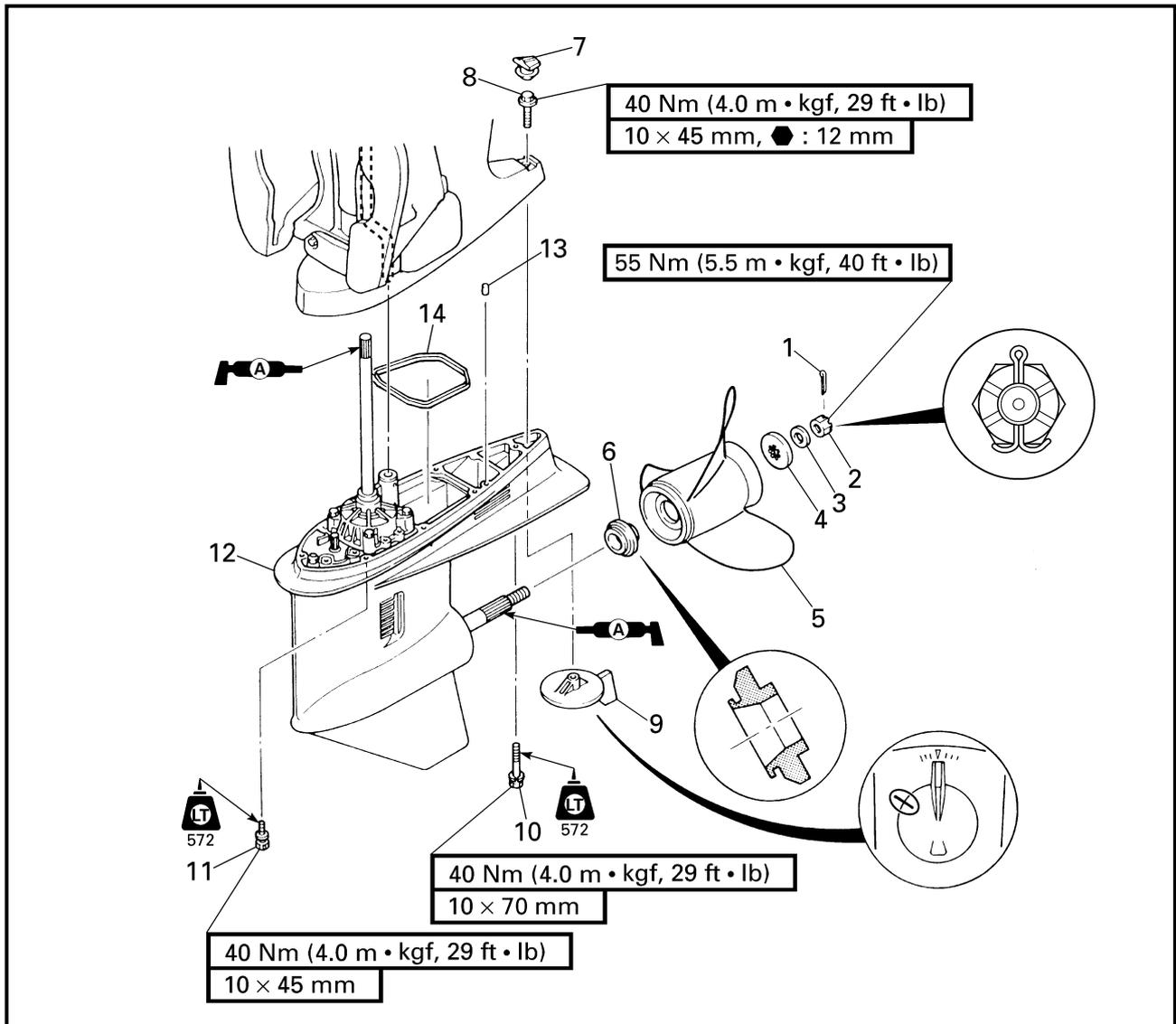
2. Install:
- Needle bearing



- |  |   |
|--|---|
| <b>Bearing/oil seal attachment ....</b>            | ① |
| <b>YB-06246 / 90890-06636</b>                      |   |
| <b>Bearing puller.....</b>                         | ② |
| <b>YB-06029 / 90890-06523</b>                      |   |
| <b>Needle bearing installation<br/>plate .....</b> | ③ |
| <b>YB-06247</b>                                    |   |

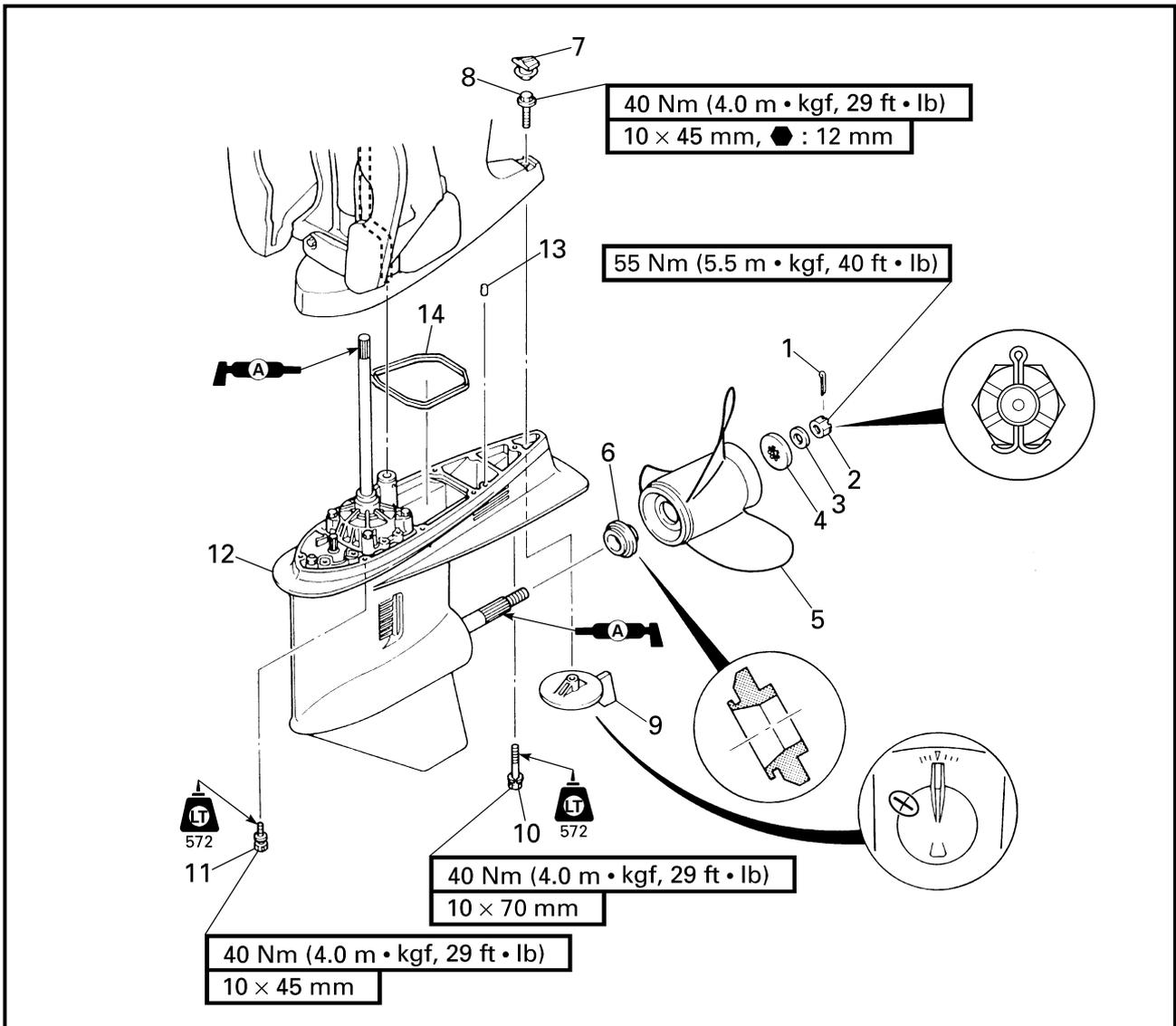


**LOWER UNIT (COUNTER ROTATION MODELS)  
REMOVING/INSTALLING THE LOWER UNIT**

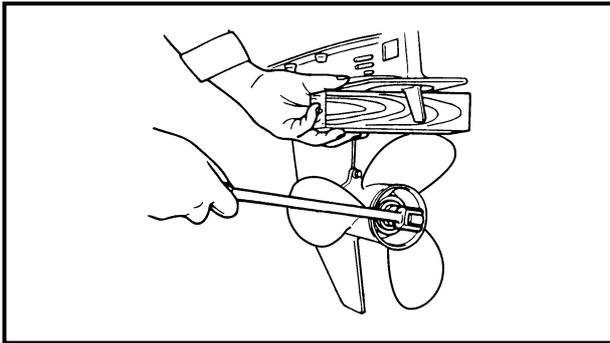


Order	Job/Part	Q'ty	Remarks
1	Cotter pin	1	
2	Propeller nut	1	
3	Washer	1	
4	Washer	1	
5	Propeller	1	
6	Spacer	1	
7	Cap	1	

Continued on next page.



Order	Job/Part	Q'ty	Remarks
8	Bolt	1	For installation, reverse the removal procedure.
9	Trim tab	1	
10	Bolt	1	
11	Bolt	6	
12	Lower unit	1	
13	Dowel pin	2	
14	Exhaust seal	1	



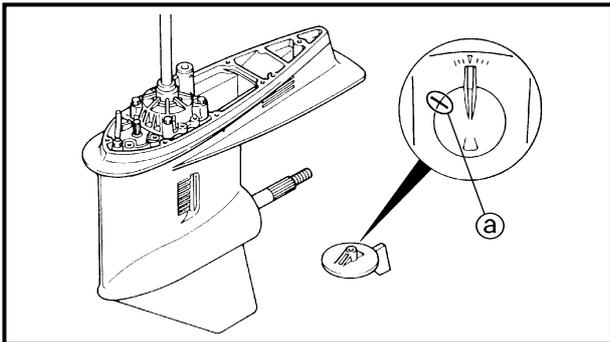
### REMOVING THE PROPELLER

Remove:

- Propeller nut

#### ⚠ WARNING

Do not hold the propeller with your hands when removing or installing it. Be sure to remove the battery leads from the batteries and the lanyard engine stop switch. Put a block of wood between the cavitation plate and propeller to keep the propeller from turning.



### REMOVING THE TRIM TAB

Remove:

- Trim tab

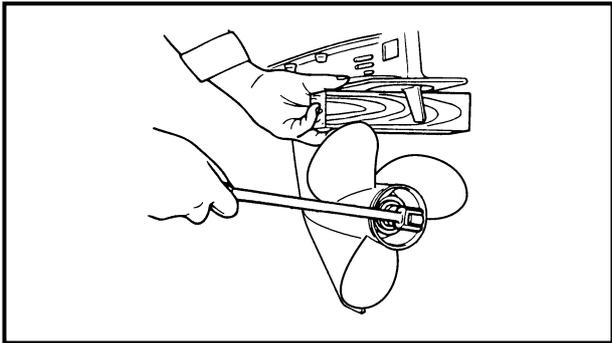
#### NOTE:

Mark the original position (a) for proper installation.

### CHECKING THE PROPELLER

Check:

- Blades
  - Splines
- Cracks/damage/wear → Replace.

**INSTALLING THE PROPELLER**

Install:

- Propeller nut

**Propeller nut**  
55 Nm (5.5 m • kgf, 40 ft • lb)**⚠ WARNING**

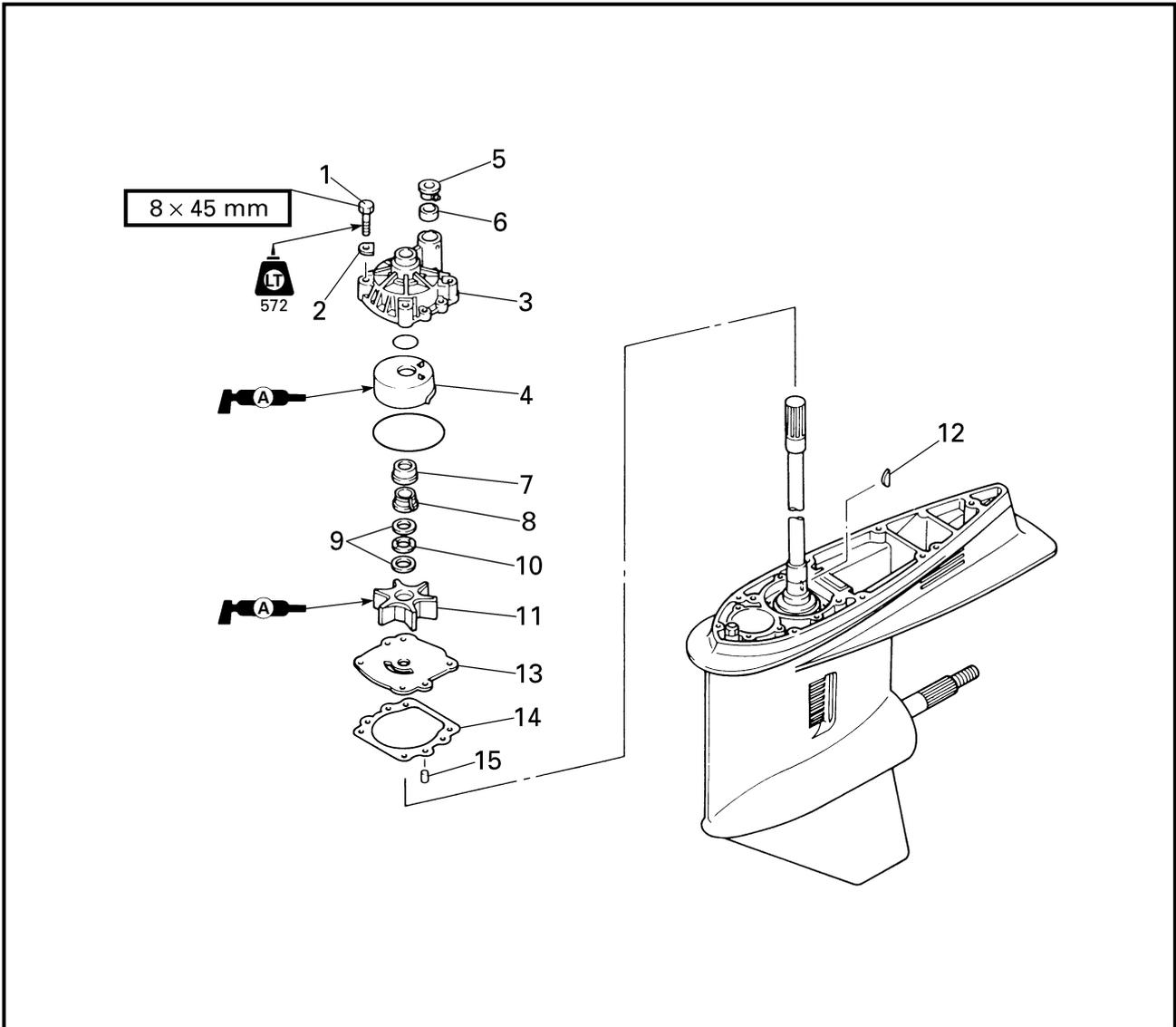
Do not hold the propeller with your hands when removing or installing it. Be sure to remove the battery leads from the batteries and the lanyard engine stop switch. Put a block of wood between the cavitation plate and propeller to keep the propeller from turning.

**NOTE:**

If the groove in the propeller nut is not aligned with the cotter pin hole, tighten the nut further until they are aligned.

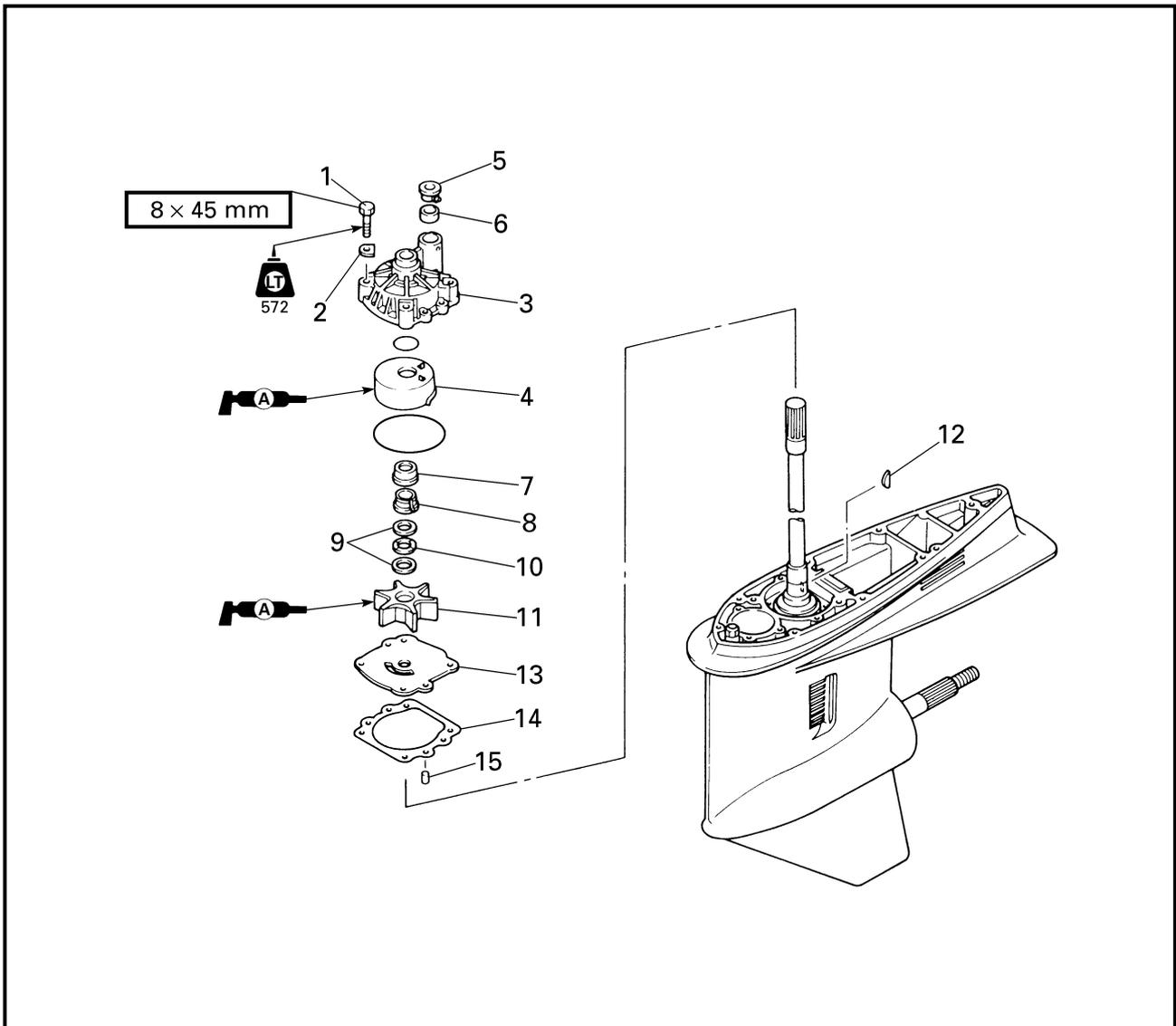


**WATER PUMP (COUNTER ROTATION MODELS)  
REMOVING/INSTALLING THE WATER PUMP**



Order	Job/Part	Q'ty	Remarks
	Lower unit		Refer to "LOWER UNIT (COUNTER ROTATION MODELS)" on page 6-28.
1	Bolt	4	
2	Plate washer	4	
3	Impeller housing	1	
4	Impeller housing cup	1	
5	Grommet	1	
6	Spacer	1	
7	Collar	1	

Continued on next page.



Order	Job/Part	Q'ty	Remarks
8	Spacer	1	
9	Washer	2	
10	Wave washer	1	
11	Impeller	1	
12	Woodruff key	1	
13	Impeller plate	1	
14	Gasket	1	<b>Not reusable</b>
15	Dowel pin	2	

For installation, reverse the removal procedure.



**CHECKING THE IMPELLER HOUSING**

Check:

- Impeller housing  
Cracks/damage → Replace.

**CHECKING THE IMPELLER AND IMPELLER HOUSING CUP**

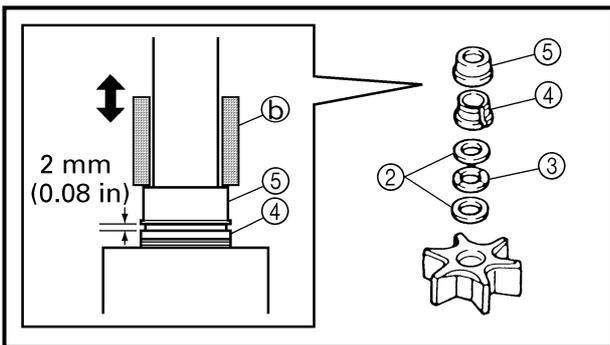
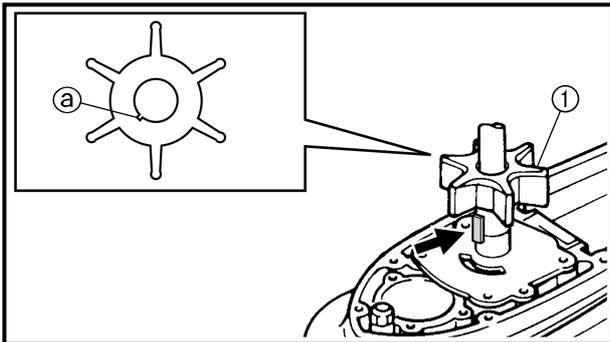
Check:

- Impeller
- Impeller housing cup  
Cracks/damage → Replace any defective parts.

**CHECKING THE WOODRUFF KEY**

Check:

- Woodruff key  
Damage/wear → Replace.



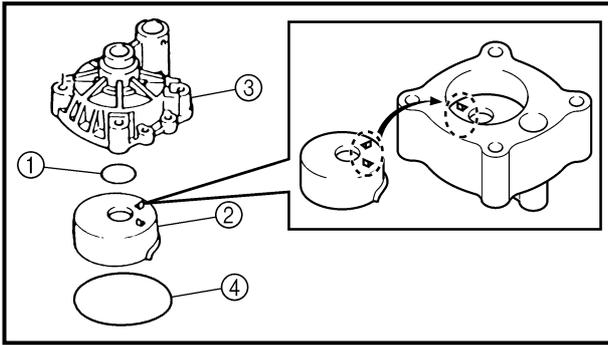
**INSTALLING THE IMPELLER AND IMPELLER HOUSING**

1. Install:

- Impeller ①
- Washers ②
- Wave washer ③
- Spacer ④
- Collar ⑤

**NOTE:**

- Make sure that the slit ① in the impeller is aligned with the woodruff key.
- The collar and spacer should fit together firmly.
- Install the collar with some appropriate tool inside diameter  $\varnothing 23 - 23.5$  mm ② that fits over the drive shaft as shown.



## 2. Install:

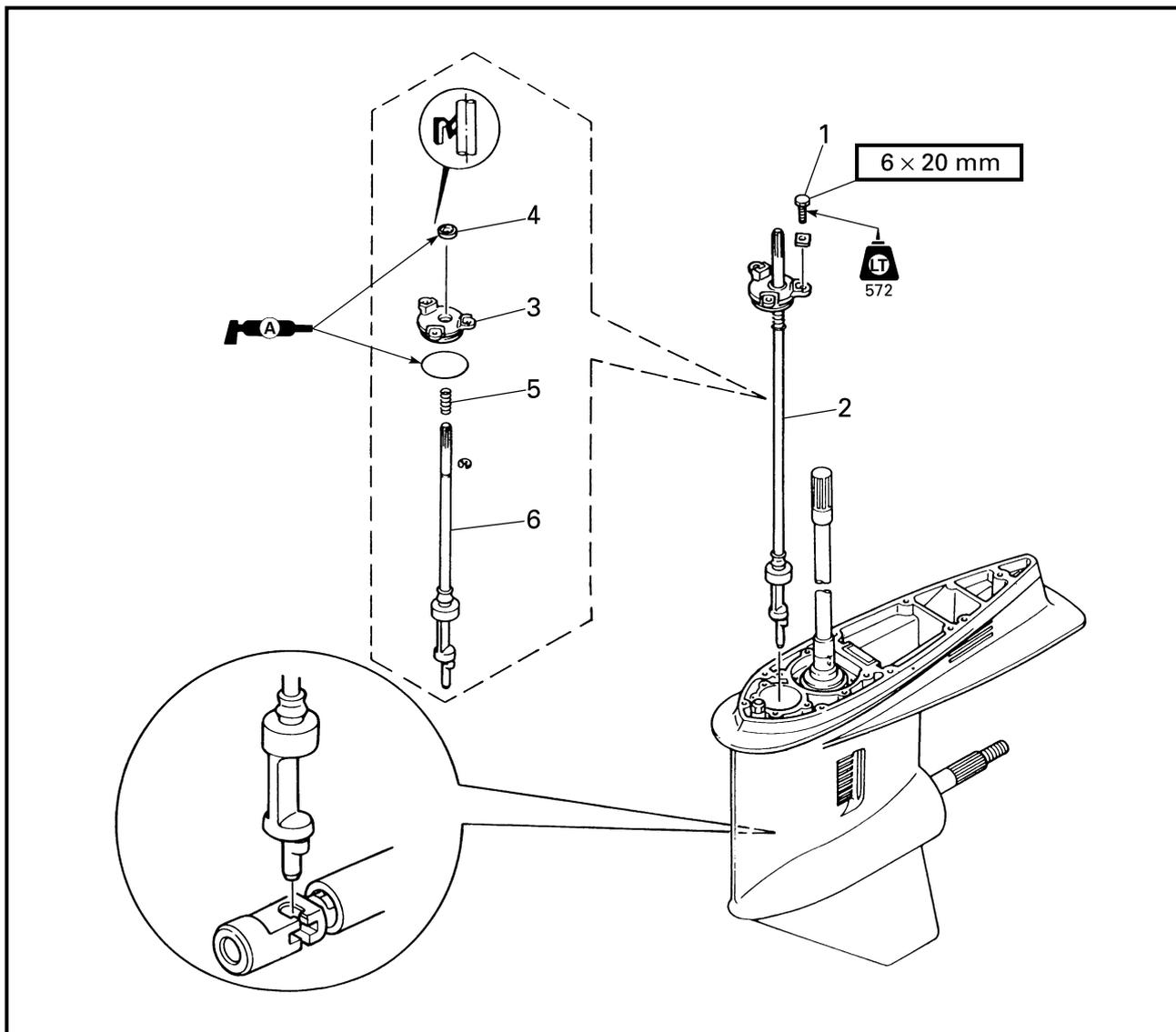
- O-ring ①
- Impeller housing cup ②
- Impeller housing ③
- O-ring ④

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

- When installing the impeller housing cup, align its projection with the hole in the impeller housing.
- When installing the water pump housing, turn the drive shaft clockwise.



**SHIFT ROD ASSEMBLY (COUNTER ROTATION MODELS)  
REMOVING/INSTALLING THE SHIFT ROD ASSEMBLY**



Order	Job/Part	Q'ty	Remarks
	Impeller plate		Refer to "WATER PUMP (COUNTER ROTATION MODELS)" on page 6-32.
1	Bolt (with plate washer)	3	
2	Shift rod assembly	1	
3	Oil seal housing	1	
4	Oil seal	1	
5	Spring	1	
6	Shift rod	1	
			For installation, reverse the removal procedure.



## SHIFT ROD ASSEMBLY (COUNTER ROTATION MODELS)

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### REMOVING THE SHIFT ROD ASSEMBLY

Remove:

- Shift rod assembly

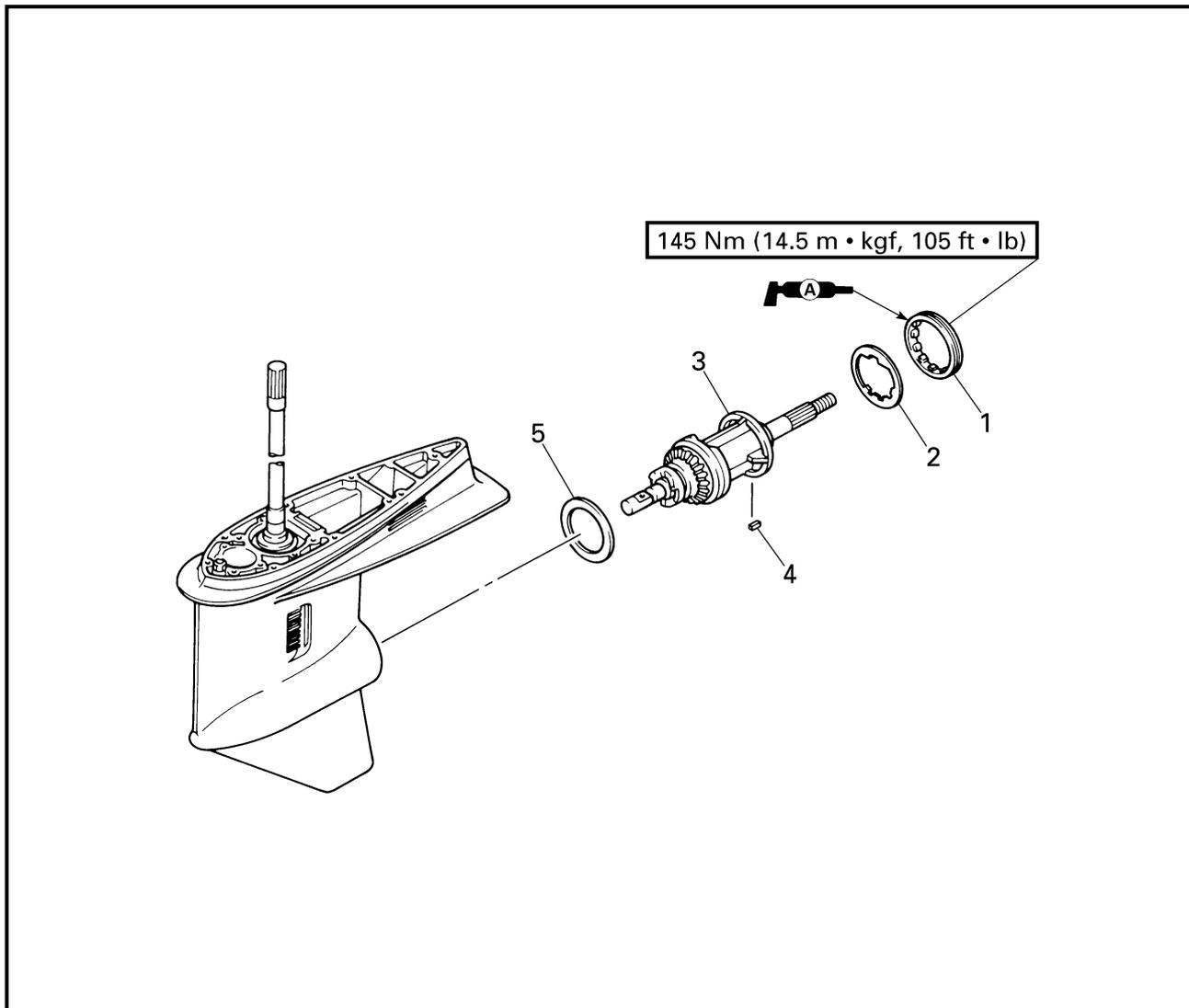
**NOTE:** \_\_\_\_\_

Remove the shift rod assembly when the shift rod is in the neutral position.

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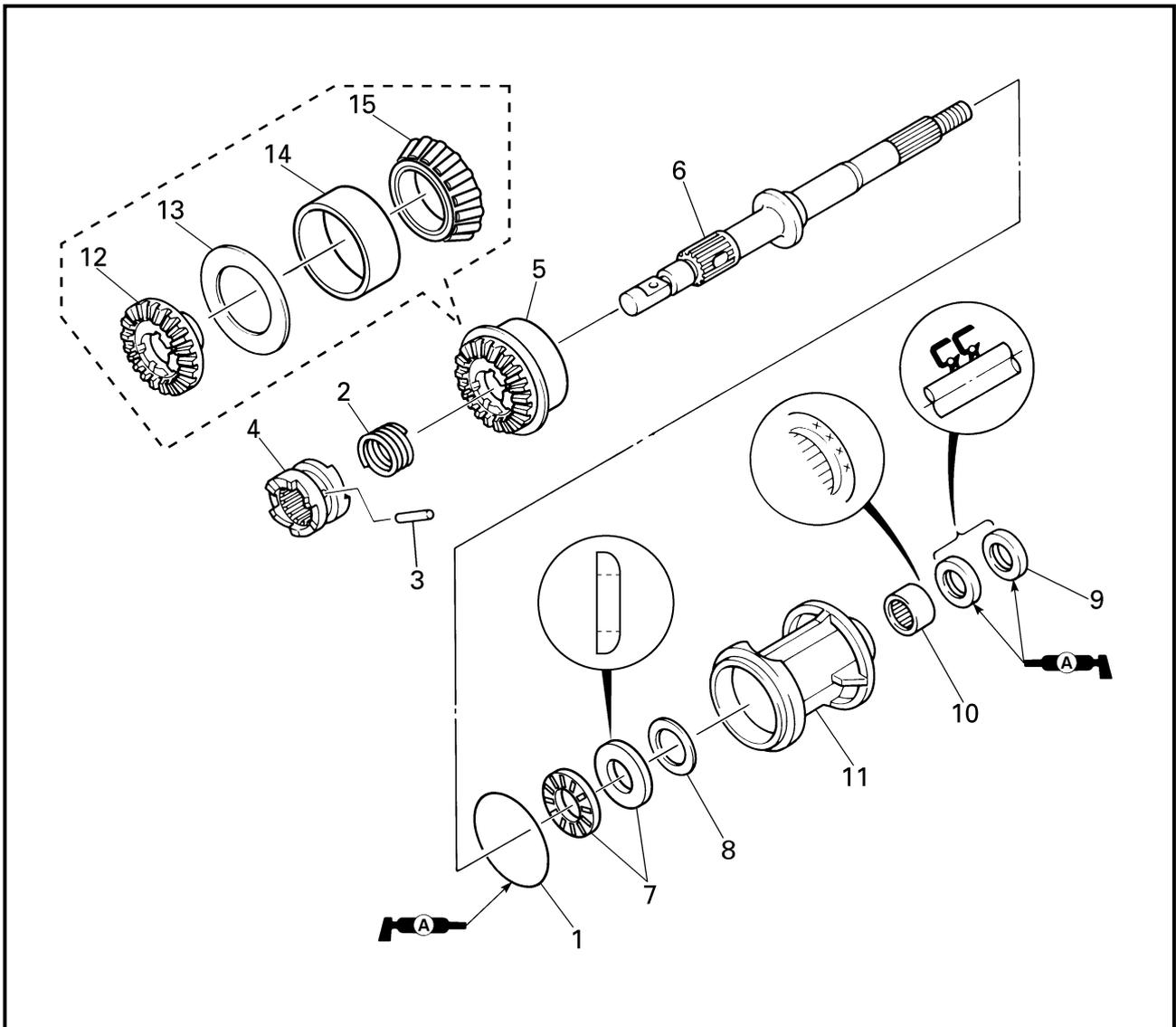
**PROPELLER SHAFT HOUSING ASSEMBLY  
(COUNTER ROTATION MODELS)  
REMOVING/INSTALLING THE PROPELLER SHAFT HOUSING ASSEMBLY**



Order	Job/Part	Q'ty	Remarks
	Gear oil		Refer to "CHANGING AND CHECKING THE GEAR OIL" on page 3-17.
	Shift rod assembly		Refer to "SHIFT ROD ASSEMBLY (COUNTER ROTATION MODELS)" on page 6-36.
1	Ring nut	1	
2	Claw washer	1	
3	Propeller shaft housing assembly	1	
4	Straight key	1	
5	Forward gear shim	*	
			For installation, reverse the removal procedure.

\*: As required

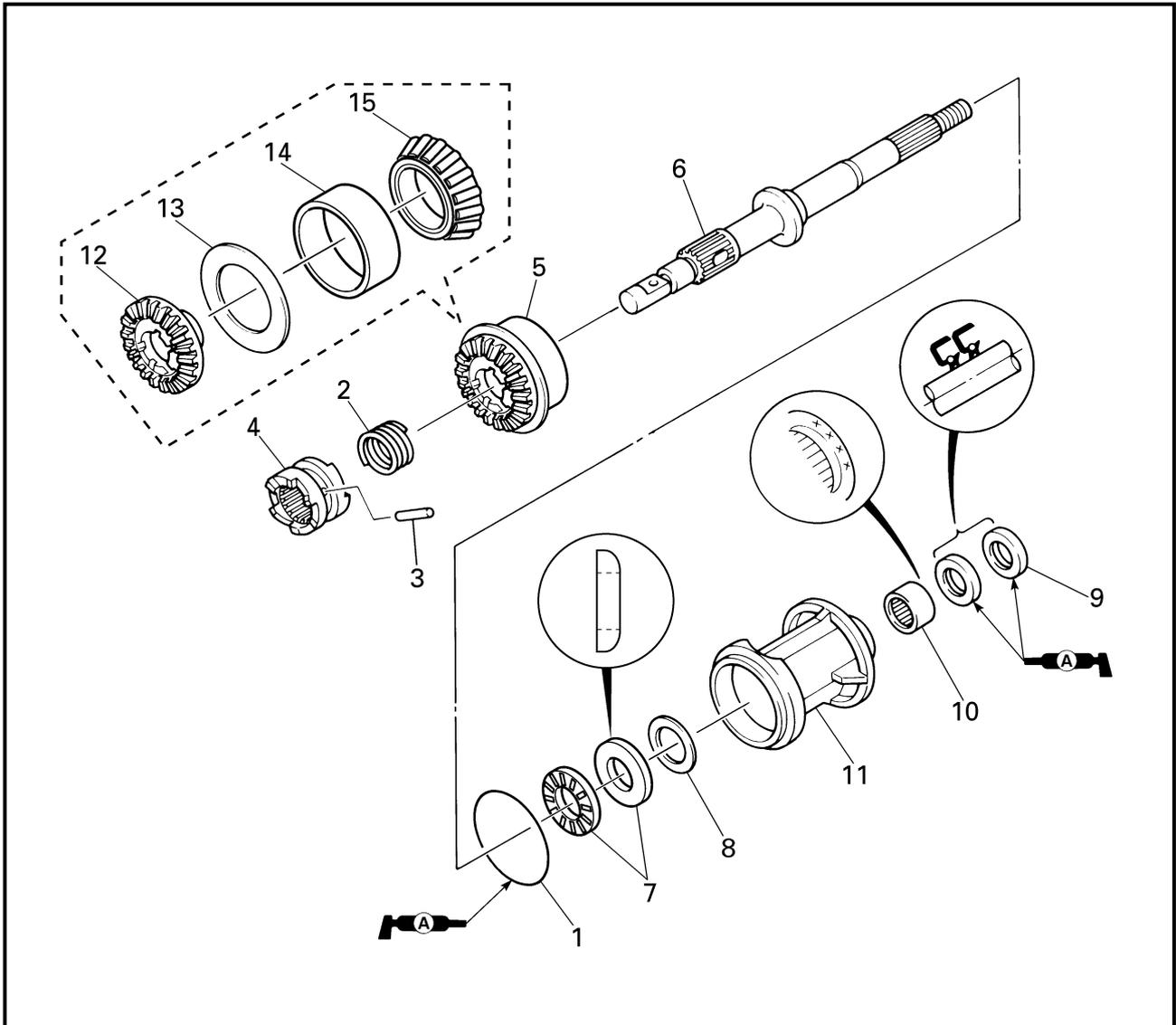
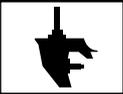
**DISASSEMBLING/ASSEMBLING THE PROPELLER SHAFT HOUSING ASSEMBLY**



Order	Job/Part	Q'ty	Remarks
1	O-ring	1	
2	Spring	1	
3	Pin	1	
4	Dog clutch	1	
5	Forward gear assembly	1	
6	Propeller shaft assembly	1	
7	Thrust bearing	1	
8	Propeller shaft shim	*	

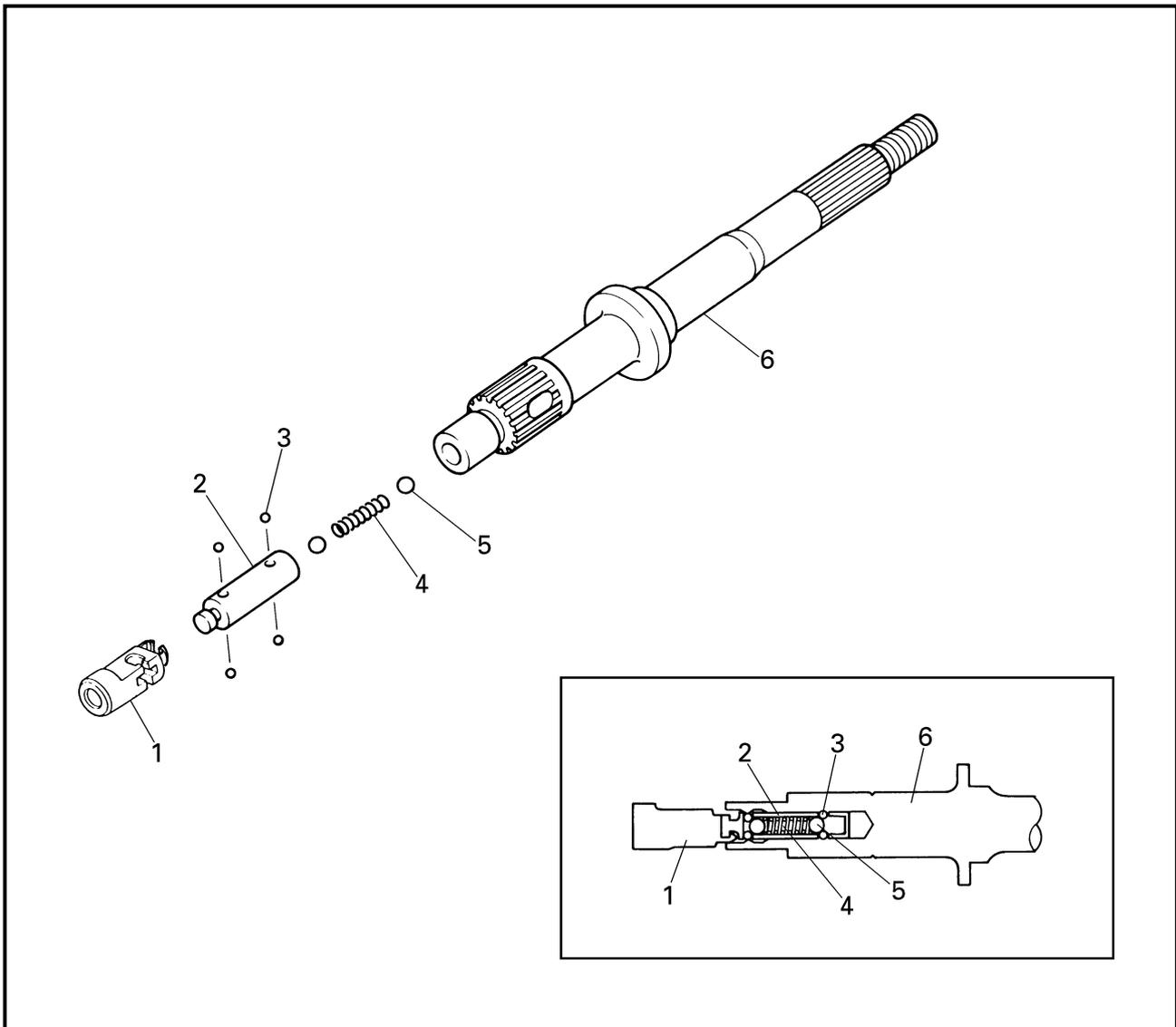
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\*: As required



Order	Job/Part	Q'ty	Remarks
9	Oil seal	2	
10	Needle bearing	1	
11	Propeller shaft housing	1	
12	Forward gear	1	
13	Thrust washer	1	
14	Tapered roller bearing outer race	1	
15	Tapered roller bearing	1	<b>Not reusable</b> For assembly, reverse the disassembly procedure.

**DISASSEMBLING/ASSEMBLING THE PROPELLER SHAFT ASSEMBLY**



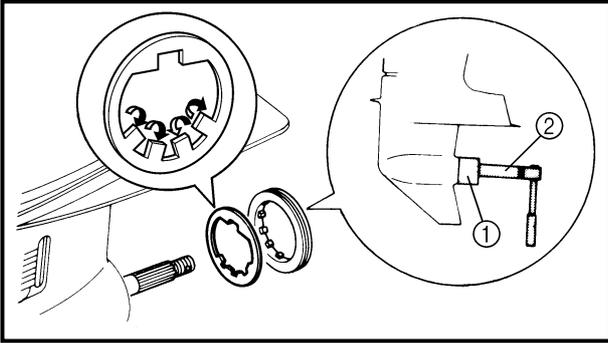
Order	Job/Part	Q'ty	Remarks
1	Shift rod joint	1	For assembly, reverse the disassembly procedure.
2	Shift rod joint slider	1	
3	Ball	4	
4	Spring	1	
5	Ball	2	
6	Propeller shaft	1	

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# PROPELLER SHAFT HOUSING ASSEMBLY (COUNTER ROTATION MODELS)

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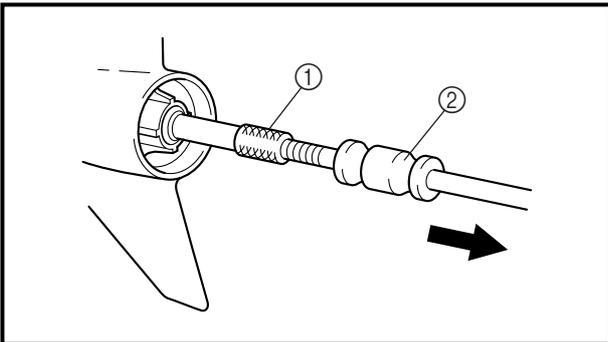


## REMOVING THE PROPELLER SHAFT HOUSING ASSEMBLY

1. Straighten:
  - Claw washer tabs
2. Remove:
  - Ring nut
  - Claw washer



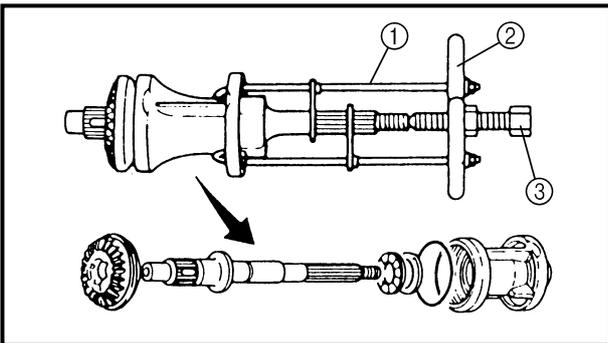
- Ring nut wrench ..... ①  
YB-34447 / 90890-06512
- Ring nut wrench extension ..... ②  
90890-06513



3. Remove:
  - Propeller shaft housing assembly
  - Straight key
  - Forward gear shim(s)



- Slide hammer attachment..... ①  
YB-06335 / 90890-06514
- Slide hammer..... ②  
YB-06096 / 90890-06531

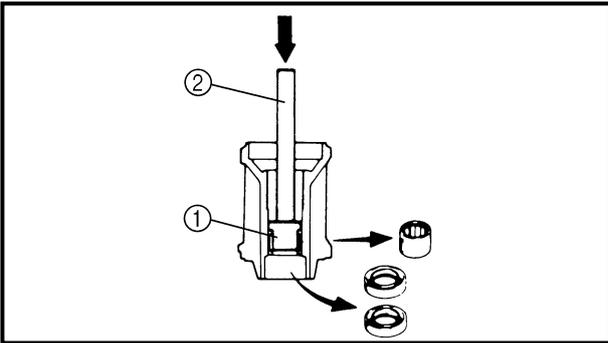


## REMOVING THE PROPELLER SHAFT ASSEMBLY

- Remove:
- Propeller shaft assembly
  - Forward gear assembly



- Propeller shaft housing puller . ①  
YB-06207 / 90890-06502
- Universal puller..... ②  
YB-06117
- Guide plate..... ②  
90890-06501
- Center bolt ..... ③  
90890-06504



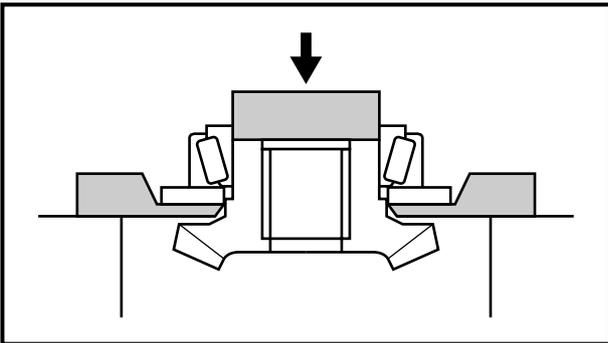
**DISASSEMBLING THE PROPELLER  
SHAFT HOUSING ASSEMBLY**

Remove:

- Oil seals
- Needle bearing



**Bearing/oil seal attachment .... ①**  
**YB-06196 / 90890-06653**  
**Driver rod ..... ②**  
**YB-06071 / 90890-06652**



**DISASSEMBLING THE FORWARD  
GEAR ASSEMBLY**

Remove:

- Tapered roller bearing



**Bearing separator**  
**YB-06219 / 90890-06534**

**CAUTION:**

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

**CHECKING THE FORWARD GEAR**

Check:

- Teeth
  - Dogs
- Damage/wear → Replace.

**CHECKING THE BEARINGS**

Check:

- Bearings
- Pitting/rumbling → Replace.

**CHECKING THE PROPELLER SHAFT  
HOUSING**

Check:

- Propeller shaft housing
- Cracks/damage → Replace.



**CHECKING THE DOG CLUTCH**

Check:

- Dog clutch  
Damage/wear → Replace.

**CHECKING THE PROPELLER SHAFT**

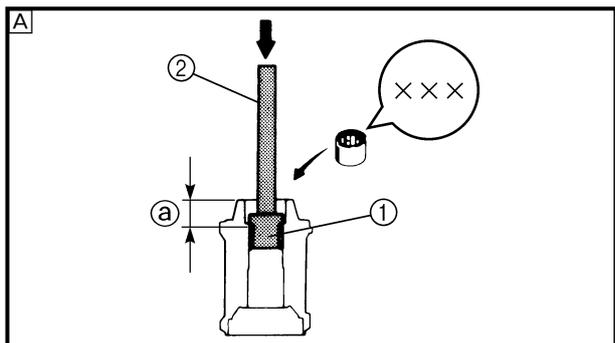
Check:

- Propeller shaft  
Damage/wear → Replace.

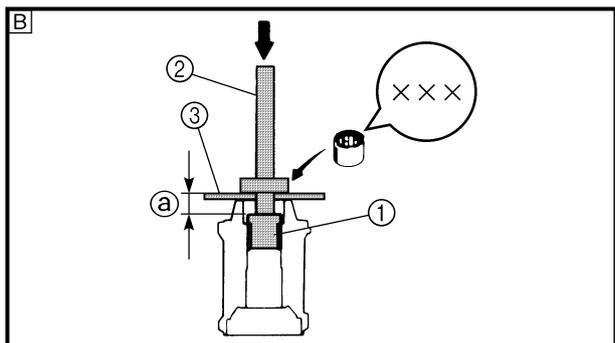
**ASSEMBLING THE PROPELLER  
SHAFT HOUSING**

1. Install:

- Needle bearing



	<b>Needle bearing installation position @</b> 24.75 - 25.25 mm (0.974 - 0.994 in)
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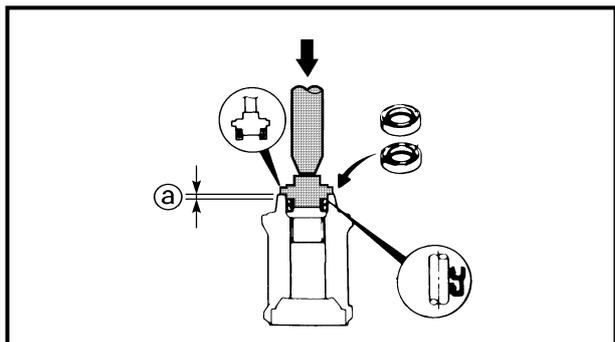


	<b>Bearing/oil seal attachment .... ①</b> YB-06196 / 90890-06610
	<b>Driver rod ..... ②</b> YB-06071 / 90890-06604
	<b>Bearing/oil seal depth plate .... ③</b> 90890-06603

- A** For USA and Canada
- B** For worldwide

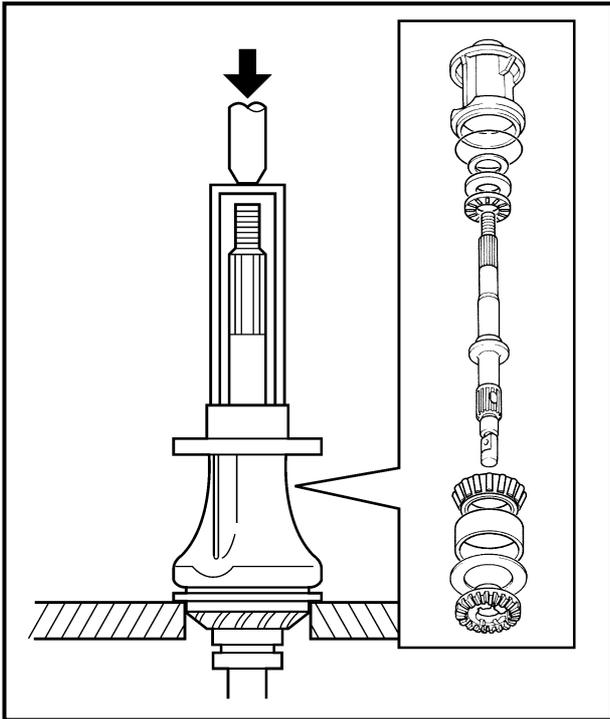
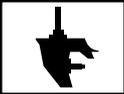
2. Install:

- Oil seals



	<b>Oil seal installation position @</b> 4.75 - 5.25 mm (0.187 - 0.207 in)
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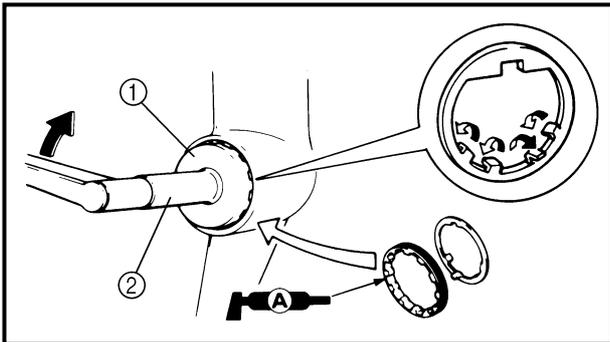
	<b>Bearing/oil seal attachment</b> YB-06195 / 90890-06633
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**INSTALLING THE PROPELLER SHAFT ASSEMBLY**

Install:

- Forward gear assembly
- Propeller shaft assembly



**INSTALLING THE PROPELLER SHAFT HOUSING ASSEMBLY**

Install:

- Forward gear shim(s)
- Propeller shaft housing assembly
- Straight key
- Claw washer
- Ring nut



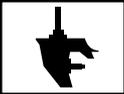
**Ring nut wrench** ..... ①  
**YB-34447 / 90890-06512**  
**Ring nut wrench extension** ..... ②  
**90890-06513**



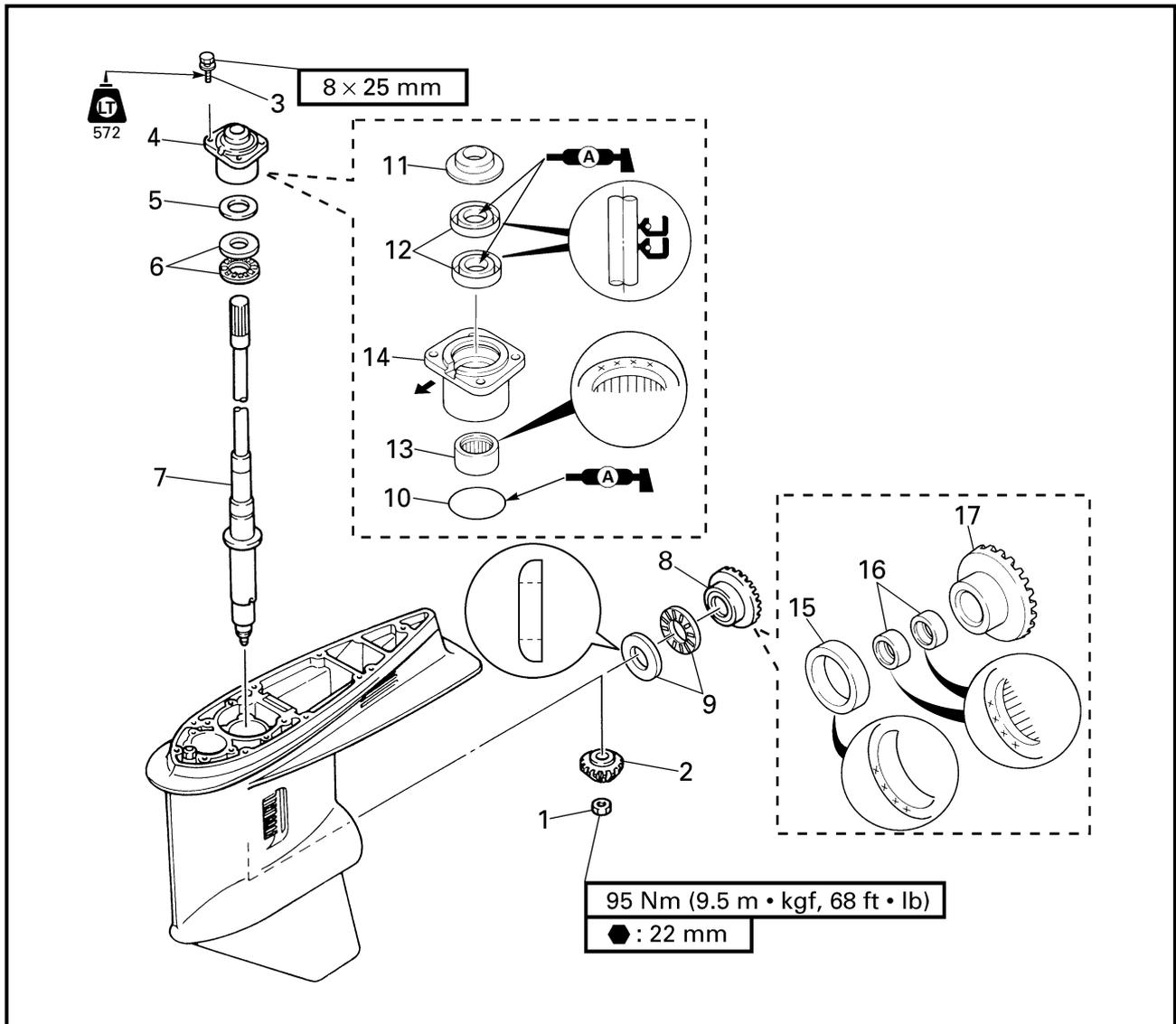
**Ring nut**  
**145 Nm (14.5 m • kgf, 105 ft • lb)**

**NOTE:**

To secure the ring nut, bend one claw washer tab into the slot in the ring nut and the other tabs toward the propeller shaft housing assembly.



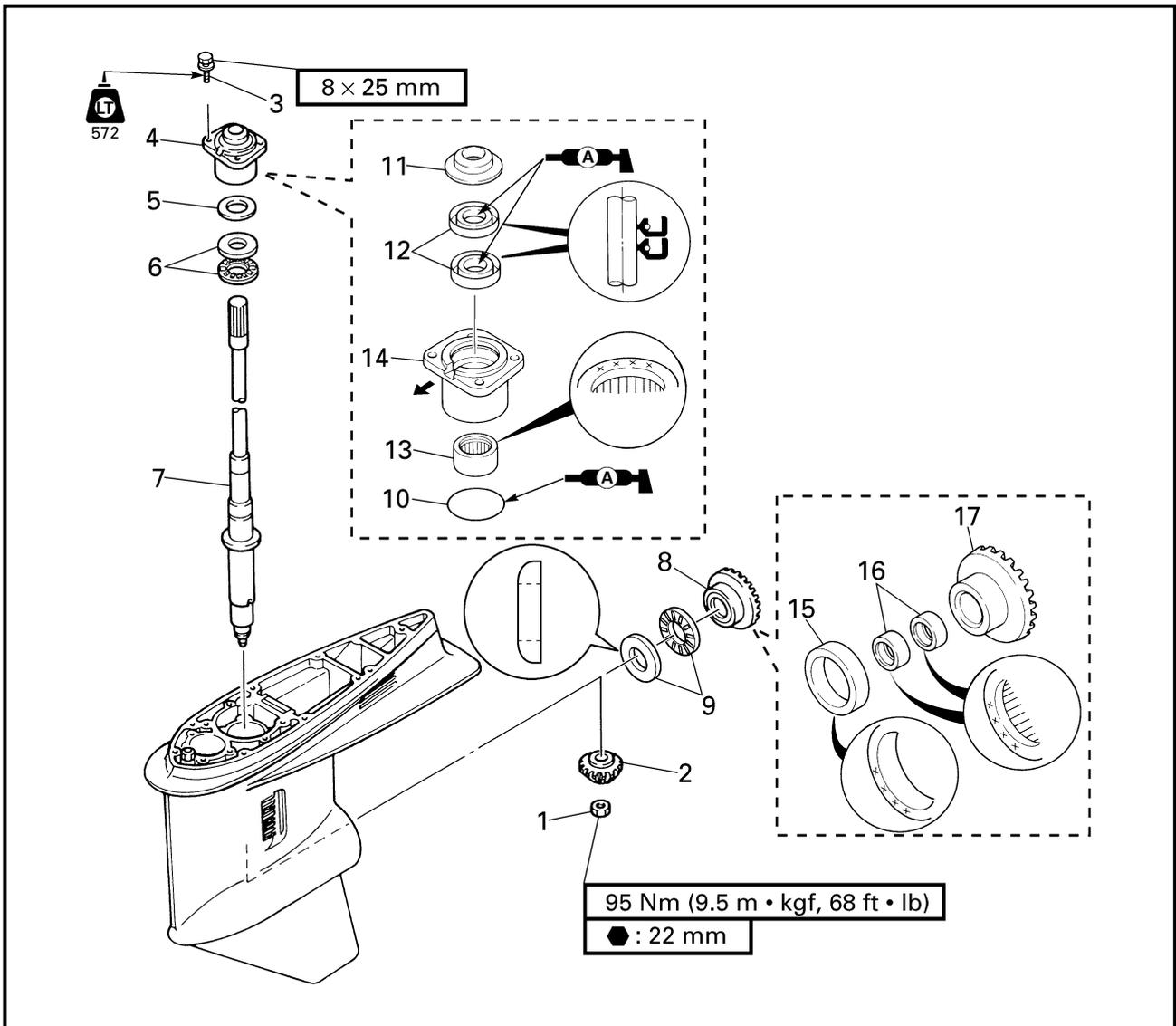
**DRIVE SHAFT (COUNTER ROTATION MODELS)  
REMOVING/INSTALLING THE DRIVE SHAFT**



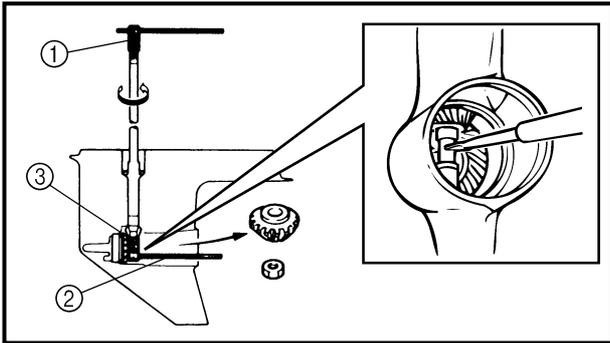
Order	Job/Part	Q'ty	Remarks
	Propeller shaft housing assembly		Refer to "PROPELLER SHAFT HOUSING ASSEMBLY (COUNTER ROTATION MODELS)" on page 6-38.
1	Pinion nut	1	
2	Pinion	1	
3	Bolt	4	
4	Drive shaft housing assembly	1	
5	Pinion shim	*	
6	Thrust bearing	1	
7	Drive shaft	1	

Continued on next page.

\*: As required



Order	Job/Part	Q'ty	Remarks
8	Reverse gear assembly	1	For installation, reverse the removal procedure.
9	Thrust bearing	1	
10	O-ring	1	
11	Oil seal cover	1	
12	Oil seal	2	
13	Needle bearing	1	
14	Drive shaft housing	1	
15	Roller bearing inner race	1	
16	Needle bearing	2	
17	Reverse gear	1	

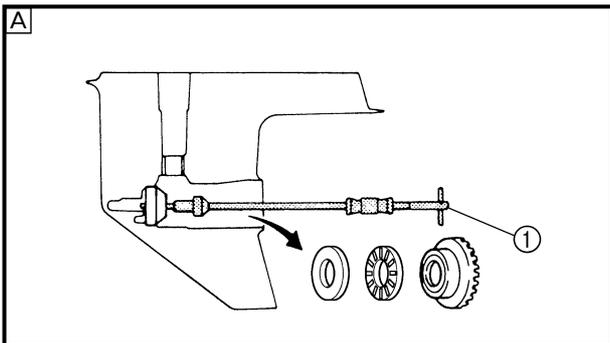


**REMOVING THE PINION**

Remove:

- Pinion nut
- Pinion

	<b>Drive shaft holder</b> ..... ① <b>YB-06201 / 90890-06520</b>
	<b>Pinion nut holder</b> ..... ② <b>90890-06505</b>
	<b>Pinion nut holder attachment</b> . ③ <b>90890-06508</b>

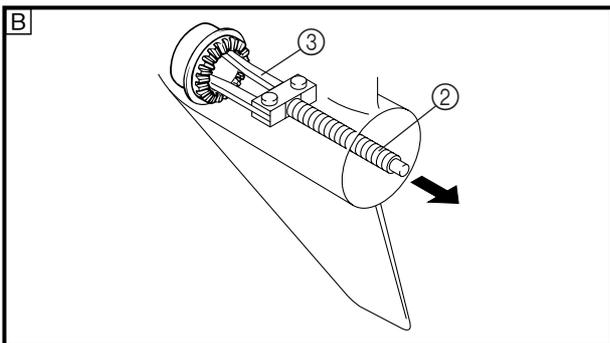


**REMOVING THE REVERSE GEAR**

Remove:

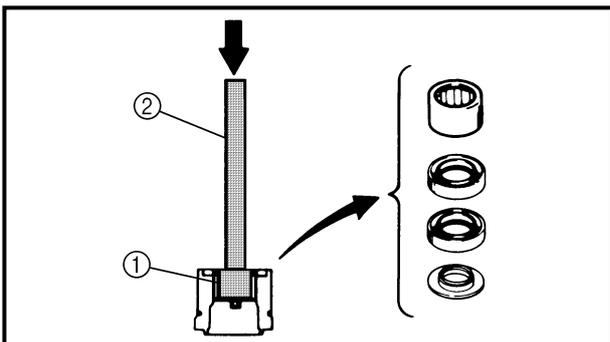
- Reverse gear assembly
- Thrust bearing

	<b>Slide hammer</b> ..... ① <b>YB-06096</b>
	<b>Bearing puller</b> ..... ② <b>90890-06535</b>
	<b>Small universal claws</b> ..... ③ <b>90890-06536</b>



**A** For USA and Canada

**B** For worldwide

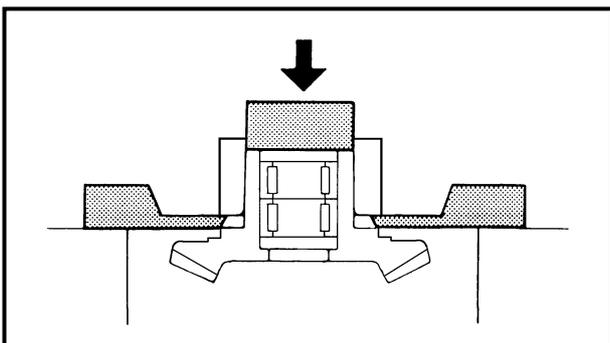


**DISASSEMBLING THE DRIVE SHAFT HOUSING ASSEMBLY**

Remove:

- Oil seals
- Needle bearing

	<b>Bearing/oil seal attachment</b> .... ① <b>YB-06196 / 90890-06610</b>
	<b>Driver rod</b> ..... ② <b>YB-06071 / 90890-06652</b>

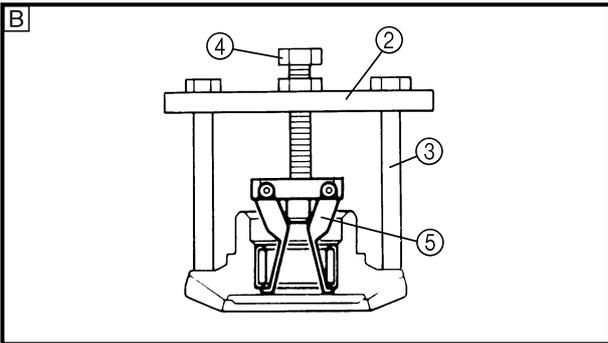
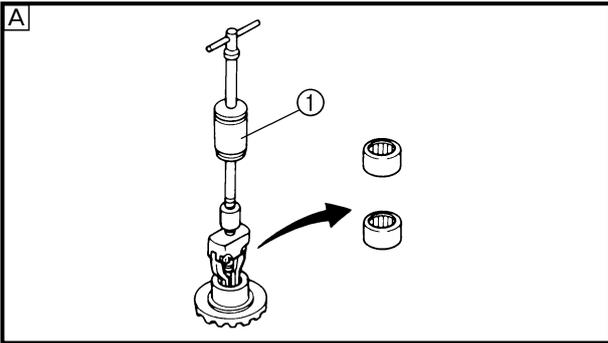


**DISASSEMBLING THE REVERSE GEAR ASSEMBLY**

1. Remove:

- Roller bearing inner race

	<b>Bearing separator</b> <b>YB-06219 / 90890-06534</b>
--	---



2. Remove:
- Needle bearings

	<b>Slide hammer</b> ..... ①
	<b>YB-06096</b>
	<b>Guide plate</b> ..... ②
	<b>90890-06501</b>
	<b>Guide plate stand</b> ..... ③
	<b>90890-06538</b>
	<b>Bearing puller</b> ..... ④
	<b>90890-06535</b>
	<b>Small universal claws</b> ..... ⑤
	<b>90890-06536</b>

- A** For USA and Canada  
**B** For worldwide

**CHECKING THE PINION**

- Check:
- Teeth
- Damage/wear → Replace.

**CHECKING THE DRIVE SHAFT**

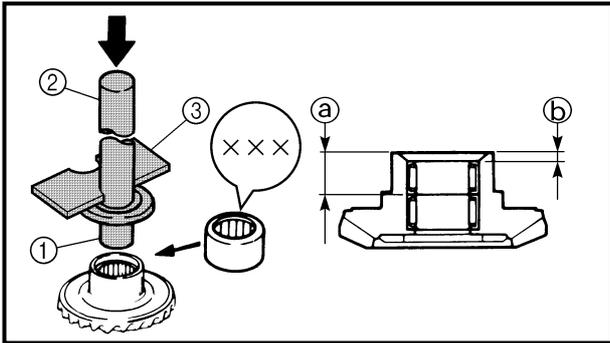
- Check:
- Drive shaft
- Damage/wear → Replace.

**CHECKING THE DRIVE SHAFT HOUSING**

- Check:
- Drive shaft housing
- Cracks/damage → Replace.

**CHECKING THE BEARINGS**

- Check:
- Bearings
- Pitting/rumbling → Replace.

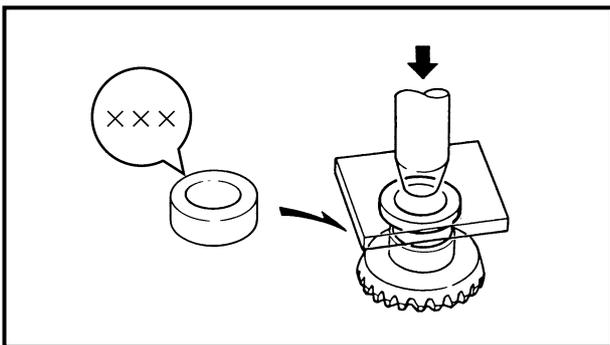


**ASSEMBLING THE REVERSE GEAR ASSEMBLY**

1. Install:
- Needle bearings

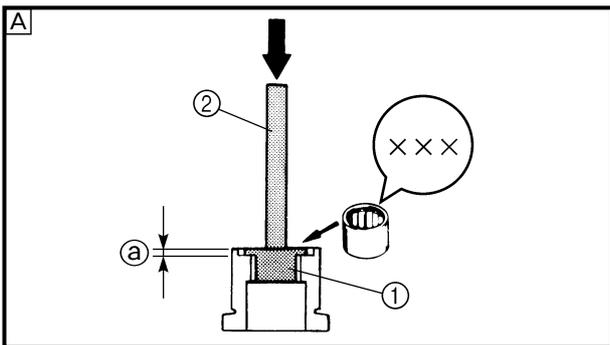
	<b>Needle bearing installation position ①</b>
	21.0 - 21.4 mm (0.827 - 0.843 in)
	<b>Needle bearing installation position ②</b>
	4.5 - 4.9 mm (0.177 - 0.193 in)

	<b>Bearing/oil seal attachment .... ①</b>
	<b>YB-06200 / 90890-06612</b>
	<b>Driver rod ..... ②</b>
	<b>YB-06071 / 90890-06604</b>
	<b>Bearing/oil seal depth plate .... ③</b>
	<b>90890-06603</b>



2. Install:
- Roller bearing inner race

	<b>Bearing/oil seal attachment</b>
	<b>90890-06660</b>

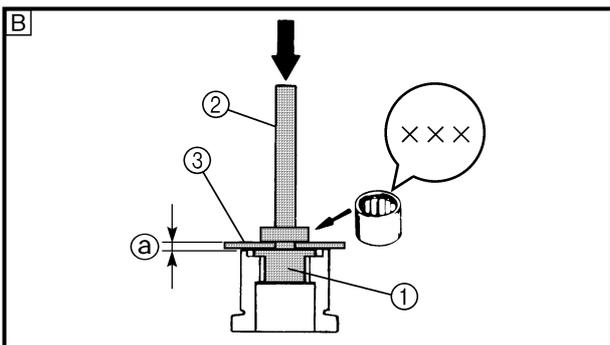


**ASSEMBLING THE DRIVE SHAFT HOUSING ASSEMBLY**

1. Install:
- Needle bearing

	<b>Position ①</b>
	5.75 - 6.25 mm (0.226 - 0.246 in)

	<b>Bearing/oil seal attachment .... ①</b>
	<b>YB-06196 / 90890-06610</b>
	<b>Driver rod ..... ②</b>
	<b>YB-06071 / 90890-06604</b>
	<b>Bearing/oil seal depth plate .... ③</b>
	<b>90890-06603</b>



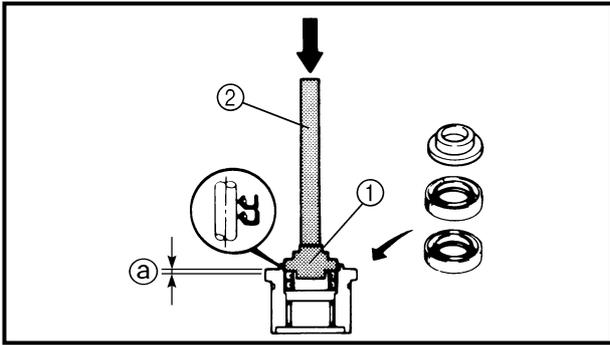
- A** For USA and Canada
- B** For worldwide

**LOWR**



# DRIVE SHAFT (COUNTER ROTATION MODELS)

**E**



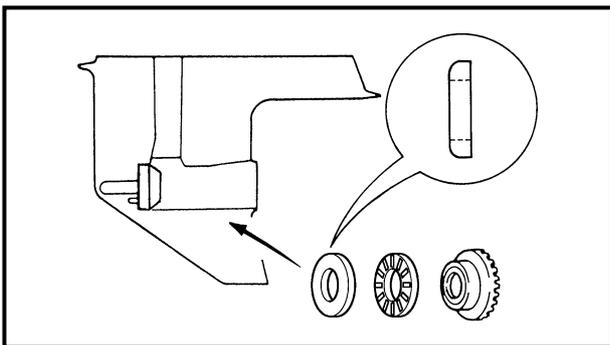
2. Install:
- Oil seals



**Oil seal installation position (a)**  
0.25 - 0.75 mm (0.010 - 0.030 in)



**Bearing/oil seal attachment .... (1)**  
YB-06195 / 90890-06633  
**Driver rod ..... (2)**  
YB-06071 / 90890-06652

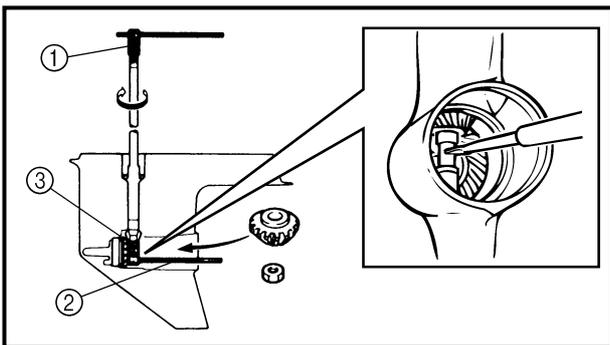


## INSTALLING THE REVERSE GEAR

- Install:
- Thrust bearing
  - Reverse gear assembly

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

Install the thrust bearing onto the reverse gear assembly and position the thrust bearing so its rounded side faces away from the reverse gear.



## INSTALLING THE PINION

- Install:
- Pinion
  - Pinion nut

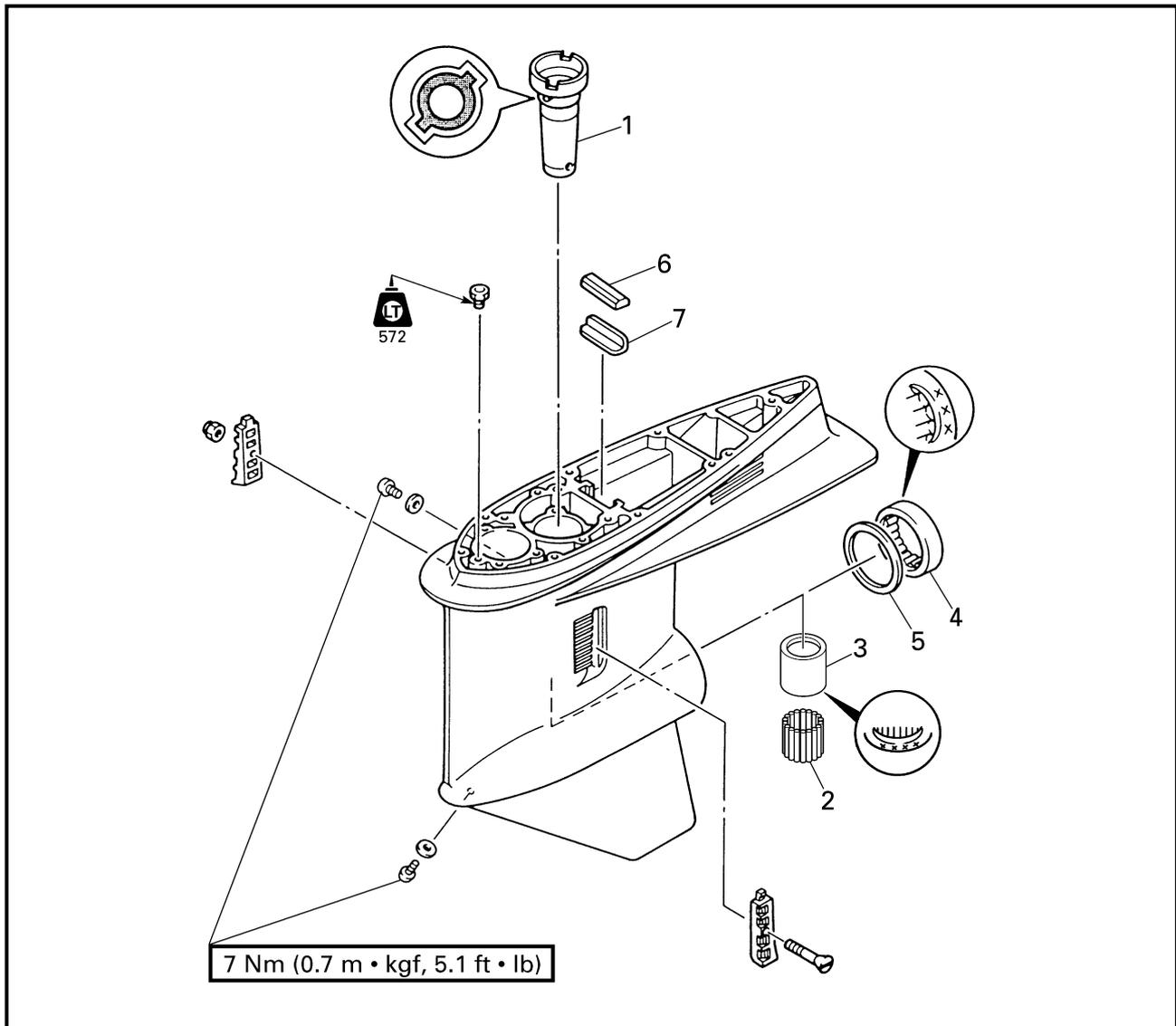


**Pinion nut**  
95 Nm (9.5 m • kgf, 68 ft • lb)



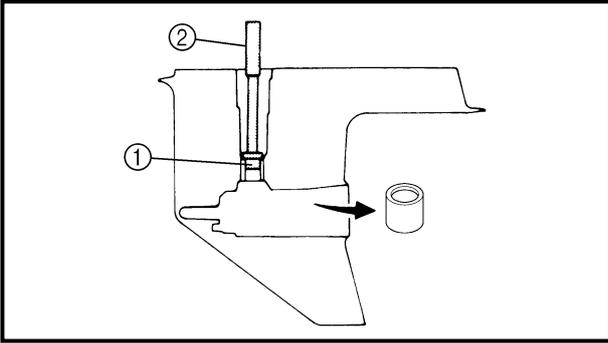
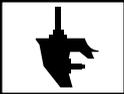
**Drive shaft holder ..... (1)**  
YB-06201 / 90890-06520  
**Pinion nut holder ..... (2)**  
90890-06505  
**Pinion nut holder attachment . (3)**  
90890-06508

**LOWER CASE ASSEMBLY (COUNTER ROTATION MODELS)  
DISASSEMBLING/ASSEMBLING THE LOWER CASE ASSEMBLY**



Order	Job/Part	Q'ty	Remarks
	Reverse gear		Refer to "DRIVE SHAFT (COUNTER ROTATION MODELS)" on page 6-46.
1	Drive shaft sleeve	1	
2	Needle bearing	18	
3	Needle bearing outer case	1	
4	Roller bearing	1	
5	Reverse gear shim	*	
6	Water seal	1	
7	Water seal seat	1	
			For assembly, reverse the disassembly procedure.

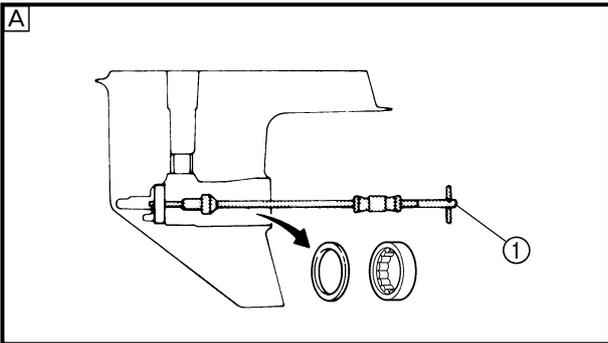
\*: As required



**DISASSEMBLING THE LOWER CASE ASSEMBLY**

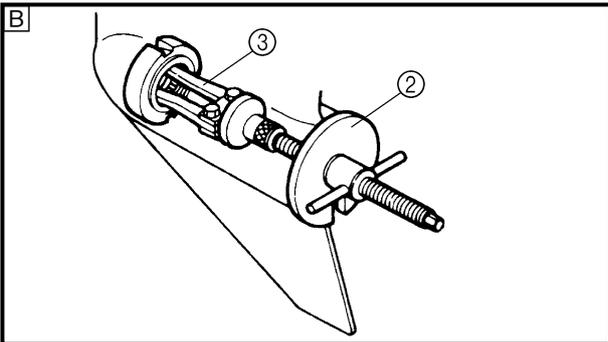
1. Remove:
- Needle bearing outer race

	<b>Bearing/oil seal attachment ....</b> ① YB-06194 / 90890-06636
	<b>Driver rod .....</b> ② YB-06071 / 90890-06605



2. Remove:
- Roller bearing
  - Reverse gear shim(s)

	<b>Slide hammer.....</b> ① YB-06096
	<b>Bearing puller.....</b> ② 90890-06523
	<b>Large universal claws.....</b> ③ 90890-06532



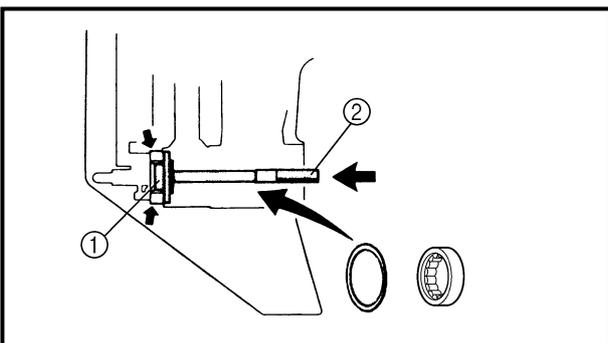
- A** For USA and Canada
- B** For worldwide

**CHECKING THE DRIVE SHAFT SLEEVE**

- Check:
- Drive shaft sleeve
- Damage/wear → Replace.

**CHECKING THE NEEDLE BEARING**

- Check:
- Needle bearing
- Pitting/rumbling → Replace.



**ASSEMBLING THE LOWER CASE ASSEMBLY**

1. Install:
- Reverse gear shim(s)
  - Roller bearing

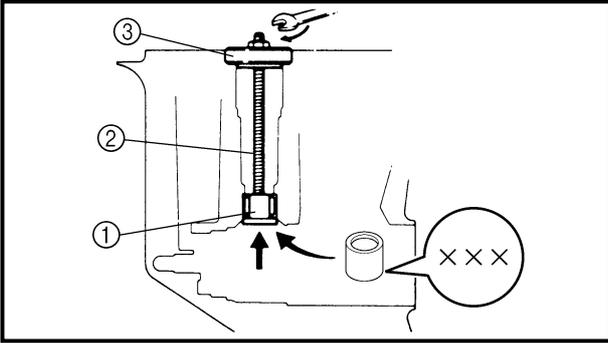
	<b>Bearing/oil seal attachment ....</b> ① YB-06336 / 90890-06629
	<b>Driver rod .....</b> ② YB-06071 / 90890-06605

**LOWR**



# LOWER CASE ASSEMBLY (COUNTER ROTATION MODELS)

E



## 2. Install:

- Needle bearing outer race



- |  |   |
|--|---|
| <b>Bearing/oil seal attachment ....</b>            | ① |
| <b>YB-06246 / 90890-06636</b>                      |   |
| <b>Bearing puller.....</b>                         | ② |
| <b>YB-06029 / 90890-06523</b>                      |   |
| <b>Needle bearing installation<br/>plate .....</b> | ③ |
| <b>YB-06247</b>                                    |   |



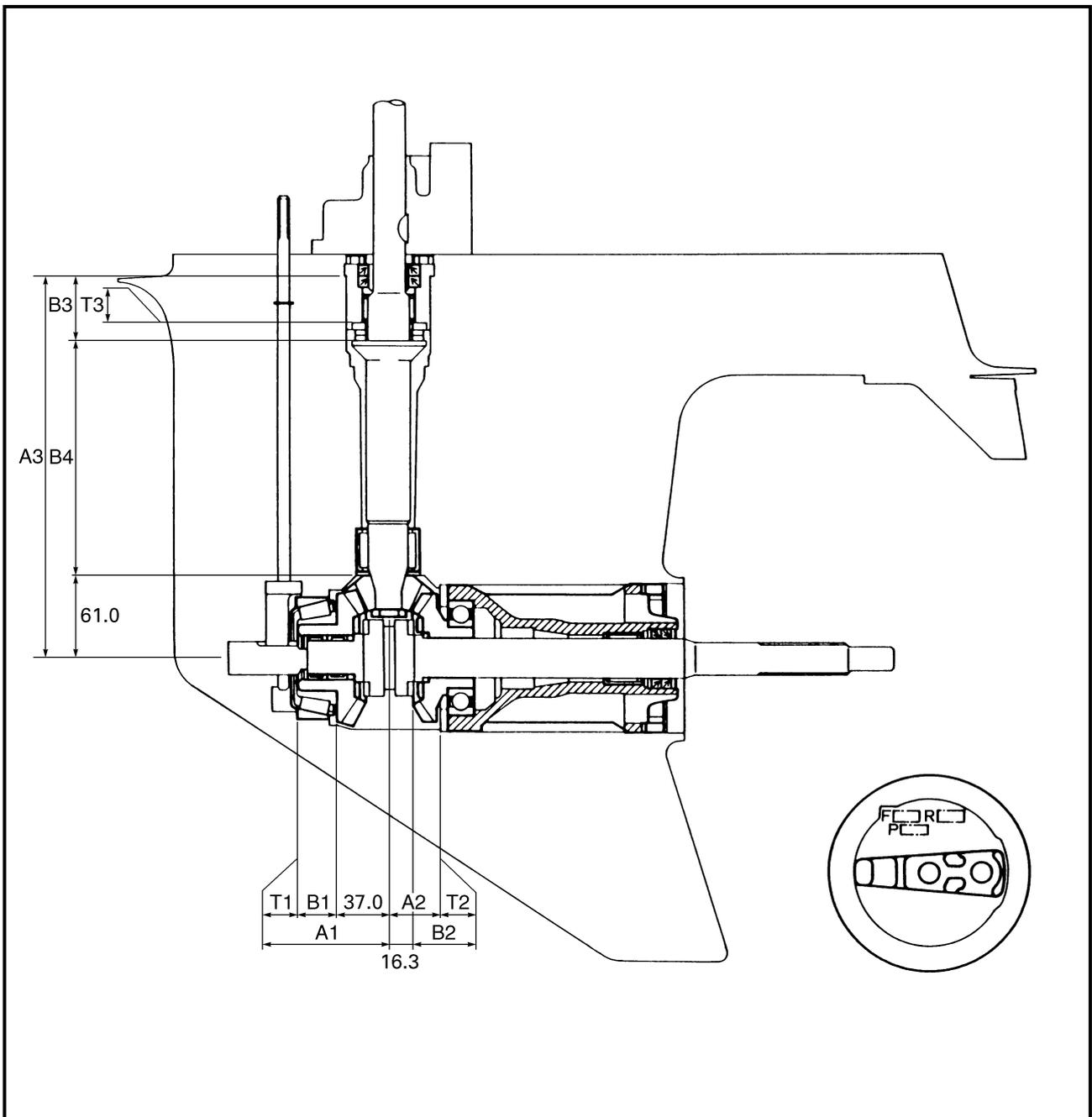
# SHIMMING (REGULAR ROTATION MODELS) (FOR USA AND CANADA)

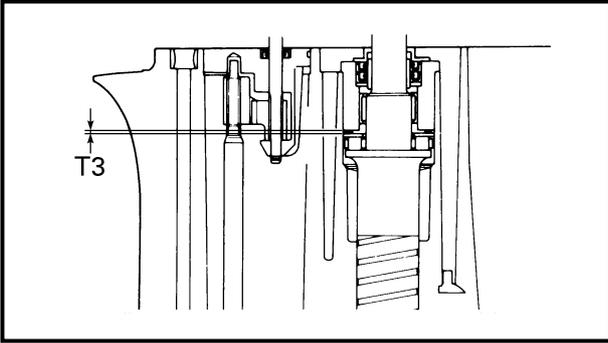
E

## SHIMMING (REGULAR ROTATION MODELS) (FOR USA AND CANADA)

**NOTE:**

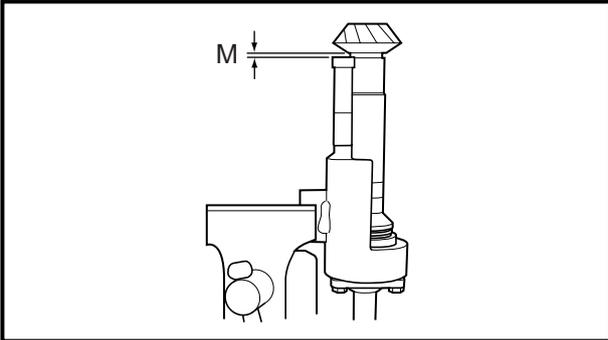
- There is no need to select shims when reassembling with the original case and inner parts.
- Shim calculations are required when reassembling with the original inner parts and a new case (the difference between the original inner parts and the new case).
- Measurements and adjustments are required when replacing the inner part(s).





**SELECTING THE PINION SHIMS**

**NOTE:** \_\_\_\_\_  
Find the shim thickness (T3) by selecting shims until the specified value (M0) is obtained with the special tool.

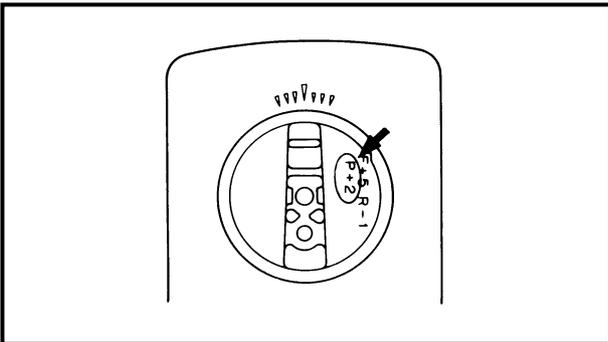


1. Measure:
- Specified measurement (M)
- Out of specified value (M0) → Adjust.

	<b>Specified value (M0) =</b> <b>1.00 + P/100 mm</b>
--	---

**Measuring steps**

- (1) Calculate the specified value (M0).



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

- “P” is the deviation of the lower case dimension from standard. It is stamped on the trim tab mounting surface of the lower case in 0.01-mm units. If the “P” mark is missing or unreadable, assume a “P” value of “0”, and check the backlash when the unit is assembled.
- If the “P” mark is negative (-), then subtract the “P” value from the measurement.

Example:

If “P” is “+5”, then

$$M0 = 1.00 + (+5)/100 \text{ mm}$$

$$= 1.00 + 0.05 \text{ mm}$$

$$= 1.05 \text{ mm}$$

If “P” is “-3”, then

$$M0 = 1.00 + (-3)/100 \text{ mm}$$

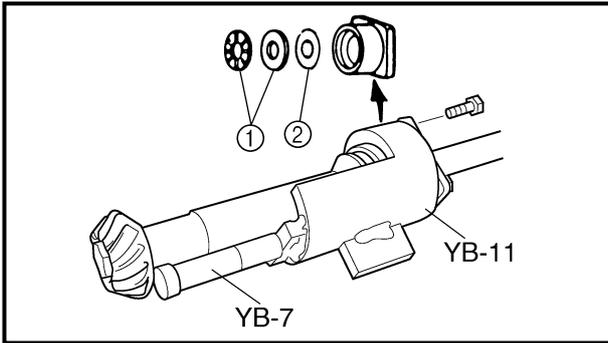
$$= 1.00 - 0.03 \text{ mm}$$

$$= 0.97 \text{ mm}$$

**LOWR**

## SHIMMING (REGULAR ROTATION MODELS) (FOR USA AND CANADA)

E



(2) Install the pinion height gauge, drive shaft, thrust bearing ①, and shim(s) ②.



**Pinion height gauge**  
**YB-34432-7, -11**

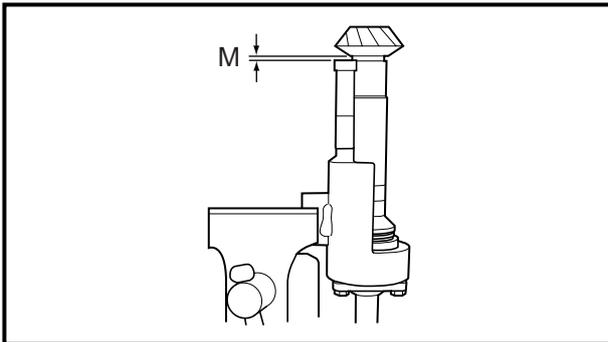
**NOTE:** \_\_\_\_\_

If the original shim(s) is unavailable, start with a 0.50-mm shim.

(3) Install the pinion and pinion nut.



**Pinion nut**  
**95 Nm (9.5 m • kgf, 69 ft • lb)**



(4) Measure the specified measurement (M).

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

- Measure the clearance between the pinion height gauge and the lower surface of the pinion as shown.
- Perform the same measurement at three points on the pinion.
- Find the average of the measurements (M).

2. Adjust:

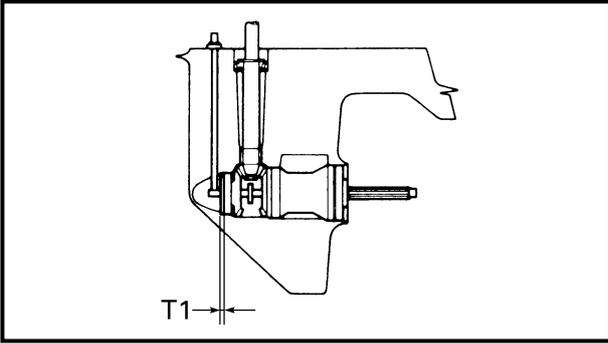
- Shim thickness (T3)  
Remove or add shim(s).



**Available shim thickness**  
**0.10, 0.12, 0.15, 0.18, 0.30, 0.40**  
**and 0.50 mm**

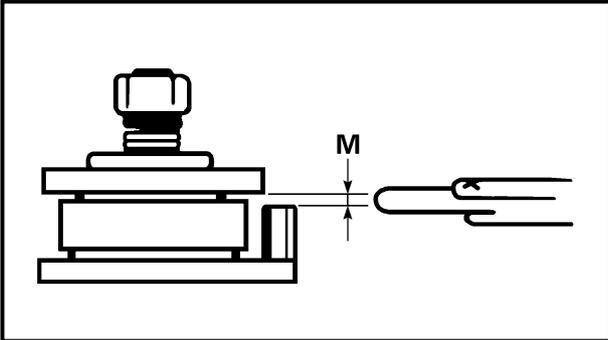
**NOTE:** \_\_\_\_\_

(M0) – (M) should be as close to “0” as possible.



**SELECTING THE FORWARD GEAR SHIMS**

**NOTE:** \_\_\_\_\_  
Find the shim thickness (T1) by selecting shims until the specified value (M0) is obtained with the special tool.



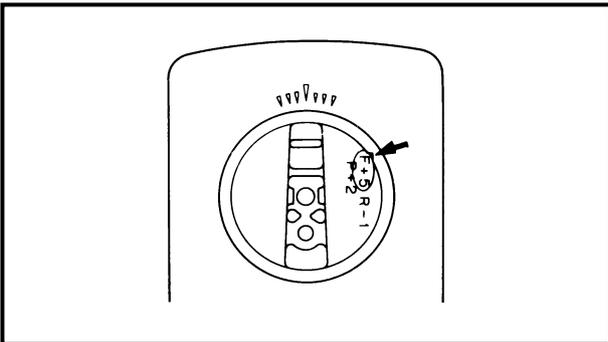
1. Measure:
- Specified measurement (M)
  - Out of specified value (M0) → Adjust.



**Specified value (M0) =**  
**1.60 + F/100 mm**

**Measuring steps**

- (1) Calculate the specified value (M0).



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

- “F” is the deviation of the lower case dimension from standard. It is stamped on the trim tab mounting surface of the lower case in 0.01-mm units. If the “F” mark is missing or unreadable, assume an “F” value of “0”, and check the backlash when the unit is assembled.
- If the “F” mark is negative (-), then subtract the “F” value from the measurement.

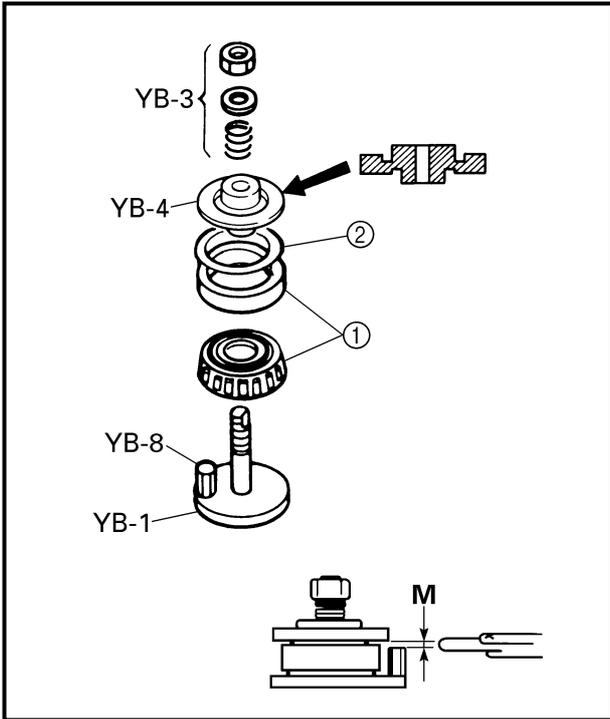
Example:

If “F” is “+5”, then

$$\begin{aligned} M0 &= 1.60 + (+5)/100 \text{ mm} \\ &= 1.60 + 0.05 \text{ mm} \\ &= 1.65 \text{ mm} \end{aligned}$$

If “F” is “-3”, then

$$\begin{aligned} M0 &= 1.60 + (-3)/100 \text{ mm} \\ &= 1.60 - 0.03 \text{ mm} \\ &= 1.57 \text{ mm} \end{aligned}$$



(2) Install the shimming gauge, bearing ①, and shim(s) ②.



**Shimming gauge  
YB-34446-1, -3, -4, -8**

**NOTE:** \_\_\_\_\_  
If the original shim(s) is unavailable, start with a 0.50-mm shim.

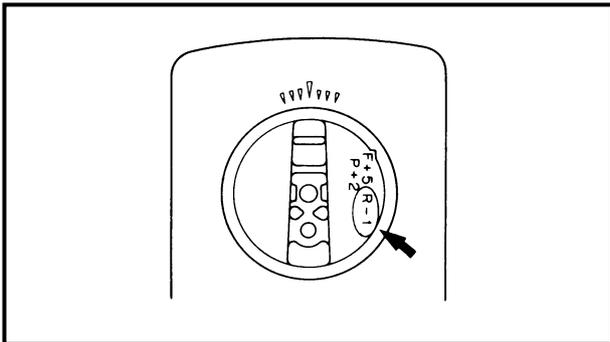
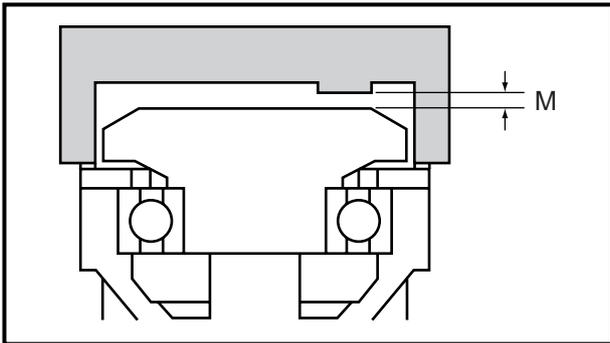
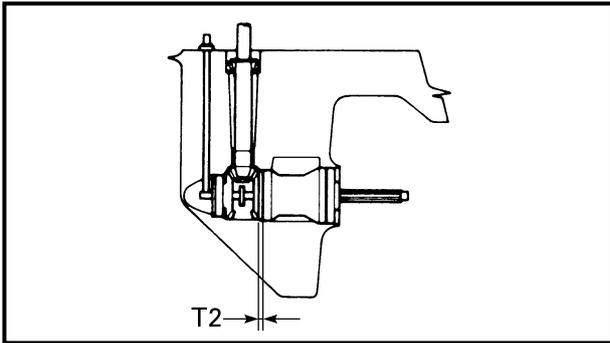
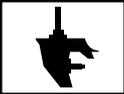
(3) Measure the specified measurement (M).

2. Adjust:
- Shim thickness (T1)
- Remove or add shim(s).



**Available shim thickness  
0.10, 0.12, 0.15, 0.18, 0.30, 0.40  
and 0.50 mm**

**NOTE:** \_\_\_\_\_  
(M0) – (M) should be as close to “0” as possible.



**SELECTING THE REVERSE GEAR SHIMS**

**NOTE:** \_\_\_\_\_  
Find the shim thickness (T2) by selecting shims until the specified value (M0) is obtained with the special tool.

1. Measure:
- Specified measurement (M)
- Out of specified value (M0) → Adjust.



**Specified value (M0) =  
1.80 - R/100 mm**

**Measuring steps**

- (1) Calculate the specified value (M0).

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

- "R" is the deviation of the lower case dimension from standard. It is stamped on the trim tab mounting surface of the lower case in 0.01-mm units. If the "R" mark is missing or unreadable, assume an "R" value of "0", and check the backlash when the unit is assembled.
- If the "R" mark is negative (-), then add the "R" value to the measurement.

**Example:**

If "R" is "+5", then  
 $M0 = 1.80 - (+5)/100 \text{ mm}$   
 $= 1.80 - 0.05 \text{ mm}$   
 $= 1.75 \text{ mm}$

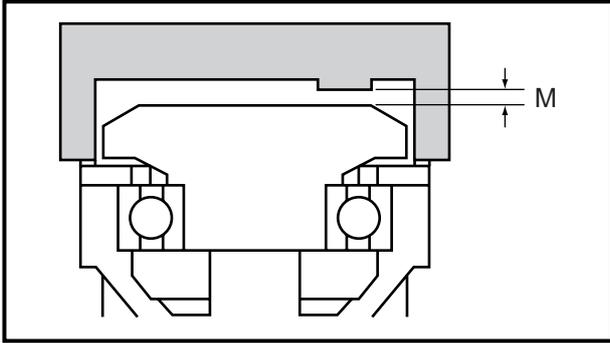
If "R" is "-3", then  
 $M0 = 1.80 - (-3)/100 \text{ mm}$   
 $= 1.80 + 0.03 \text{ mm}$   
 $= 1.83 \text{ mm}$

**LOWR**



## SHIMMING (REGULAR ROTATION MODELS) (FOR USA AND CANADA)

E



(2) Install the shimming gauge, bearing, thrust washer, reverse gear, and shim(s).



**Shimming gauge  
YB-34468-1**

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

- If the original shim(s) is unavailable, start with a 0.50-mm shim.
- Turn the reverse gear assembly a few times until the gear and bearing are horizontal.

(3) Measure the specified measurement (M).

2. Adjust:

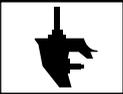
- Shim thickness (T2)  
Remove or add shim(s).



**Available shim thickness  
0.10, 0.12, 0.15, 0.18, 0.30, 0.40  
and 0.50 mm**

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

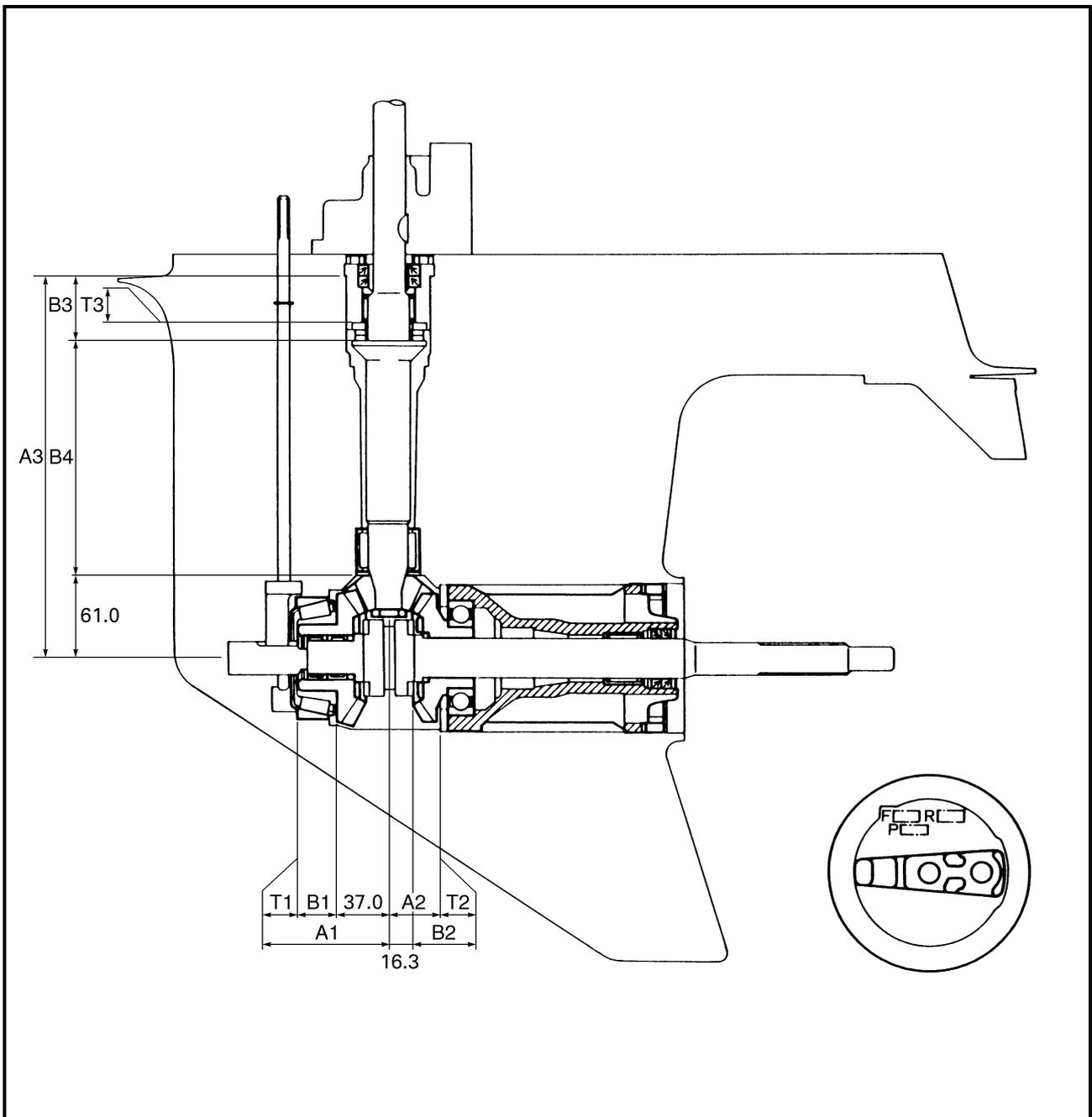
(M0) – (M) should be as close to “0” as possible.

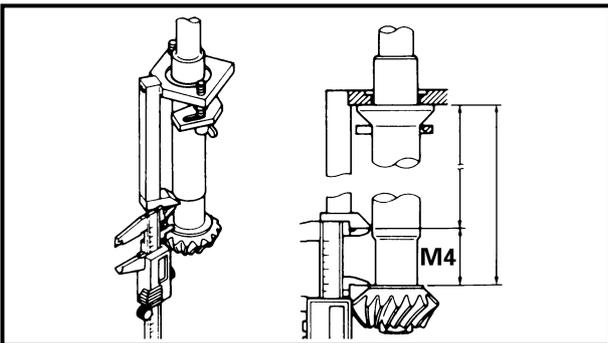
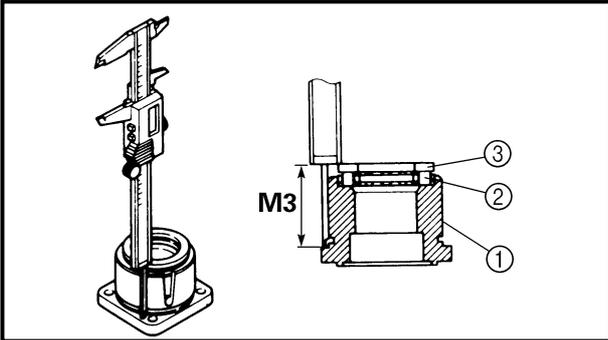
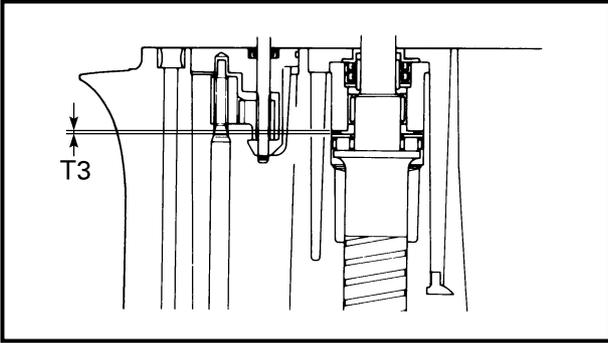


SHIMMING (REGULAR ROTATION MODELS) (FOR WORLDWIDE)

NOTE:

- There is no need to select shims when reassembling with the original case and inner parts.
- Shim calculations are required when reassembling with the original inner parts and a new case (the difference between the original inner parts and the new case).
- Measurements and adjustments are required when replacing the inner part(s).





**SELECTING THE PINION SHIMS**

**NOTE:** \_\_\_\_\_  
Select the shim thickness (T3) by using the specified measurement(s) and the calculation formula.

- Select:
- Shim thickness (T3)

**Selecting steps**

(1) Measure (M3).

	<b>Digital caliper</b> 90890-06704
--	---------------------------------------

**NOTE:** \_\_\_\_\_  
Install the bearing housing ①, thrust bearing ②, and washer ③.

(2) Install the pinion and pinion nut.

	<b>Pinion nut</b> 95 Nm (9.5 m • kgf, 69 ft • lb)
--	--

(3) Install the pinion height gauge.

	<b>Pinion height gauge</b> 90890-06702
--	---

**NOTE:** \_\_\_\_\_  
After the wing nuts contact the fixing plate, tighten them another 1/4 of a turn.

(4) Measure (M4).

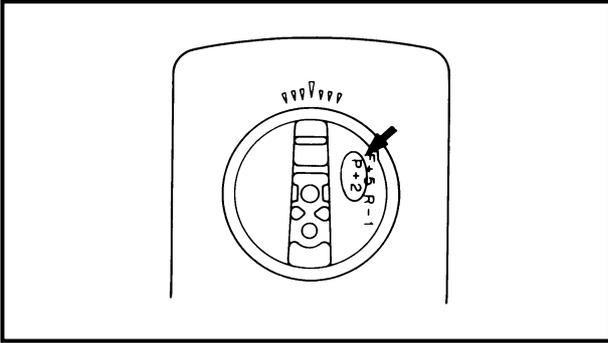
	<b>Digital caliper</b> 90890-06704
--	---------------------------------------

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

- Measure the clearance between the pinion height gauge and the pinion, as shown.
- Perform the same measurement at three points on the pinion.
- Find the average of the measurements (M4).



**SHIMMING (REGULAR ROTATION MODELS)  
(FOR WORLDWIDE)**



(5) Calculate the pinion shim thickness (T3).



**Pinion shim thickness (T3) =**  
**80.0 + P/100 – M3 – M4**

**NOTE:**

- "P" is the deviation of the lower case dimension from standard. It is stamped on the trim tab mounting surface of the lower case in 0.01-mm units. If the "P" mark is missing or unreadable, assume a "P" value of "0", and check the backlash when the unit is assembled.
- If the "P" mark is negative (-), then add the "P" value to the measurement.

Example:

If M3 is "46.85 mm", M4 is "32.52 mm" and P is "-5", then

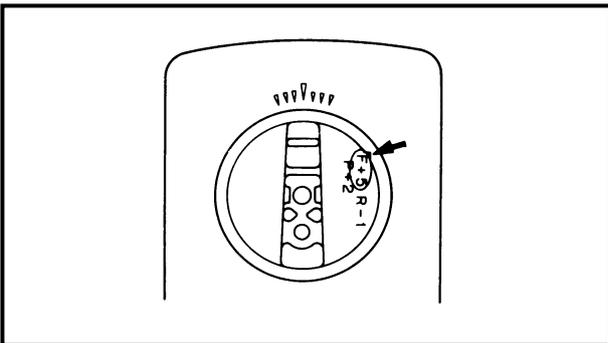
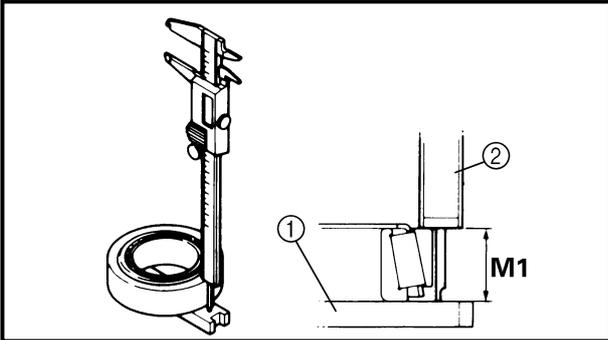
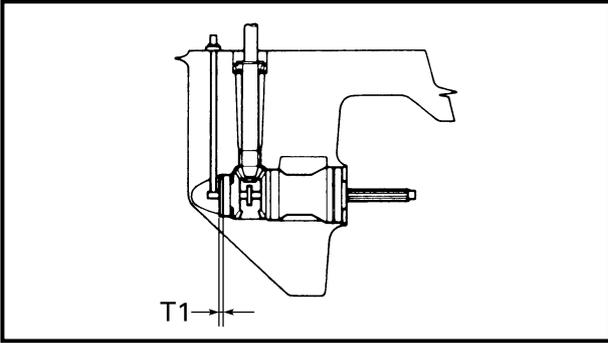
$$\begin{aligned}
 T3 &= 80.0 + (-5)/100 - 46.85 - 32.52 \text{ mm} \\
 &= 80.0 - 0.05 - 46.85 - 32.52 \text{ mm} \\
 &= 0.58 \text{ mm}
 \end{aligned}$$

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

Calculated numeral at 1/100th place		Rounded numeral
More than	or less	
0.00	0.02	0.00
0.02	0.05	0.02
0.05	0.08	0.05
0.08	0.10	0.08



**Available shim thickness**  
**0.10, 0.12, 0.15, 0.18, 0.30, 0.40**  
**and 0.50 mm**



**SELECTING THE FORWARD GEAR SHIMS**

**NOTE:** \_\_\_\_\_  
Select the shim thickness (T1) by using the specified measurement(s) and the calculation formula.

- Select:
- Shim thickness (T1)

**Selecting steps**

(1) Measure (M1).

	<b>Shimming plate</b> ..... ①
	<b>90890-06701</b>
	<b>Digital caliper</b> ..... ②
	<b>90890-06704</b>

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

- Turn the roller bearing outer race two or three times so the rollers seat. Then, measure the height of the bearing, as shown.
- Perform the same measurement at three points on the roller bearing outer race.
- Find the average of the measurements (M1).

(2) Calculate the forward gear shim thickness (T1).

	<b>Forward gear shim thickness (T1)</b>
	<b>(T1) = 28.6 + F/100 - M1</b>

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

- "F" is the deviation of the lower case dimension from standard. It is stamped on the trim tab mounting surface of the lower case in 0.01-mm units. If the "F" mark is missing or unreadable, assume an "F" value of "0", and check the backlash when the unit is assembled.
- If the "F" mark is negative (-), then subtract the "F" value from the measurement.

Example:

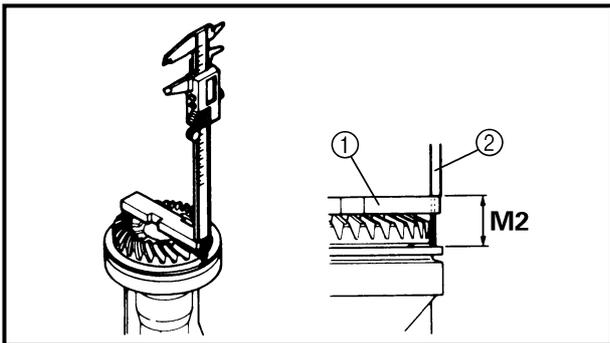
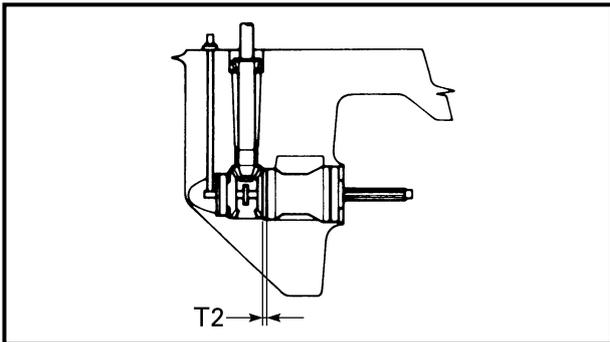
If M1 is "28.10 mm" and F is "+5", then  
 $T1 = 28.6 + (+5)/100 - 28.10 \text{ mm}$   
 $= 28.6 + 0.05 - 28.10 \text{ mm}$   
 $= 0.55 \text{ mm}$

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

Calculated numeral at 1/100th place		Rounded numeral
More than	or less	
0.00	0.02	0.00
0.02	0.05	0.02
0.05	0.08	0.05
0.08	0.10	0.08



**Available shim thickness**  
 0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm



**SELECTING THE REVERSE GEAR SHIMS**

**NOTE:** \_\_\_\_\_  
 Select the shim thickness (T2) by using the specified measurement(s) and the calculation formula.

- Select:
- Shim thickness (T2)

**Selecting steps**

(1) Measure (M2).

	<b>Shimming plate</b> ..... ①
	<b>90890-06701</b>
	<b>Digital caliper</b> ..... ②
	<b>90890-06704</b>

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

- Measure the height of the gear as shown.
- Perform the same measurement at three points on the gear.
- Find the average of the measurements (M2).



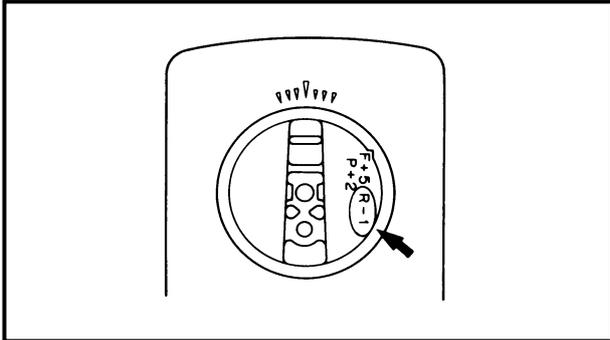
(2) Calculate the reverse gear shim thickness (T2).



**Reverse gear shim thickness**  
**(T2) = M2 - 29.0 - R/100**

**NOTE:**

- "R" is the deviation of the lower case dimension from standard. It is stamped on the trim tab mounting surface of the lower case in 0.01-mm units. If the "R" mark is missing or unreadable, assume a "R" value of "0", and check the backlash when the unit is assembled.
- If the "R" mark is negative (-), then subtract the "R" value from the measurement.



Example:

If M2 is "30.50 mm", R is "+2", then  
 $T2 = 30.50 - 29.0 - (+2)/100$  mm  
 $= 30.50 - 29.0 - 0.02$  mm  
 $= 1.48$  mm

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

Calculated numeral at 1/100th place		Rounded numeral
More than	or less	
0.00	0.02	0.02
0.02	0.05	0.05
0.05	0.08	0.08
0.08	0.10	0.10



**Available shim thickness**  
**0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm**



## BACKLASH (REGULAR ROTATION MODELS)

**NOTE:**

- Do not install the water pump components when measuring the backlash.
- Measure both the forward and reverse gear backlashes.
- If both the forward and reverse gear backlashes are larger than specification, the pinion may be too high.
- If both the forward and reverse gear backlashes are smaller than specification, the pinion may be too low.

### MEASURING THE FORWARD GEAR BACKLASH

1. Measure:

- Forward gear backlash
- Out of specification → Adjust.

	<p><b>Forward gear backlash</b> 0.25 - 0.46 mm (0.010 - 0.018 in)</p>
--	---

**Measuring steps**

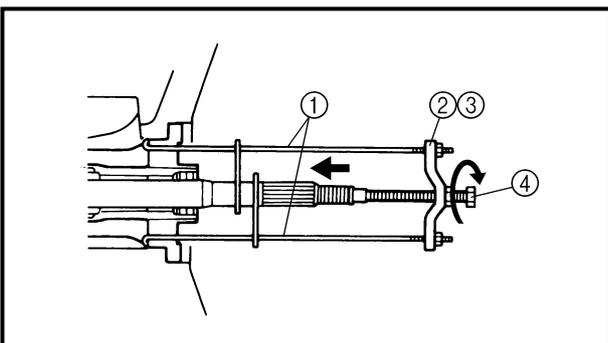
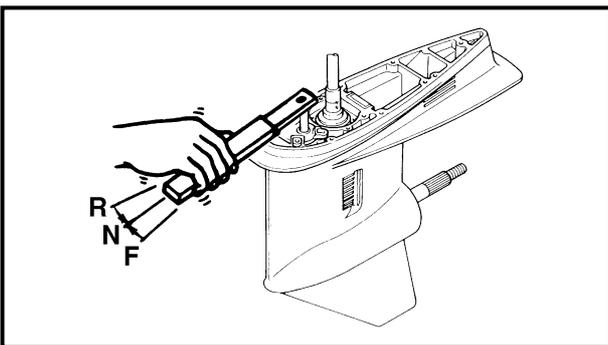
- (1) Set the shift rod into the neutral position.

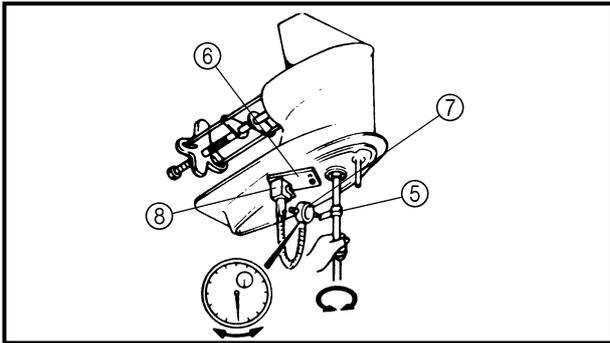
	<p><b>Shift rod wrench</b> YB-06052 / 90890-06052</p>
--	---

- (2) Install the propeller shaft housing puller so it pushes against the propeller shaft.

	<p><b>Propeller shaft housing puller .</b> ① YB-06207 / 90890-06502</p> <p><b>Universal puller.....</b> ② YB-06117</p> <p><b>Guide plate.....</b> ③ 90890-06501</p> <p><b>Center bolt .....</b> ④ 90890-06504</p>
--	---

	<p><b>Center bolt</b> 10 Nm (1.0 m • kgf, 7.2 ft • lb)</p>
--	--





(3) Install the backlash indicator onto the drive shaft (on the 22.4 mm (0.88 in) diameter portion of the drive shaft).

	<b>Backlash indicator</b> ..... ⑤ <b>YB-06265 / 90890-06706</b>
--	--

(4) Install the dial gauge onto the lower unit and have the dial gauge plunger contact the mark on the backlash indicator.

	<b>Magnetic-base plate</b> ..... ⑥ <b>YB-07003 / 90890-07003</b>
	<b>Dial gauge set</b> ..... ⑦ <b>YU-03097 / 90890-01252</b>
	<b>Magnetic base</b> ..... ⑧ <b>YU-34481 / 90890-06705</b>

- (5) Set the lower unit upside down.
- (6) Slowly turn the drive shaft clockwise and counterclockwise. When the drive shaft stops in each direction, measure the backlash.

**2. Adjust:**

- Forward gear shim

Remove or add shim(s).

Forward gear backlash	Shim thickness
<b>Less than 0.25 mm (0.010 in)</b>	<b>To be decreased by (0.36 - M) × 0.54</b>
<b>More than 0.46 mm (0.018 in)</b>	<b>To be increased by (M - 0.36) × 0.54</b>

M: Measurement



**MEASURING THE REVERSE GEAR BACKLASH**

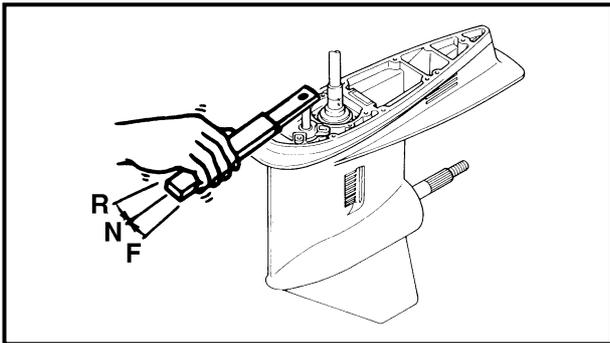
1. Measure:

- Reverse gear backlash
- Out of specification → Adjust.

	<p><b>Reverse gear backlash</b>  <b>0.74 - 1.29 mm (0.029 - 0.051 in)</b></p>
---	---

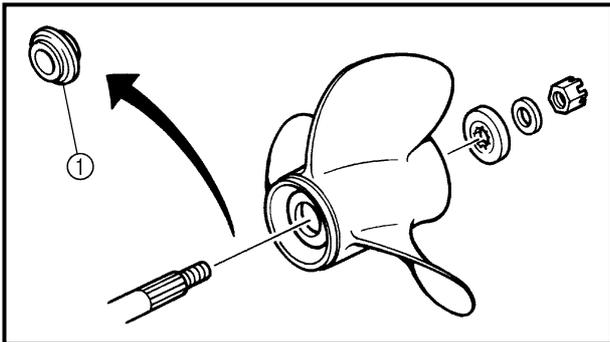
**Measuring steps**

(1) Set the shift rod into the neutral position.



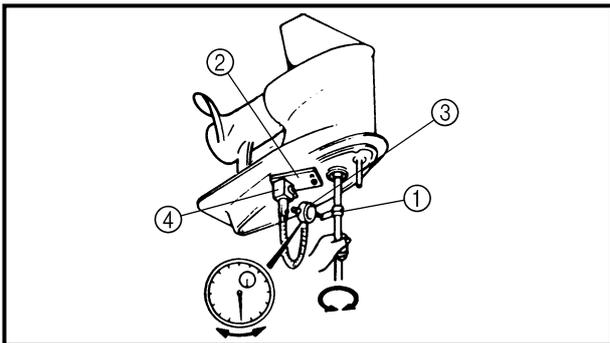
	<p><b>Shift rod wrench</b>  <b>YB-06052 / 90890-06052</b></p>
---	---

(2) Load the reverse gear by installing the propeller without the spacer ① and then tighten the propeller nut.



	<p><b>Propeller nut</b>  <b>10 Nm (1.0 m • kgf, 7.2 ft • lb)</b></p>
---	--

(3) Install the backlash indicator onto the drive shaft (on the 22.4 mm (0.88 in) diameter portion of the drive shaft).



	<p><b>Backlash indicator ..... ①</b>  <b>YB-06265 / 90890-06706</b></p>
---	---

(4) Install the dial gauge onto the lower unit and have the dial gauge plunger contact the mark on the backlash indicator.

	<p><b>Magnetic-base plate ..... ②</b>  <b>YB-07003 / 90890-07003</b></p>
	<p><b>Dial gauge set ..... ③</b>  <b>YU-03097 / 90890-01252</b></p>
	<p><b>Magnetic base ..... ④</b>  <b>YU-34481 / 90890-06705</b></p>

(5) Set the lower unit upside down.



## BACKLASH (REGULAR ROTATION MODELS)

E

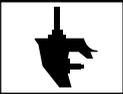
(6) Slowly turn the drive shaft clockwise and counterclockwise. When the drive shaft stops in each direction, measure the backlash.

2. Adjust:

- Reverse gear shim  
Remove or add shim(s).

 Reverse gear backlash	Shim thickness
Less than 0.74 mm (0.029 in)	To be increased by $(1.02 - M) \times 0.54$
More than 1.29 mm (0.051 in)	To be decreased by $(M - 1.02) \times 0.54$

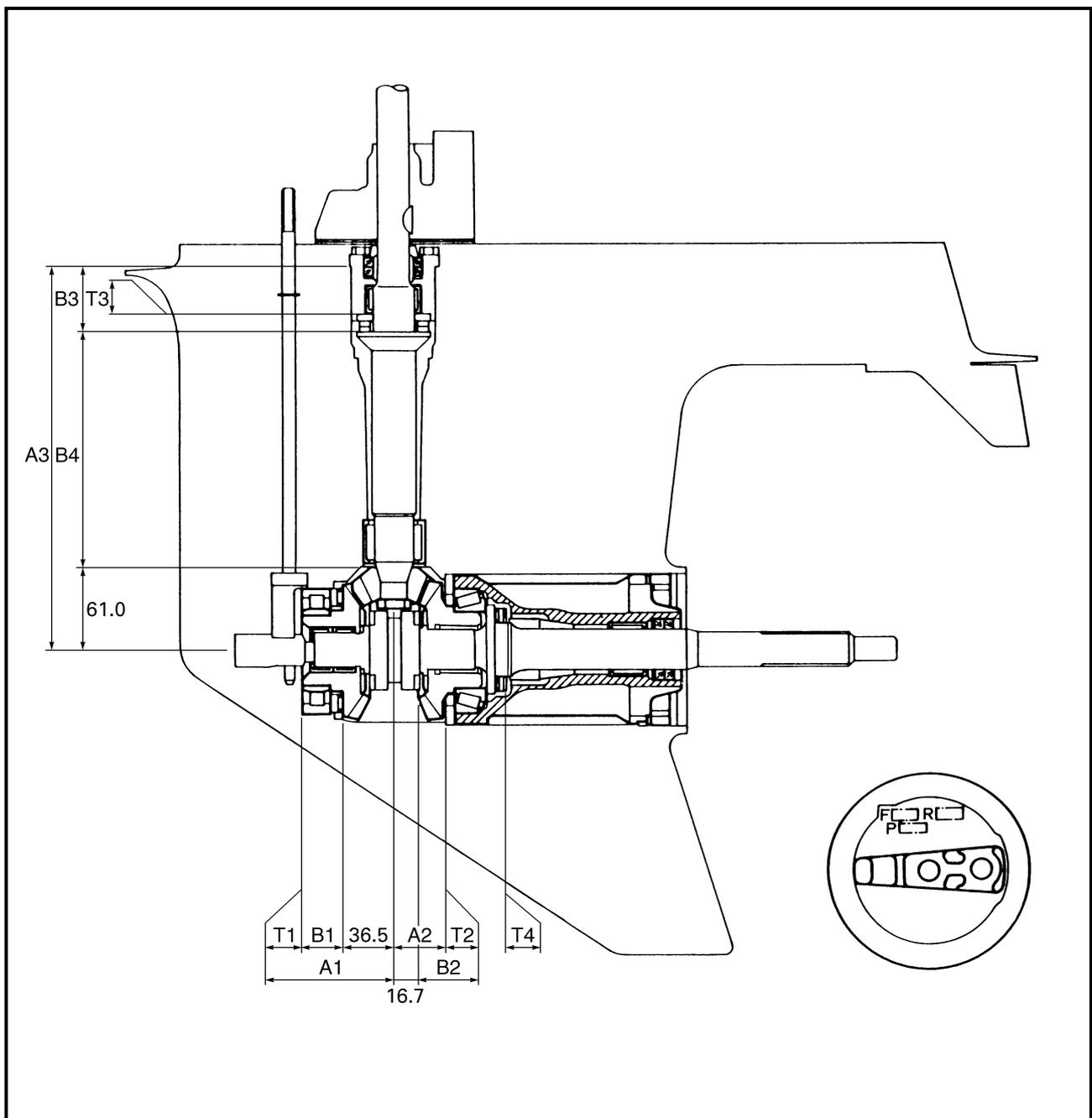
M: Measurement

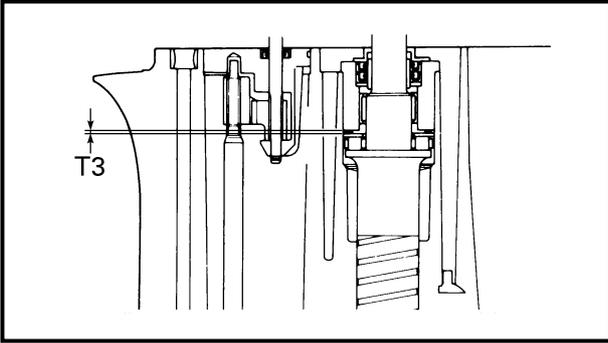


**SHIMMING (COUNTER ROTATION MODELS) (FOR USA AND CANADA)**

**NOTE:**

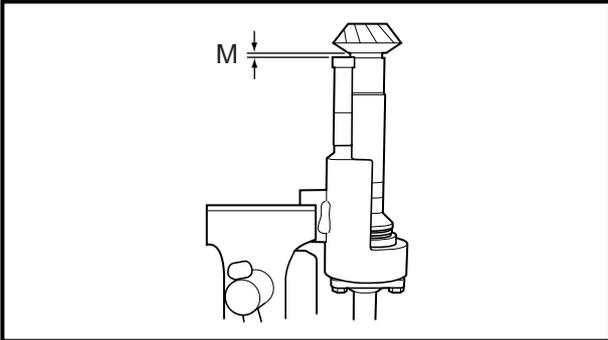
- There is no need to select shims when reassembling with the original case and inner parts.
- Shim calculations are required when reassembling with the original inner parts and a new case (the difference between the original inner parts and the new case).
- Measurements and adjustments are required when replacing the inner part(s).





**SELECTING THE PINION SHIMS**

**NOTE:** \_\_\_\_\_  
Find the shim thickness (T3) by selecting shims until the specified measurement (M) is obtained with the special tool.



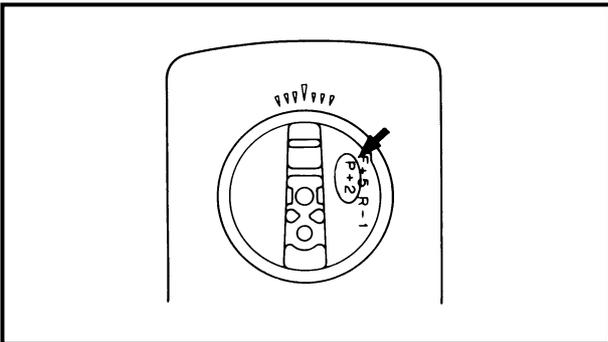
1. Measure:
- Specified measurement (M)
- Out of specified value (M0) → Adjust.



**Specified value (M0) =**  
**1.00 + P/100 mm**

**Measuring steps**

- (1) Calculate the specified value (M0).



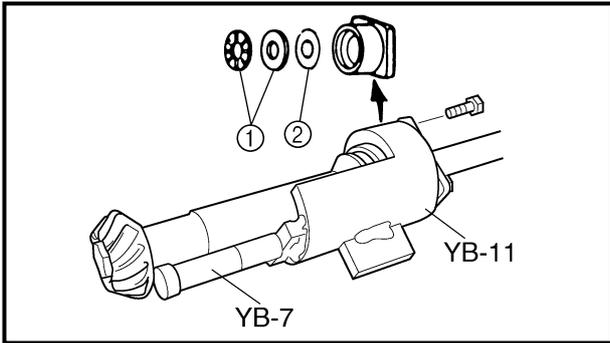
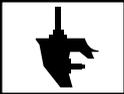
**NOTE:** \_\_\_\_\_

- “P” is the deviation of the lower case dimension from standard. It is stamped on the trim tab mounting surface of the lower case in 0.01-mm units. If the “P” mark is missing or unreadable, assume a “P” value of “0”, and check the backlash when the unit is assembled.
- If the “P” mark is negative (-), then subtract the “P” value from the measurement.

Example:

If “P” is “+5”, then  
 $M0 = 1.00 + (+5)/100 \text{ mm}$   
 $= 1.00 + 0.05 \text{ mm}$   
 $= 1.05 \text{ mm}$

If “P” is “-3”, then  
 $M0 = 1.00 + (-3)/100 \text{ mm}$   
 $= 1.00 - 0.03 \text{ mm}$   
 $= 0.97 \text{ mm}$



(2) Install the pinion height gauge, drive shaft, thrust bearing ①, and shim(s) ②.



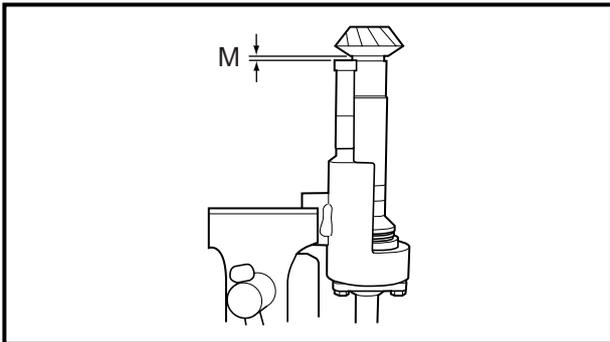
**Pinion height gauge  
YB-34432-7, -11**

**NOTE:** \_\_\_\_\_  
If the original shim(s) is unavailable, start with a 0.50-mm shim.

(3) Install the pinion and pinion nut.



**Pinion nut  
95 Nm (9.5 m • kgf, 69 ft • lb)**



(4) Measure the specified measurement (M).

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

- Measure the clearance between the pinion height gauge and the lower surface of the pinion as shown.
- Perform the same measurement at three points on the pinion.
- Find the average of the measurements (M).

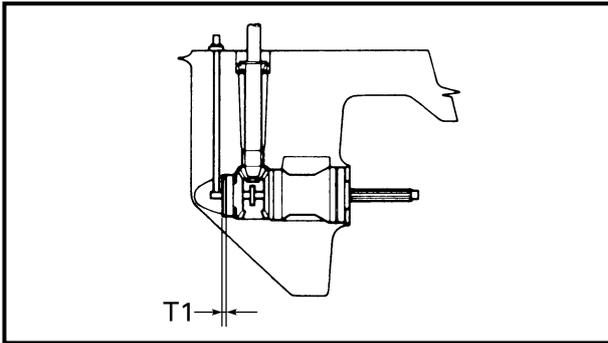
2. Adjust:

- Shim thickness (T3)  
Remove or add shim(s).



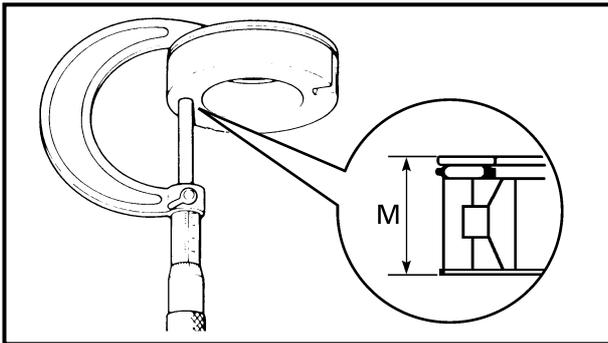
**Available shim thickness  
0.10, 0.12, 0.15, 0.18, 0.30, 0.40  
and 0.50 mm**

**NOTE:** \_\_\_\_\_  
(M0) – (M) should be as close to “0” as possible.



**SELECTING THE REVERSE GEAR SHIMS**

**NOTE:** \_\_\_\_\_  
Find the shim thickness (T1) by selecting shims until the specified value (M0) is obtained with the special tool.

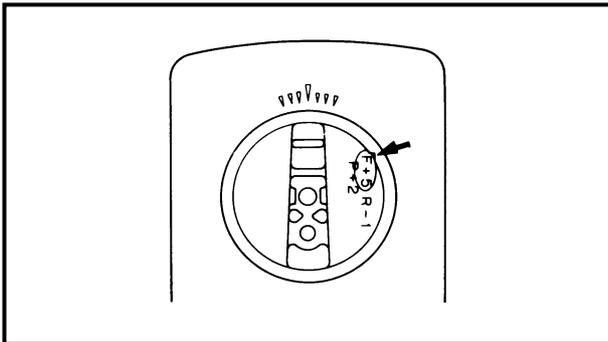


1. Measure:
- Specified measurement (M)
- Out of specified value (M0) → Adjust.

	<p><b>Specified value (M0) =</b> <b>29.10 + F/100 mm</b></p>
--	--

**Measuring steps**

- (1) Calculate the specified value (M0).



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

- “F” is the deviation of the lower case dimension from standard. It is stamped on the trim tab mounting surface of the lower case in 0.01-mm units. If the “F” mark is missing or unreadable, assume an “F” value of “0”, and check the backlash when the unit is assembled.
- If the “F” mark is negative (-), then subtract the “F” value from the measurement.

Example:

If “F” is “+5”, then

$$M0 = 29.10 + (+5)/100 \text{ mm}$$

$$= 29.10 + 0.05 \text{ mm}$$

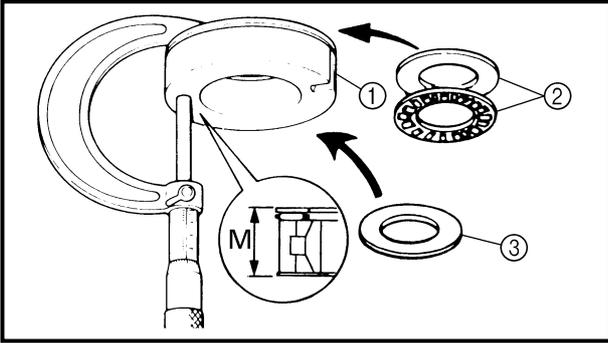
$$= 29.15 \text{ mm}$$

If “F” is “-3”, then

$$M0 = 29.10 + (-3)/100 \text{ mm}$$

$$= 29.10 - 0.03 \text{ mm}$$

$$= 29.07 \text{ mm}$$



(2) Install the roller bearing ①, thrust bearing ②, and shim(s) ③.

**NOTE:** \_\_\_\_\_  
If the original shim(s) is unavailable, start with a 0.50-mm shim.

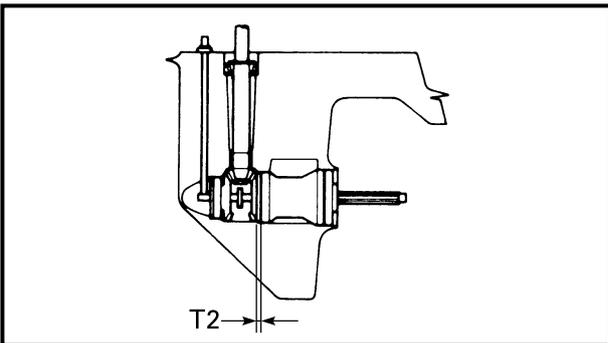
(3) Measure the specified measurement (M).

2. Adjust:
- Shim thickness (T1)
- Remove or add shim(s).



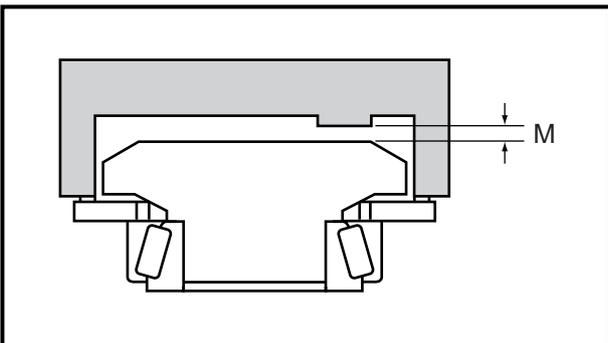
**Available shim thickness**  
**0.10, 0.12, 0.15, 0.18, 0.30, 0.40**  
**and 0.50 mm**

**NOTE:** \_\_\_\_\_  
(M0) – (M) should be as close to “0” as possible.



**SELECTING THE FORWARD GEAR SHIMS**

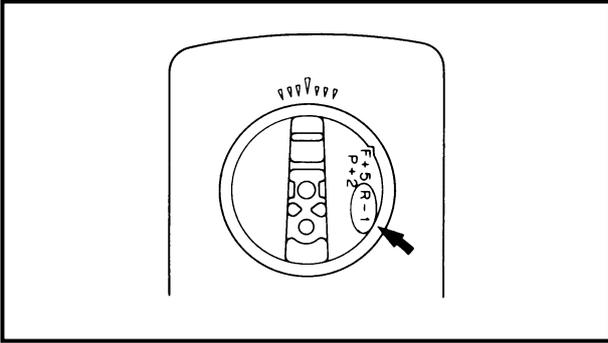
**NOTE:** \_\_\_\_\_  
Find the shim thickness (T2) by selecting shims until the specified value (M0) is obtained with the special tool.



1. Measure:
- Specified measurement (M)
- Out of specified value (M0) → Adjust.



**Specified value (M0) =**  
**1.30 – R/100 mm**



**Measuring steps**

(1) Calculate the specified value (M0).

**NOTE:**

- "R" is the deviation of the lower case dimension from standard. It is stamped on the trim tab mounting surface of the lower case in 0.01-mm units. If the "R" mark is missing or unreadable, assume an "R" value of "0", and check the backlash when the unit is assembled.
- If the "R" mark is negative (-), then add the "R" value to the measurement.

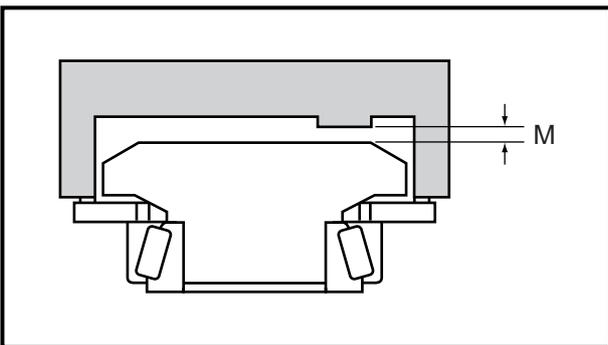
Example:

If "R" is "+5", then

$$\begin{aligned} M_0 &= 1.30 - (+5)/100 \text{ mm} \\ &= 1.30 - 0.05 \text{ mm} \\ &= 1.25 \text{ mm} \end{aligned}$$

If "R" is "-3", then

$$\begin{aligned} M_0 &= 1.30 - (-3)/100 \text{ mm} \\ &= 1.30 + 0.03 \text{ mm} \\ &= 1.33 \text{ mm} \end{aligned}$$



(2) Install the shimming gauge, bearing, thrust washer, forward gear, and shim(s).

	<p><b>Shimming gauge YB-34468-2</b></p>
--	---

**NOTE:**

- If the original shim(s) is unavailable, start with a 0.50-mm shim.
- Turn the forward gear assembly a few times until the gear and bearing are horizontal.

(3) Measure the specified measurement (M).

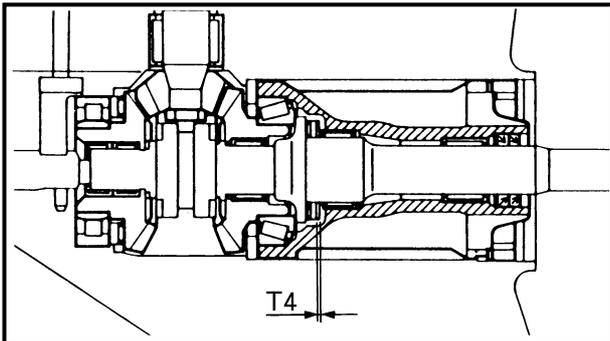


2. Adjust:
- Shim thickness (T2)
- Remove or add shim(s).



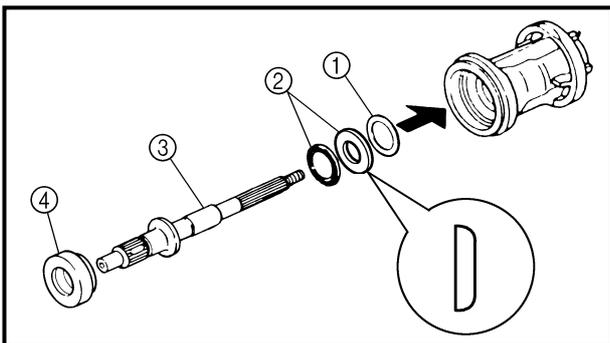
**Available shim thickness**  
0.10, 0.12, 0.15, 0.18, 0.30, 0.40  
and 0.50 mm

**NOTE:** \_\_\_\_\_  
(M0) – (M) should be as close to “0” as possible.

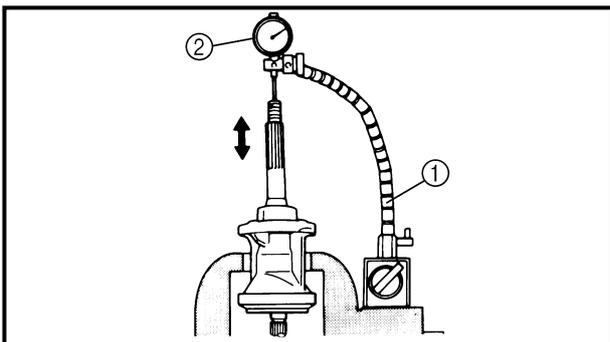


**SELECTING THE PROPELLER SHAFT SHIMS**

**NOTE:** \_\_\_\_\_  
Find the shim thickness (T4) by selecting shims until the specified measurement is obtained with the special tool.



1. Install:
- Shim(s) ①
  - Thrust bearing ②
  - Propeller shaft ③
  - Tapered roller bearing ④



2. Measure:
- Propeller shaft free play
- Out of specification → Adjust.



**Propeller shaft free play**  
0.30 ± 0.05 mm (0.012 ± 0.002 in)

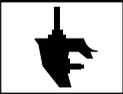


**Magnetic base**..... ①  
**YU-34481**  
**Dial gauge set** ..... ②  
**YU-03097**

3. Adjust:
- Propeller shaft free play
- Remove or add shim(s).



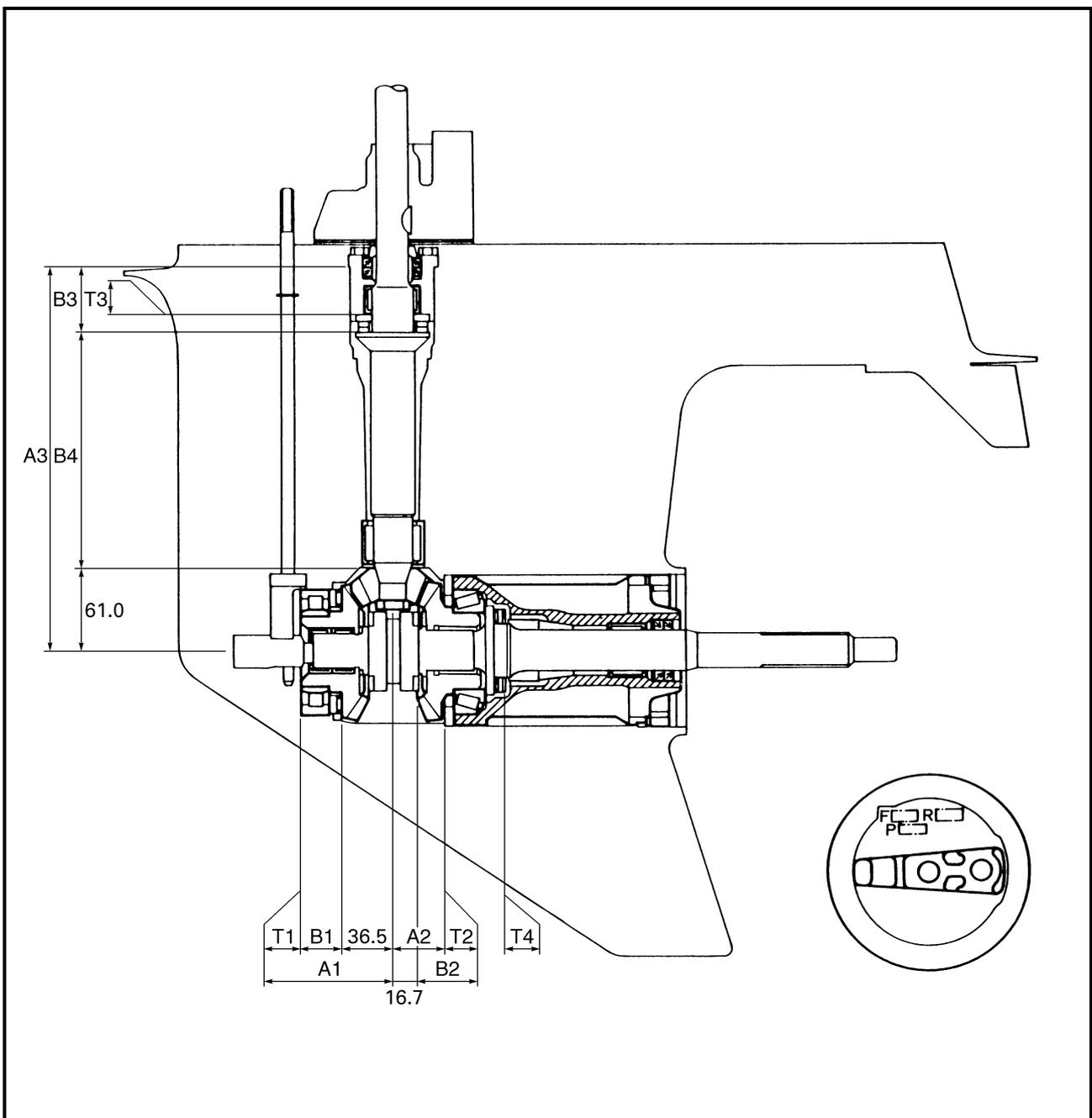
**Available shim thickness**  
0.10, 0.12, 0.15, 0.18, 0.30, 0.40  
and 0.50 mm

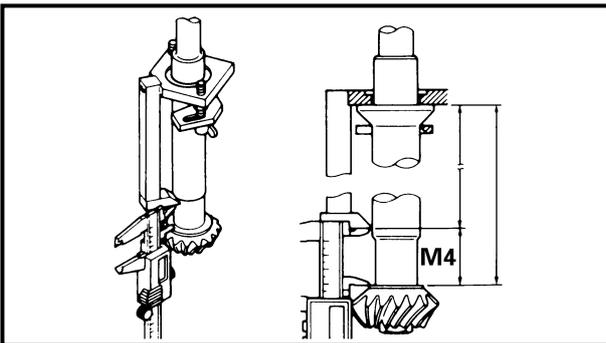
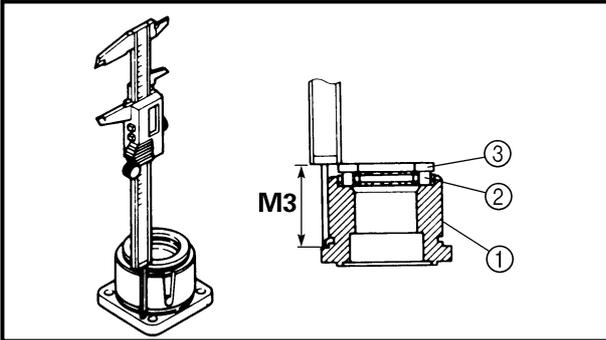
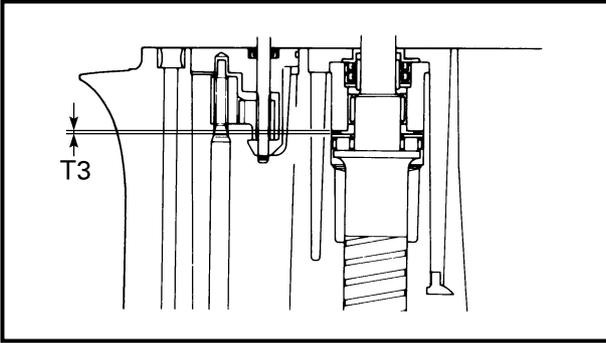
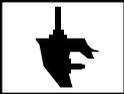


SHIMMING (COUNTER ROTATION MODELS) (FOR WORLDWIDE)

**NOTE:**

- There is no need to select shims when reassembling with the original case and inner parts.
- Shim calculations are required when reassembling with the original inner parts and a new case (the difference between the original inner parts and the new case).
- Measurements and adjustments are required when replacing the inner part(s).





**SELECTING THE PINION SHIMS**

**NOTE:** \_\_\_\_\_  
Select the shim thickness (T3) by using the specified measurement(s) and the calculation formula.

- Select:
- Shim thickness (T3)

**Selecting steps**

(1) Measure (M3).

	<b>Digital caliper</b> 90890-06704
--	---------------------------------------

**NOTE:** \_\_\_\_\_  
Install the bearing housing ①, thrust bearing ②, and washer ③.

(2) Install the pinion and pinion nut.

	<b>Pinion nut</b> 95 Nm (9.5 m • kgf, 69 ft • lb)
--	--

(3) Install the pinion height gauge.

	<b>Pinion height gauge</b> 90890-06702
--	---

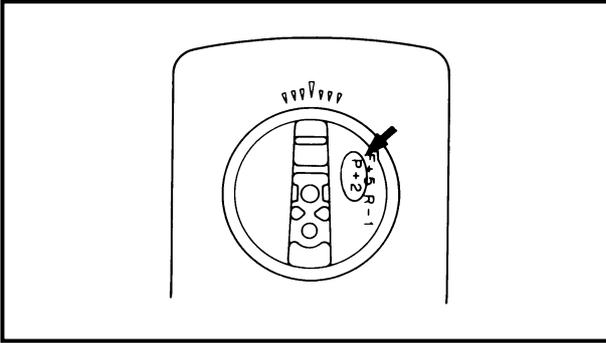
**NOTE:** \_\_\_\_\_  
After the wing nuts contact the fixing plate, tighten them another 1/4 of a turn.

(4) Measure (M4).

	<b>Digital caliper</b> 90890-06704
--	---------------------------------------

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

- Measure the clearance between the pinion height gauge and the pinion, as shown.
- Perform the same measurement at three points on the pinion.
- Find the average of the measurements (M4).



(5) Calculate the pinion shim thickness (T3).



**Pinion shim thickness (T3) =**  
**80.0 + P/100 – M3 – M4**

**NOTE:**

- "P" is the deviation of the lower case dimension from standard. It is stamped on the trim tab mounting surface of the lower case in 0.01-mm units. If the "P" mark is missing or unreadable, assume a "P" value of "0", and check the backlash when the unit is assembled.
- If the "P" mark is negative (-), then add the "P" value to the measurement.

Example:

If M3 is "46.85 mm", M4 is "32.52 mm" and P is "-5", then

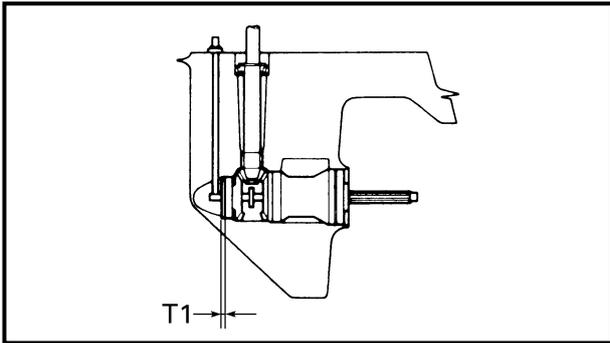
$$\begin{aligned}
 T3 &= 80.0 + (-5)/100 - 46.85 - 32.52 \text{ mm} \\
 &= 80.0 - 0.05 - 46.85 - 32.52 \text{ mm} \\
 &= 0.58 \text{ mm}
 \end{aligned}$$

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

Calculated numeral at 1/100th place		Rounded numeral
More than	or less	
0.00	0.02	0.00
0.02	0.05	0.02
0.05	0.08	0.05
0.08	0.10	0.08



**Available shim thickness**  
**0.10, 0.12, 0.15, 0.18, 0.30, 0.40**  
**and 0.50 mm**



**SELECTING THE REVERSE GEAR SHIMS**

**NOTE:** \_\_\_\_\_  
Select the shim thickness (T1) by using the specified measurement(s) and the calculation formula.

- Select:
- Shim thickness (T1)

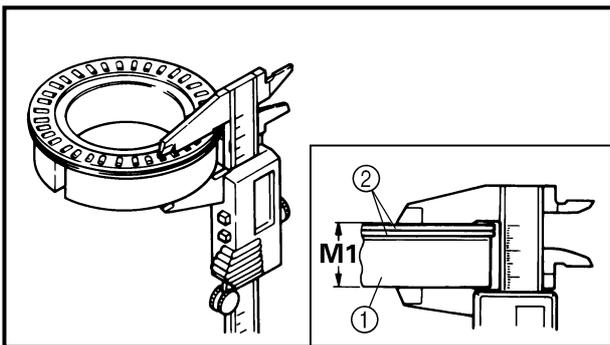
**Selecting steps**

(1) Measure (M1).



**Digital caliper  
90890-06704**

- NOTE:** \_\_\_\_\_
- Measure the combined thickness of the roller bearing ① and thrust bearing ②.
  - Turn the roller bearing outer race two or three times so the rollers seat. Then, measure the height of the bearing, as shown.
  - Perform the same measurement at three points on the roller bearing outer race.
  - Find the average of the measurements (M1).

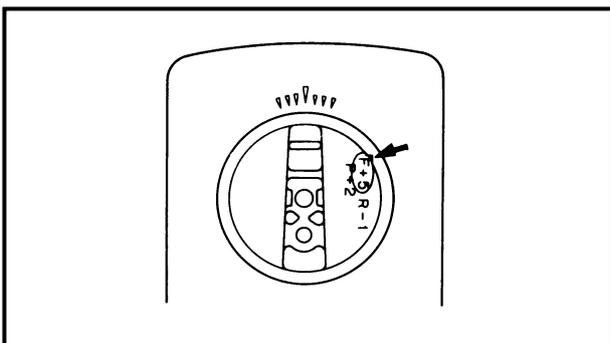


(2) Calculate the reverse gear shim thickness (T1).



**Reverse gear shim thickness (T1)  
(T1) = 29.1 + F/100 - M1**

- NOTE:** \_\_\_\_\_
- "F" is the deviation of the lower case dimension from standard. It is stamped on the trim tab mounting surface of the lower case in 0.01-mm units. If the "F" mark is missing or unreadable, assume an "F" value of "0", and check the backlash when the unit is assembled.
  - If the "F" mark is negative (-), then subtract the "F" value from the measurement.





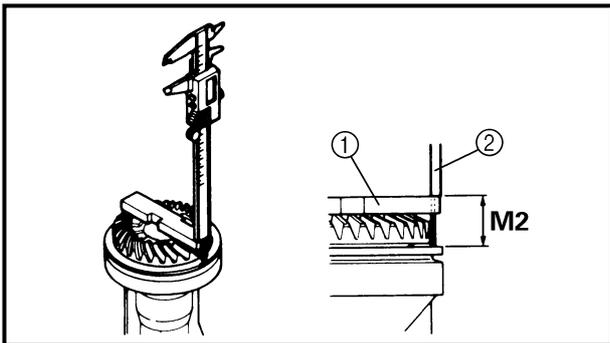
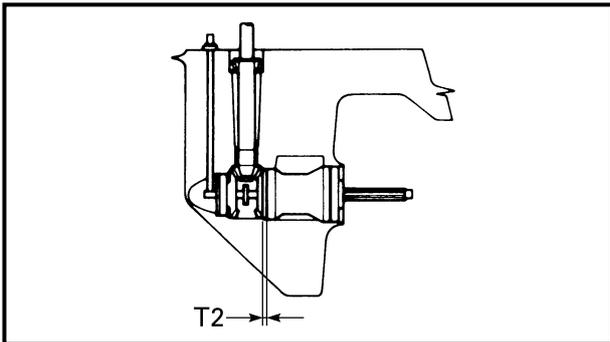
Example:

If M1 is "28.10 mm" and F is "+5", then  
 $T1 = 29.1 + (+5)/100 - 28.10 \text{ mm}$   
 $= 29.1 + 0.05 - 28.10 \text{ mm}$   
 $= 1.05 \text{ mm}$

(3) Select the reverse gear shim(s).

Calculated numeral at 1/100th place		Rounded numeral
More than	or less	
0.00	0.02	0.00
0.02	0.05	0.02
0.05	0.08	0.05
0.08	0.10	0.08

**Available shim thickness**  
0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm



**SELECTING THE FORWARD GEAR SHIMS**

**NOTE:** \_\_\_\_\_  
 Select the shim thickness (T2) by using the specified measurement(s) and the calculation formula.

- Select:
- Shim thickness (T2)

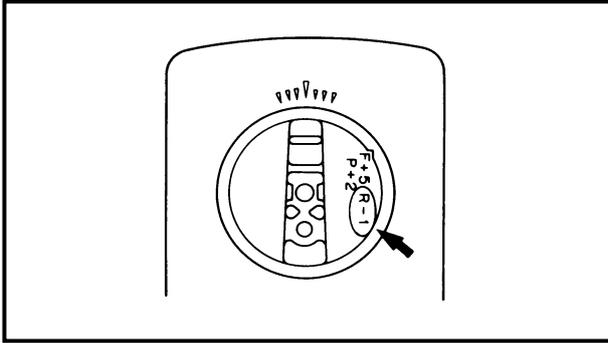
**Selecting steps**

(1) Measure (M2).

	<b>Shimming plate</b> ..... ①
	<b>Digital caliper</b> ..... ②

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

- Measure the height of the gear as shown.
- Perform the same measurement at three points on the gear.
- Find the average of the measurements (M2).



(2) Calculate the forward gear shim thickness (T2).



**Forward gear shim thickness  
(T2) = M2 - 29.5 - R/100**

**NOTE:**

- "R" is the deviation of the lower case dimension from standard. It is stamped on the trim tab mounting surface of the lower case in 0.01-mm units. If the "R" mark is missing or unreadable, assume a "R" value of "0", and check the backlash when the unit is assembled.
- If the "R" mark is negative (-), then subtract the "R" value from the measurement.

Example:

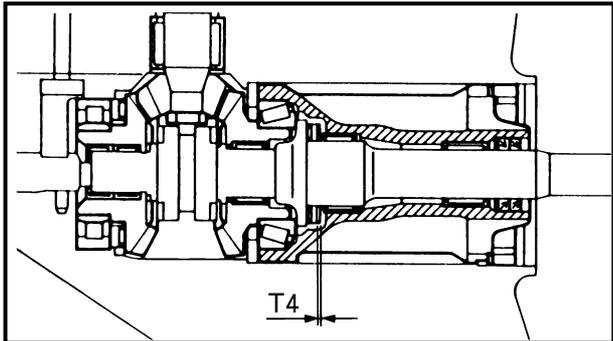
If M2 is "30.50 mm", R is "+2", then  
 $T2 = 30.50 - 29.5 - (+2)/100$  mm  
 $= 30.50 - 29.5 - 0.02$  mm  
 $= 0.98$  mm

(3) Select the forward gear shim(s) (T2).

Calculated numeral at 1/100th place		Rounded numeral
More than	or less	
0.00	0.02	0.02
0.02	0.05	0.05
0.05	0.08	0.08
0.08	0.10	0.10

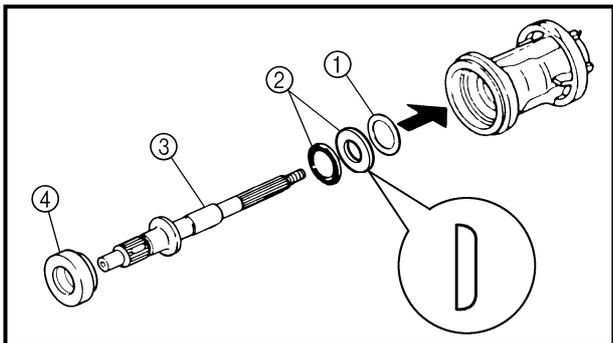


**Available shim thickness  
0.10, 0.12, 0.15, 0.18, 0.30, 0.40  
and 0.50 mm**

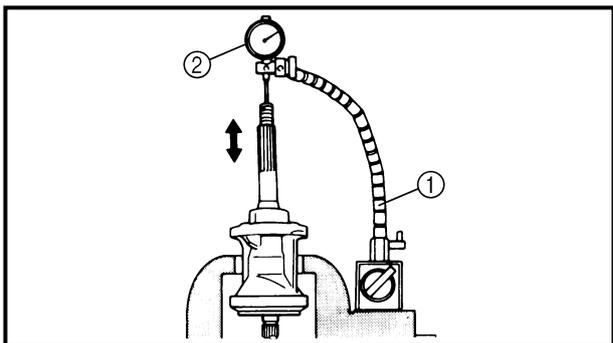


**SELECTING THE PROPELLER SHAFT SHIMS**

**NOTE:** \_\_\_\_\_  
Find the shim thickness (T4) by selecting shims until the specified measurement is obtained with the special tool.



1. Install:
- Shim(s) ①
  - Thrust bearing ②
  - Propeller shaft ③
  - Tapered roller bearing ④



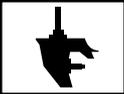
2. Measure:
- Propeller shaft free play  
Out of specification → Adjust.

	<b>Propeller shaft free play</b> <b>0.30 ± 0.05 mm (0.012 ± 0.002 in)</b>
--	--

	<b>Magnetic base..... ①</b> <b>90890-06705</b>
	<b>Dial gauge set ..... ②</b> <b>90890-01252</b>

3. Adjust:
- Propeller shaft free play  
Remove or add shim(s).

	<b>Available shim thickness</b> <b>0.10, 0.12, 0.15, 0.18, 0.30, 0.40</b> <b>and 0.50 mm</b>
--	--



**BACKLASH  
(COUNTER ROTATION MODELS)**

**NOTE:**

- Do not install the water pump components when measuring the backlash.
- Measure both the forward and reverse gear backlashes.
- If both the forward and reverse gear backlashes are larger than specification, the pinion may be too high.
- If both the forward and reverse gear backlashes are smaller than specification, the pinion may be too low.

**MEASURING THE FORWARD GEAR BACKLASH**

1. Measure:

- Forward gear backlash
- Out of specification → Adjust.

	<b>Forward gear backlash</b> 0.21 - 0.43 mm (0.008 - 0.017 in)
--	---

**Measuring steps**

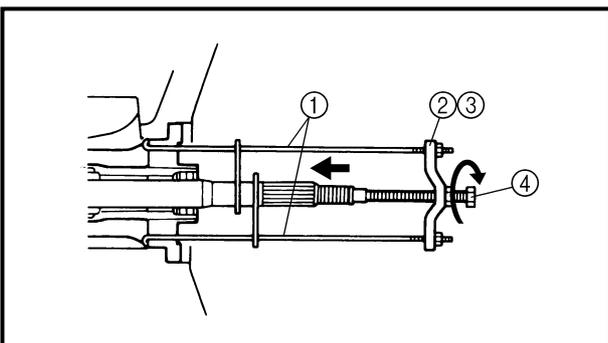
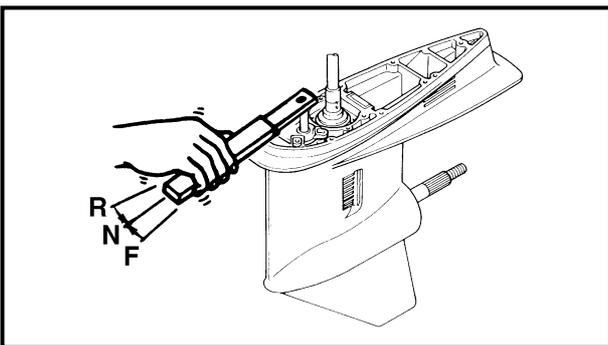
- (1) Set the shift rod into the neutral position.

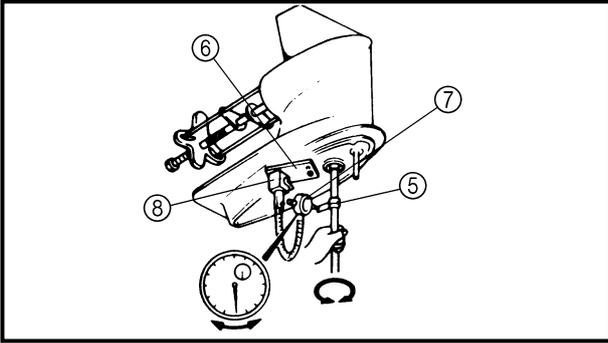
	<b>Shift rod wrench</b> YB-06052 / 90890-06052
--	---

- (2) Install the propeller shaft housing puller so it pushes against the propeller shaft.

	<b>Propeller shaft housing puller</b> ① YB-06207 / 90890-06502
	<b>Universal puller</b> ..... ② YB-06117
	<b>Guide plate</b> ..... ③ 90890-06501
	<b>Center bolt</b> ..... ④ 90890-06504

	<b>Center bolt</b> 10 Nm (1.0 m • kgf, 7.2 ft • lb)
--	--





(3) Install the backlash indicator onto the drive shaft (on the 22.4 mm (0.88 in) diameter portion of the drive shaft).

	<b>Backlash indicator</b> ..... ⑤ <b>YB-06265 / 90890-06706</b>
--	--

(4) Install the dial gauge onto the lower unit and have the dial gauge plunger contact the mark on the backlash indicator.

	<b>Magnetic-base plate</b> ..... ⑥ <b>YB-07003 / 90890-07003</b>
	<b>Dial gauge set</b> ..... ⑦ <b>YU-03097 / 90890-01252</b>
	<b>Magnetic base</b> ..... ⑧ <b>YU-34481 / 90890-06705</b>

- (5) Set the lower unit upside down.
- (6) Slowly turn the drive shaft clockwise and counterclockwise. When the drive shaft stops in each direction, measure the backlash.

**2. Adjust:**

- Forward gear shim  
Remove or add shim(s).

Forward gear backlash	Shim thickness
<b>Less than 0.21 mm (0.008 in)</b>	<b>To be increased by (0.32 - M) × 0.54</b>
<b>More than 0.43 mm (0.017 in)</b>	<b>To be decreased by (M - 0.32) × 0.54</b>

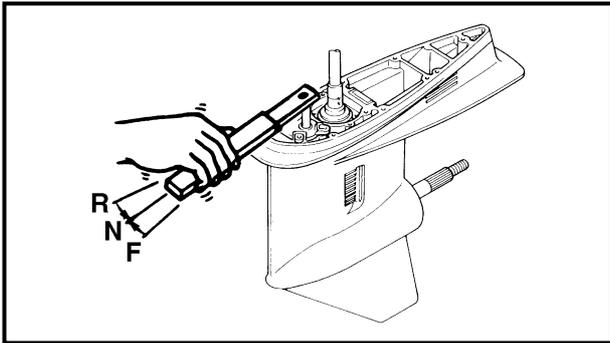
M: Measurement

**MEASURING THE REVERSE GEAR BACKLASH**

**1. Measure:**

- Reverse gear backlash  
Out of specification → Adjust.

	<b>Reverse gear backlash</b> <b>0.97 - 1.29 mm (0.038 - 0.051 in)</b>
--	--

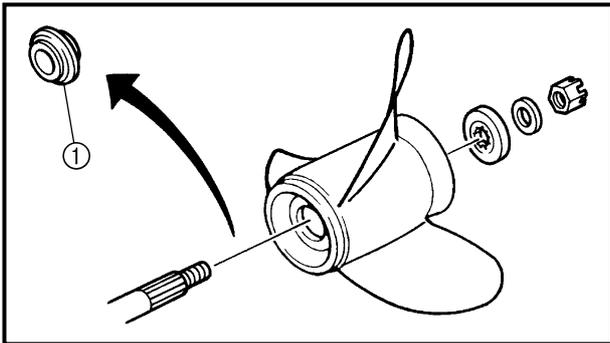


**Measuring steps**

(1) Set the shift rod into the neutral position.



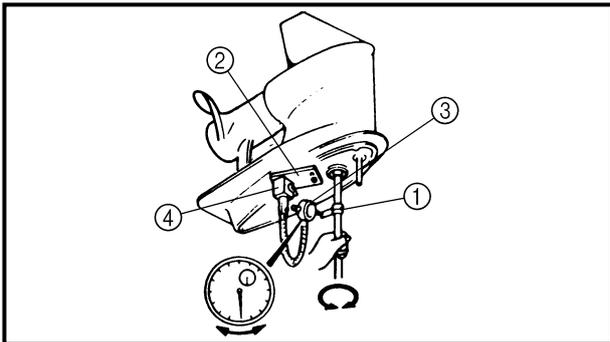
**Shift rod wrench**  
YB-06052 / 90890-06052



(2) Load the reverse gear by installing the propeller without the spacer ① and then tighten the propeller nut.



**Propeller nut**  
5 Nm (0.5 m • kgf, 3.6 ft • lb)



(3) Install the backlash indicator onto the drive shaft (on the 22.4 mm (0.88 in) diameter portion of the drive shaft).



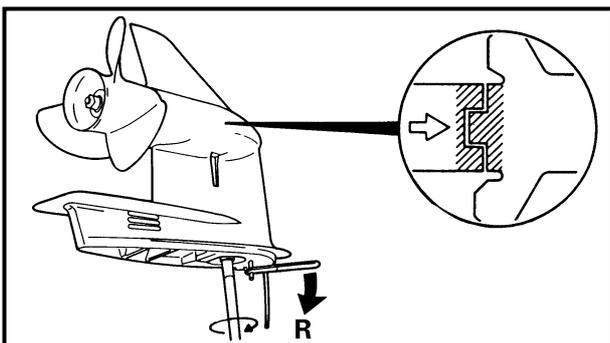
**Backlash indicator** ..... ①  
YB-06265 / 90890-06706

(4) Install the dial gauge onto the lower unit and have the dial gauge plunger contact the mark on the backlash indicator.



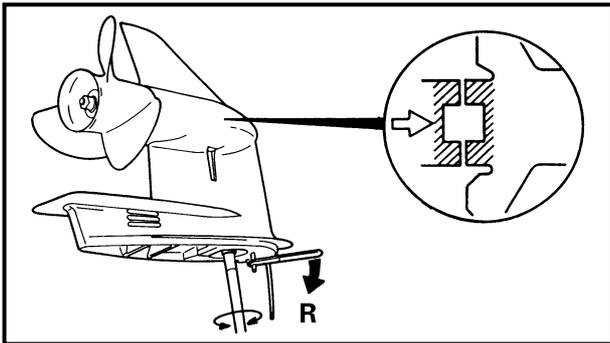
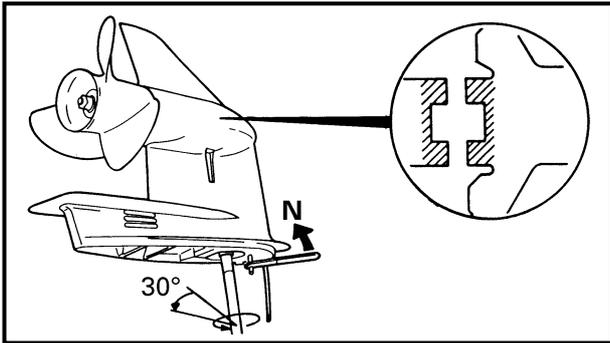
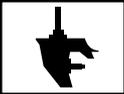
**Magnetic-base plate** ..... ②  
YB-07003 / 90890-07003  
**Dial gauge set** ..... ③  
YU-03097 / 90890-01252  
**Magnetic base** ..... ④  
YU-34481 / 90890-06705

(5) Set the lower unit upside down.



(6) Turn the shift rod into the reverse position with the shift rod wrench.

(7) Turn the drive shaft clockwise until the clutch dog is fully engaged.



- (8) Turn the shift rod into the neutral position with the shift rod wrench.
- (9) Turn the drive shaft counterclockwise approximately 30° more.

- (10) Turn the shift rod into the reverse position with the shift rod wrench.
- (11) Slowly turn the drive shaft clockwise and counterclockwise. When the drive shaft stops in each direction, measure the backlash.

**NOTE:** \_\_\_\_\_  
 When measuring the reverse gear backlash, turn the shift rod wrench slightly towards the reverse position.

- 2. Adjust:
  - Reverse gear shim  
 Remove or add shim(s).

 Reverse gear backlash	Shim thickness
Less than 0.97 mm (0.038 in)	To be decreased by $(1.13 - M) \times 0.54$
More than 1.29 mm (0.051 in)	To be increased by $(M - 1.13) \times 0.54$

M: Measurement



## CHAPTER 7 BRACKET UNIT

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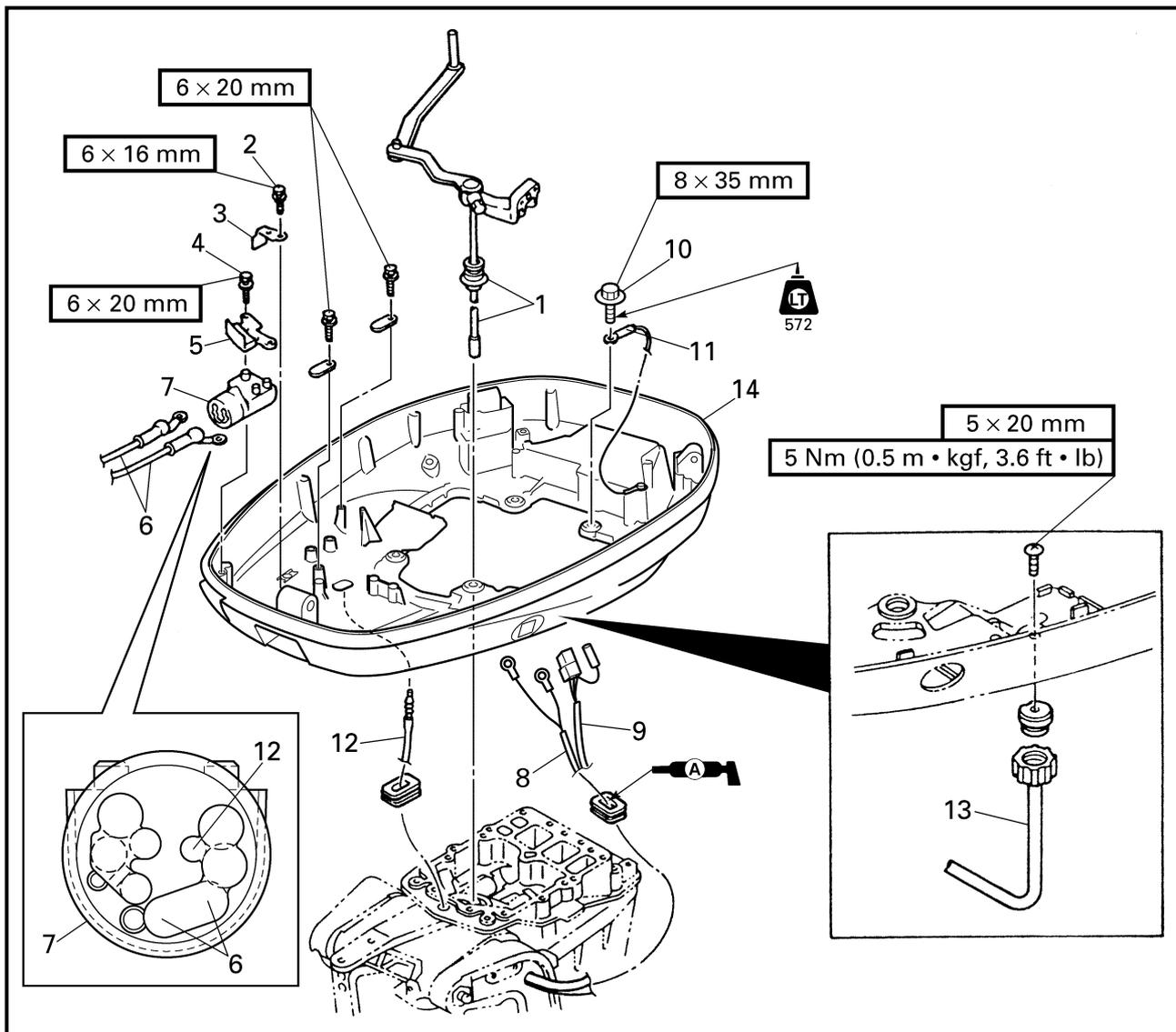
**TILT RAM ASSEMBLY AND GEAR PUMP UNIT** ..... 7-30

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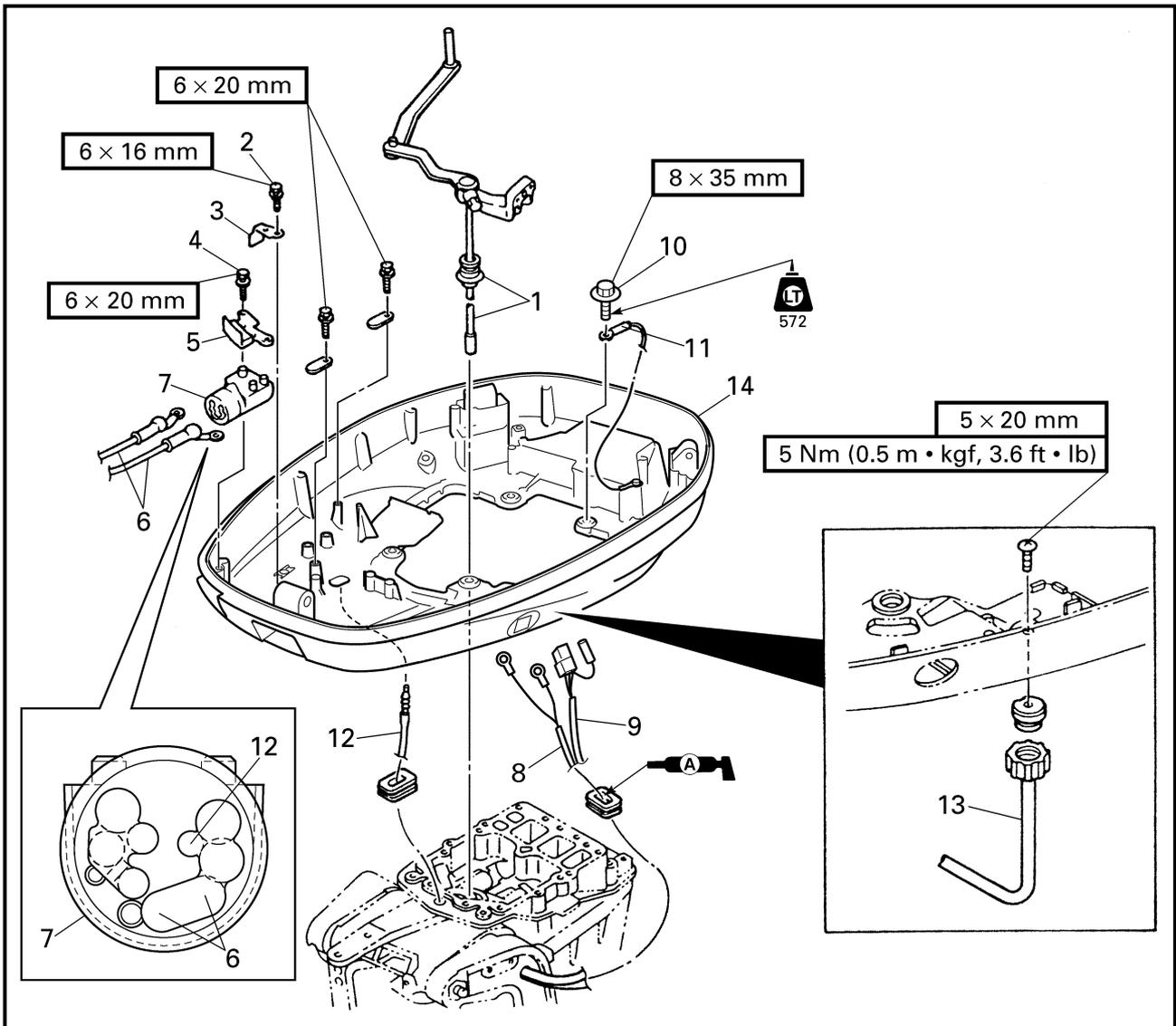
- REMOVING/INSTALLING THE TRIM RAM ASSEMBLIES AND FREE PISTON ..... 7-37
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**BOTTOM COWLING  
REMOVING/INSTAING THE BOTTOM COWLING**



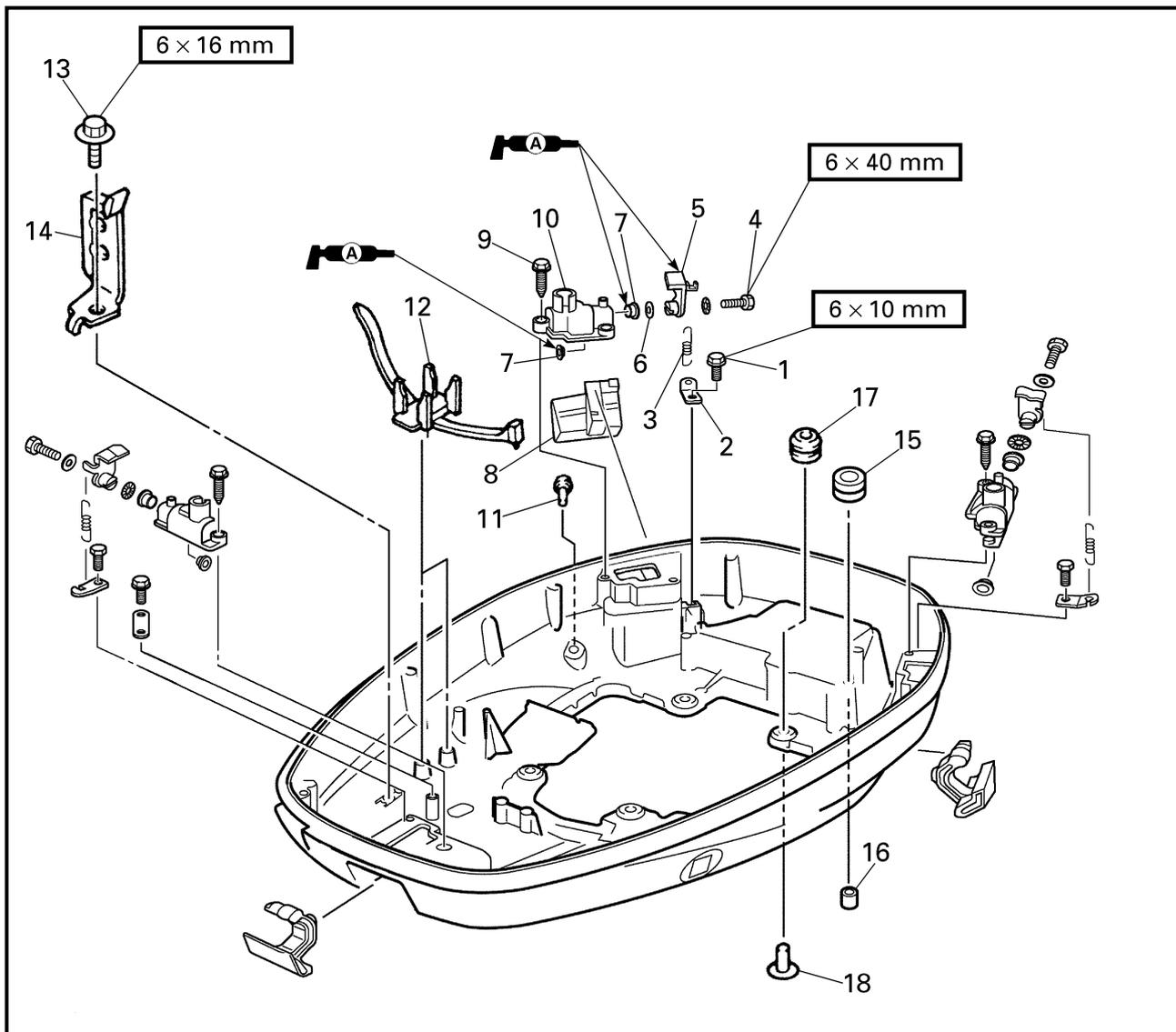
Order	Job/Part	Q'ty	Remarks
	Power unit		Refer to "POWER UNIT" on page 5-4.
1	Shift rod assembly	1	
2	Bolt	1	
3	Holder	1	
4	Bolt	2	
5	Bracket	1	
6	Battery lead	2	
7	Hose guide	1	

Continued on next page.



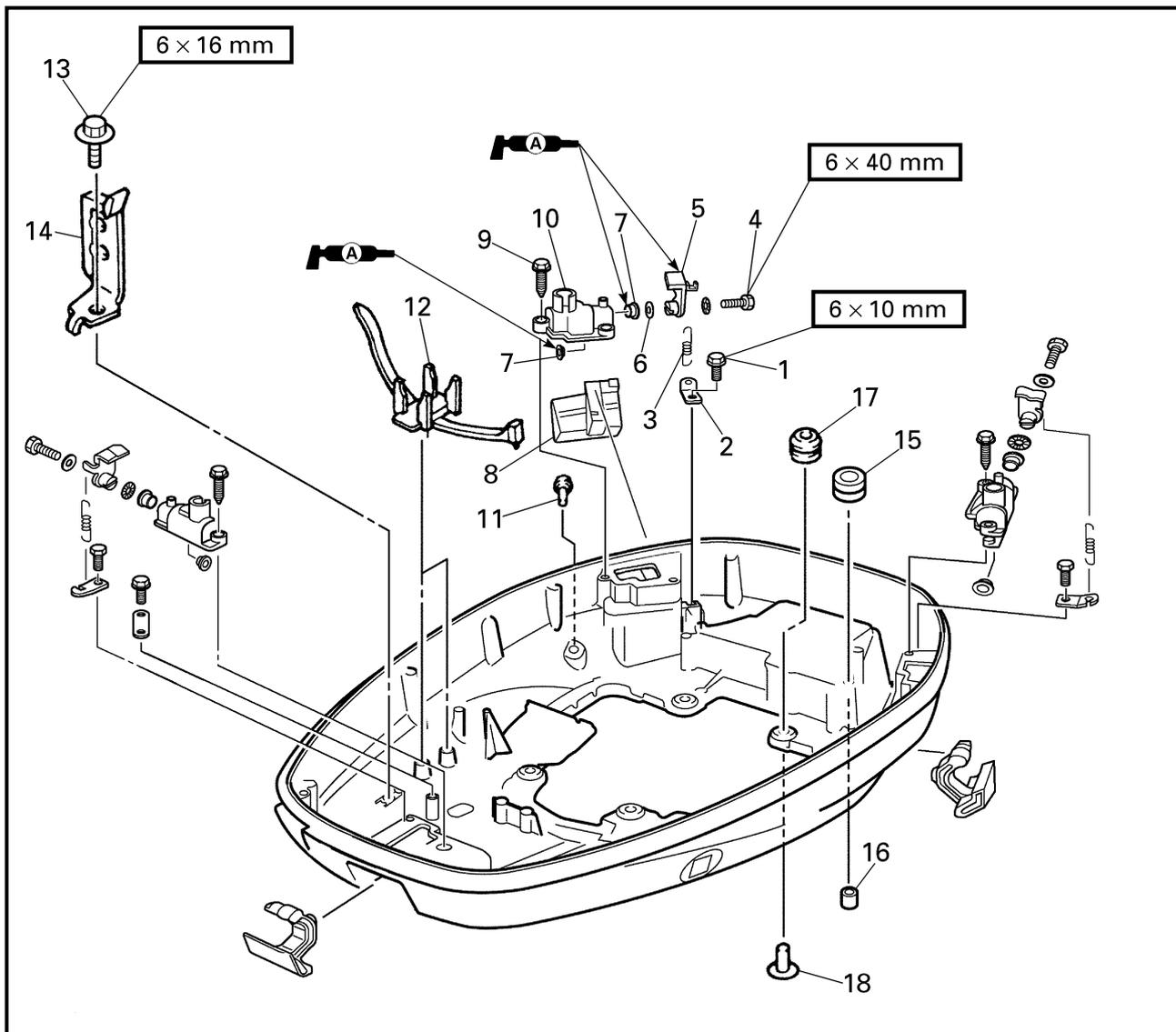
Order	Job/Part	Q'ty	Remarks
8	Power trim and tilt lead	1	For installation, reverse the removal procedure.
9	Trim sensor lead	1	
10	Bolt	4	
11	Ground lead	1	
12	Speedometer hose	1	
13	Flushing hose	1	
14	Bottom cowling	1	

**DISASSEMBLING/ASSEMBLING THE BOTTOM COWLING**



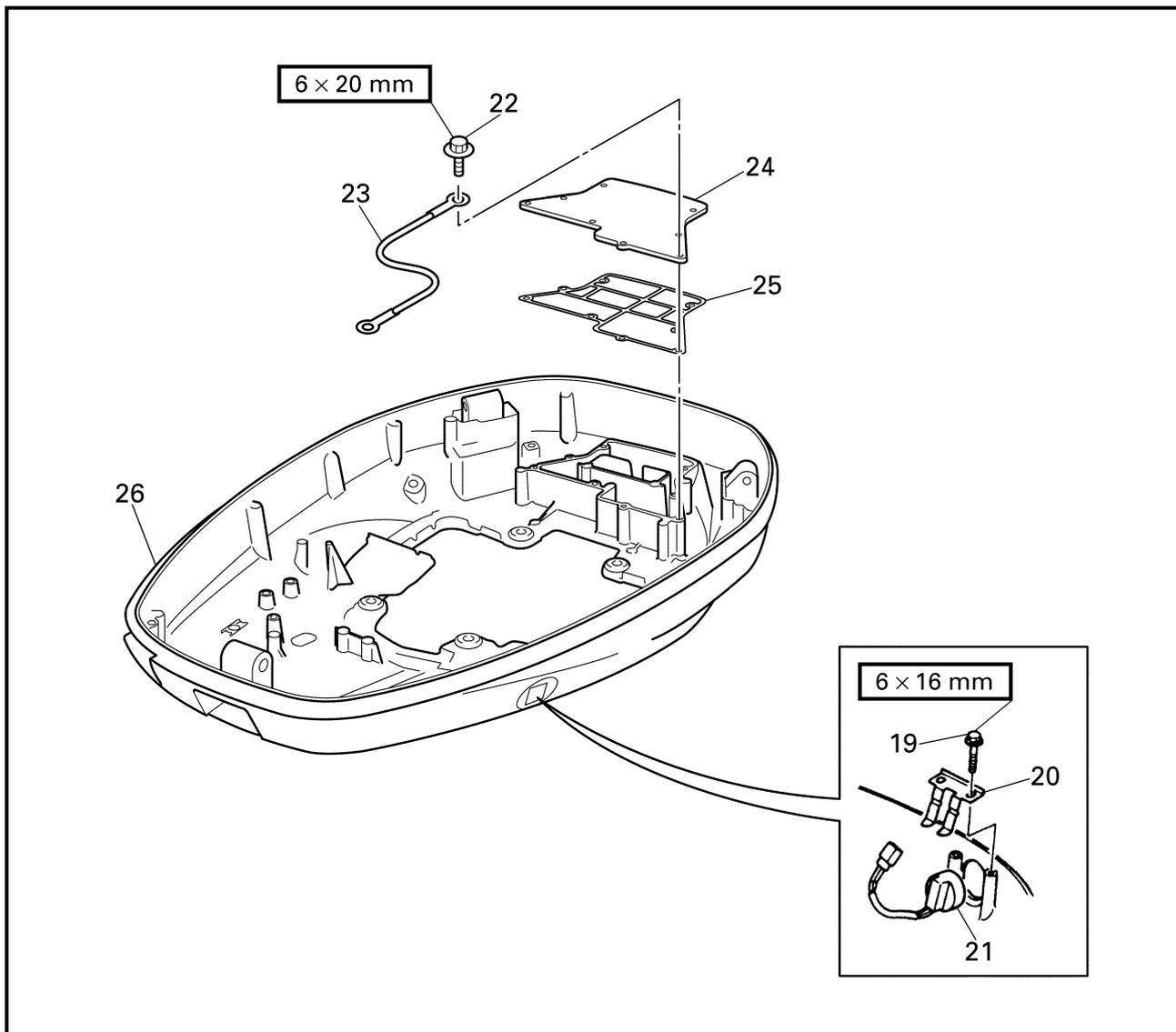
Order	Job/Part	Q'ty	Remarks
1	Bolt	3	
2	Lower spring holder	3	
3	Spring	3	
4	Bolt	3	
5	Upper spring holder	3	
6	Wave washer	3	
7	Bushing	6	
8	Clamp lever	3	
9	Bolt	6	

Continued on next page.



Order	Job/Part	Q'ty	Remarks
10	Clamp plate	3	
11	Pilot water outlet	1	
12	Wire harness clamp	1	
13	Bolt	1	
14	Cable holder	1	
15	Grommet	2	
16	Collar	2	
17	Grommet	4	
18	Collar	4	

Continued on next page.

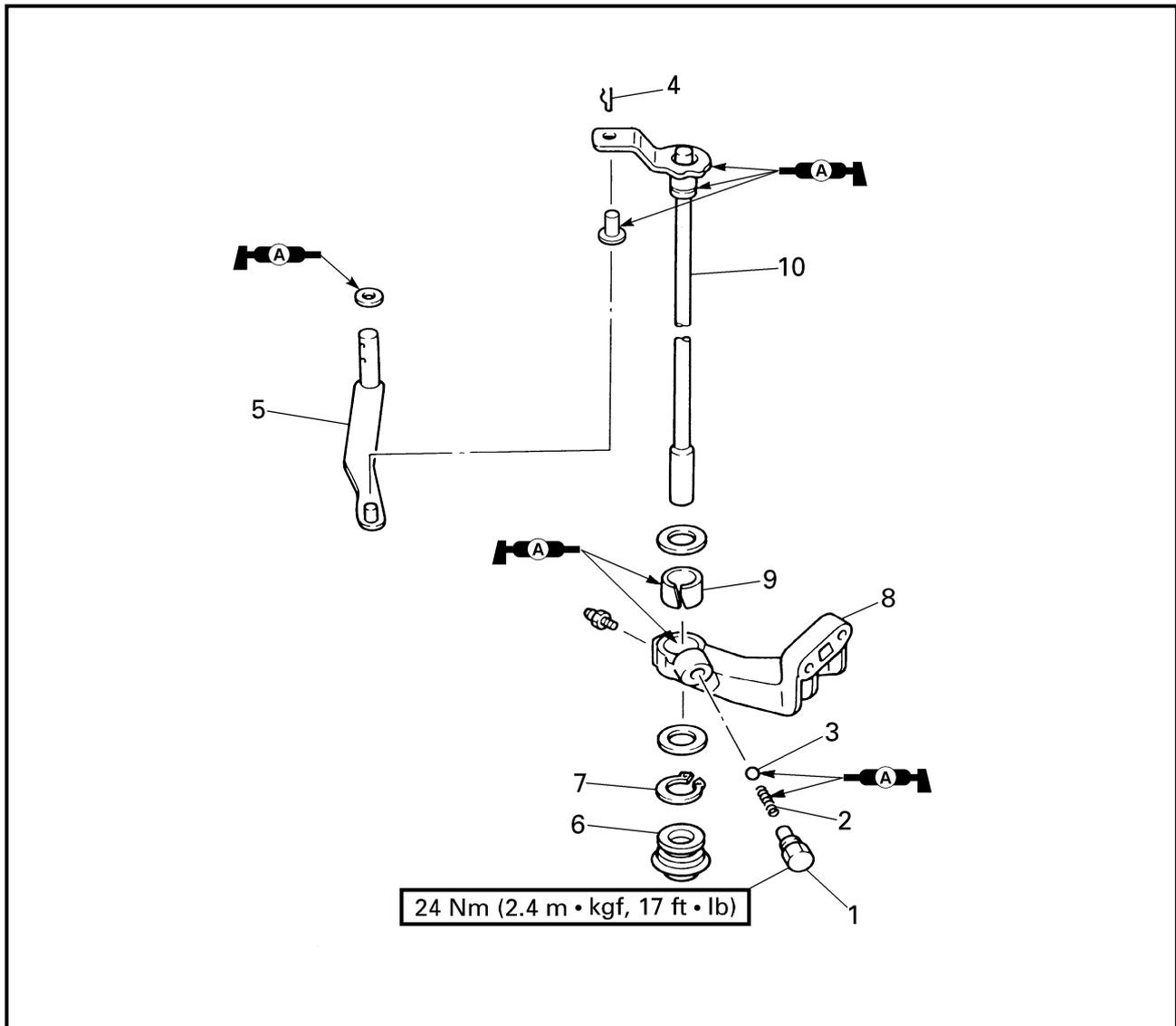


Order	Job/Part	Q'ty	Remarks
19	Bolt	2	
20	Trailer switch holder	1	
21	Trailer switch	1	
22	Bolt	8	
23	Ground lead	1	
24	Silencer cover	1	
25	Gasket	1	<b>Not reusable</b>
26	Bottom cowling	1	

For assembly, reverse the disassembly procedure.

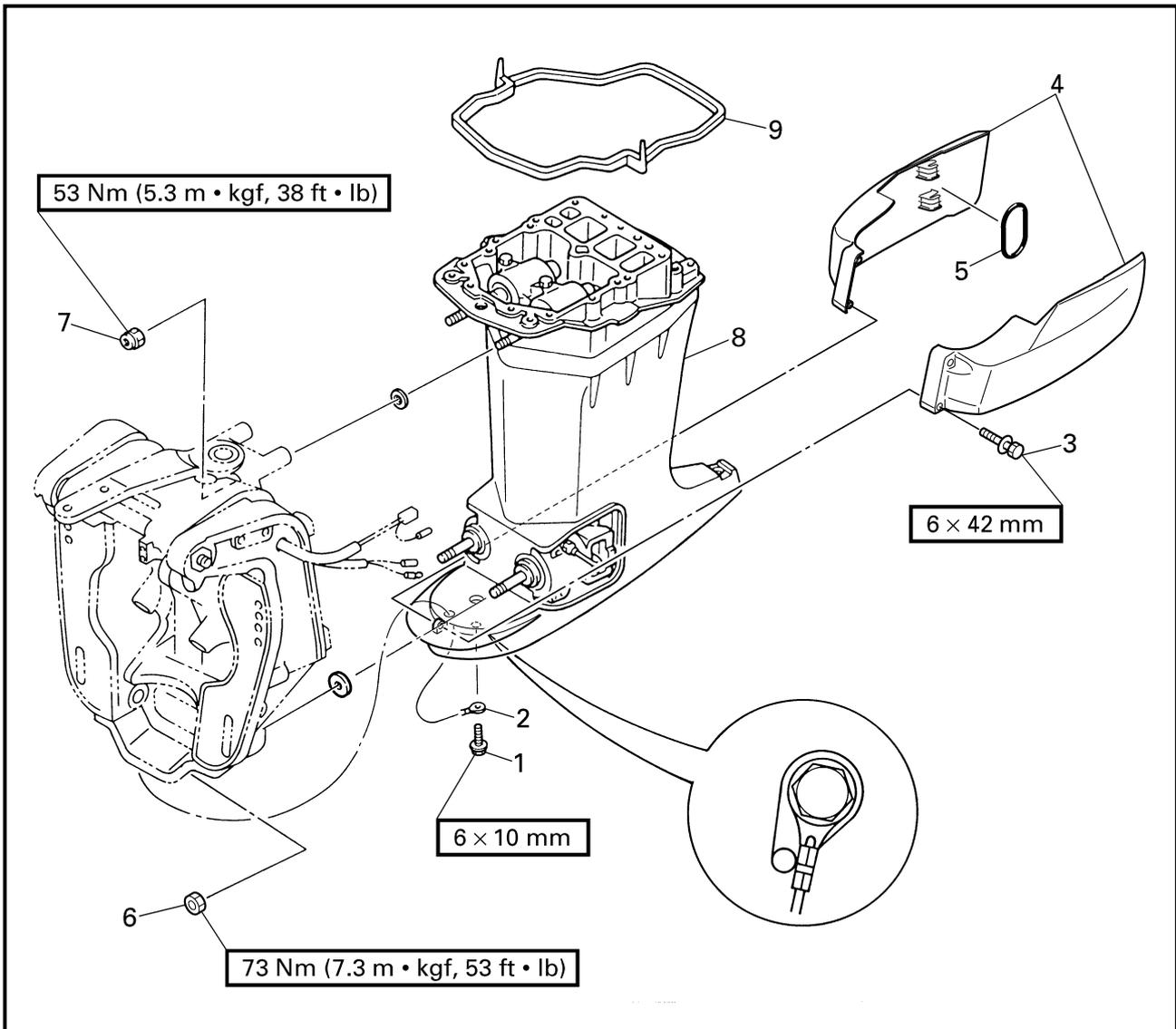
**SHIFT ROD ASSEMBLY**

**DISASSEMBLING/ASSEMBLING THE SHIFT ROD ASSEMBLY**

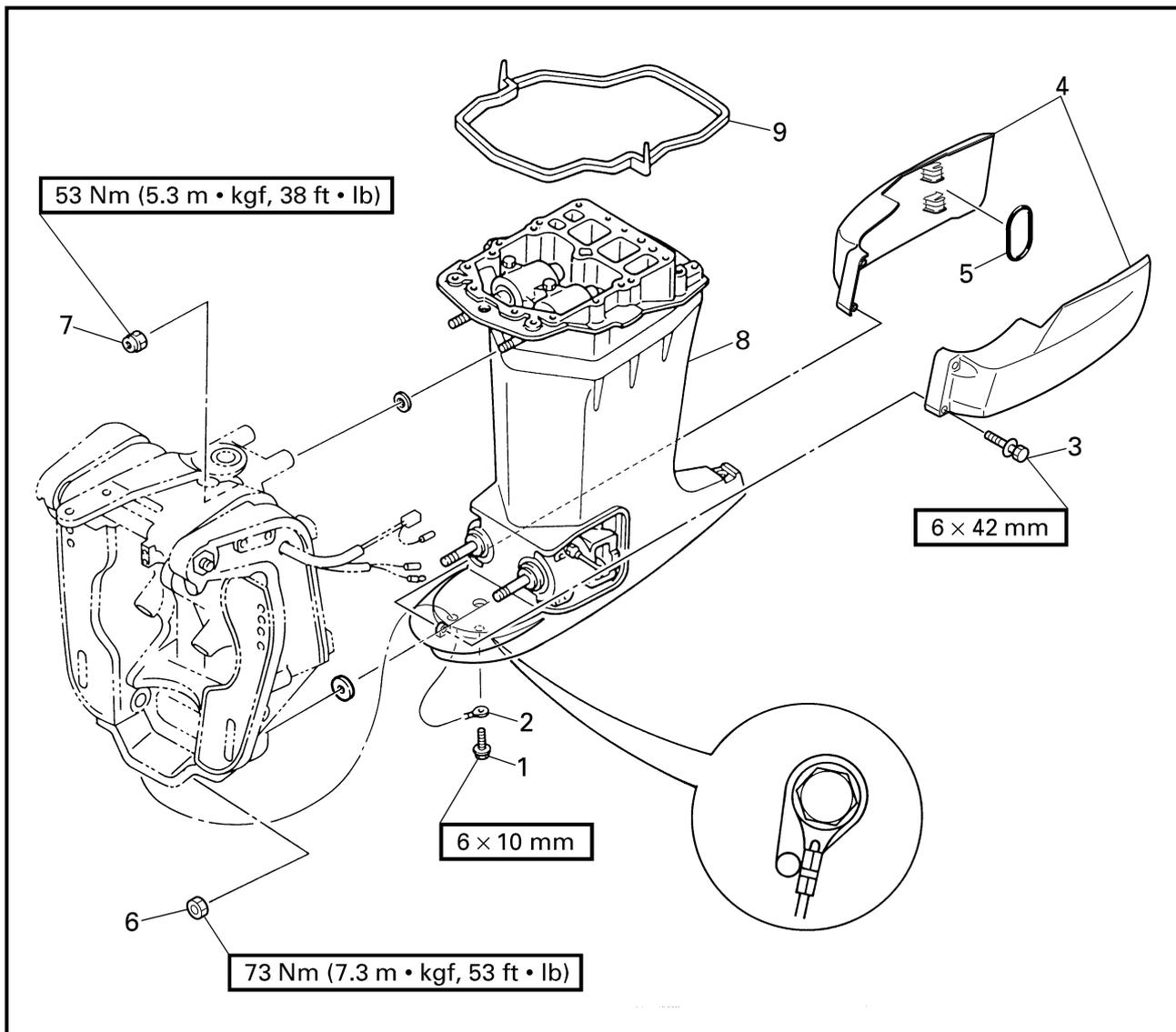


Order	Job/Part	Q'ty	Remarks
1	Screw	1	
2	Spring	1	
3	Ball	1	
4	Clip	1	
5	Shift rod lever	1	
6	Rubber seal	1	
7	Circlip	1	
8	Shift rod bracket	1	
9	Bushing	1	
10	Shift rod	1	
			For assembly, reverse the disassembly procedure.

**UPPER CASE ASSEMBLY  
REMOVING/INSTALLING THE UPPER CASE ASSEMBLY**

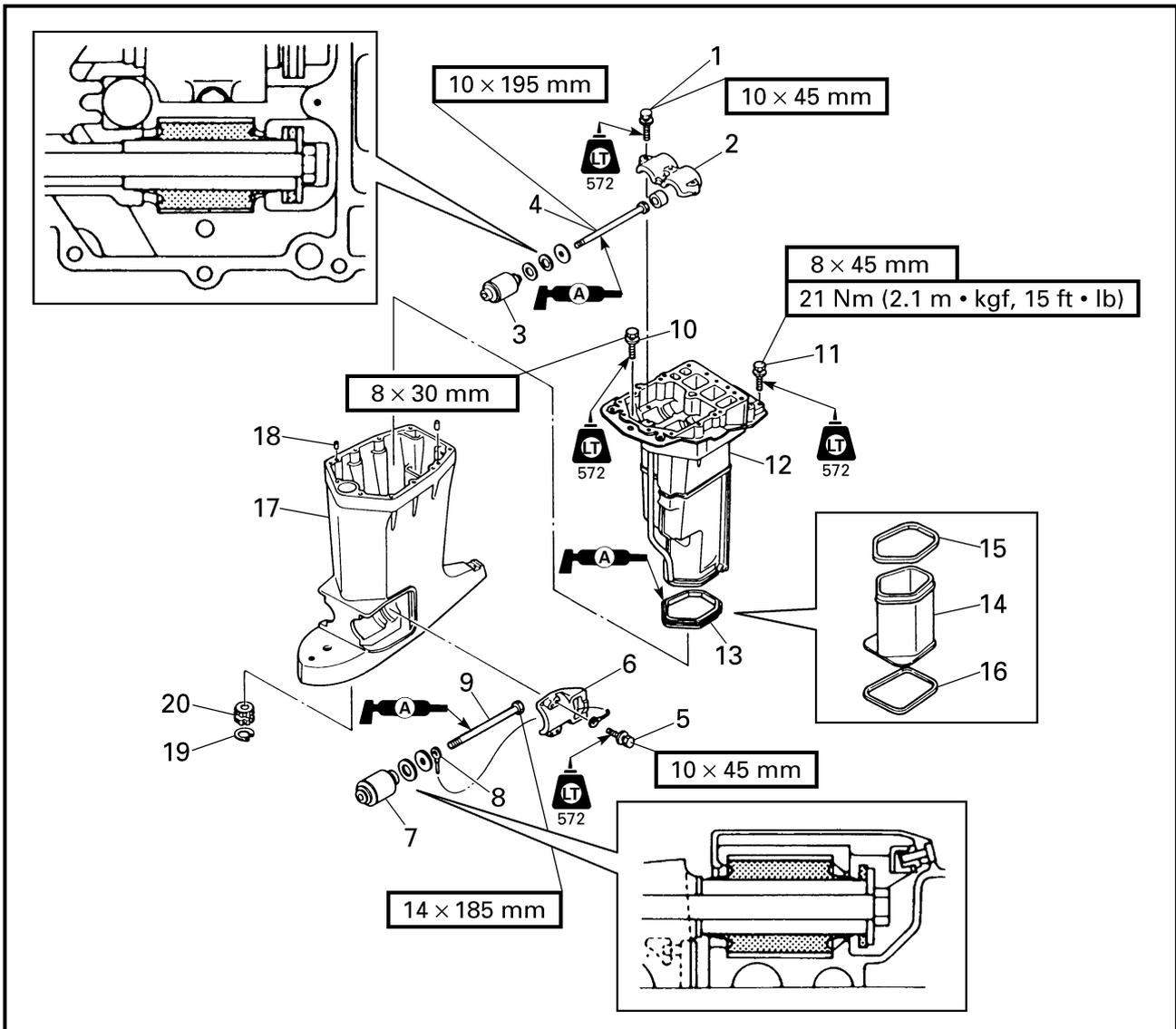


Order	Job/Part	Q'ty	Remarks
	Lower unit		Refer to "LOWER UNIT (REGULAR ROTATION MODELS)" on page 6-1.
	Bottom cowling		Refer to "BOTTOM COWLING" on page 7-1.
1	Bolt	1	
2	Ground lead	1	(upper case-to-swivel bracket)
3	Bolt	2	
4	Lower mount cover	2	
			Continued on next page.



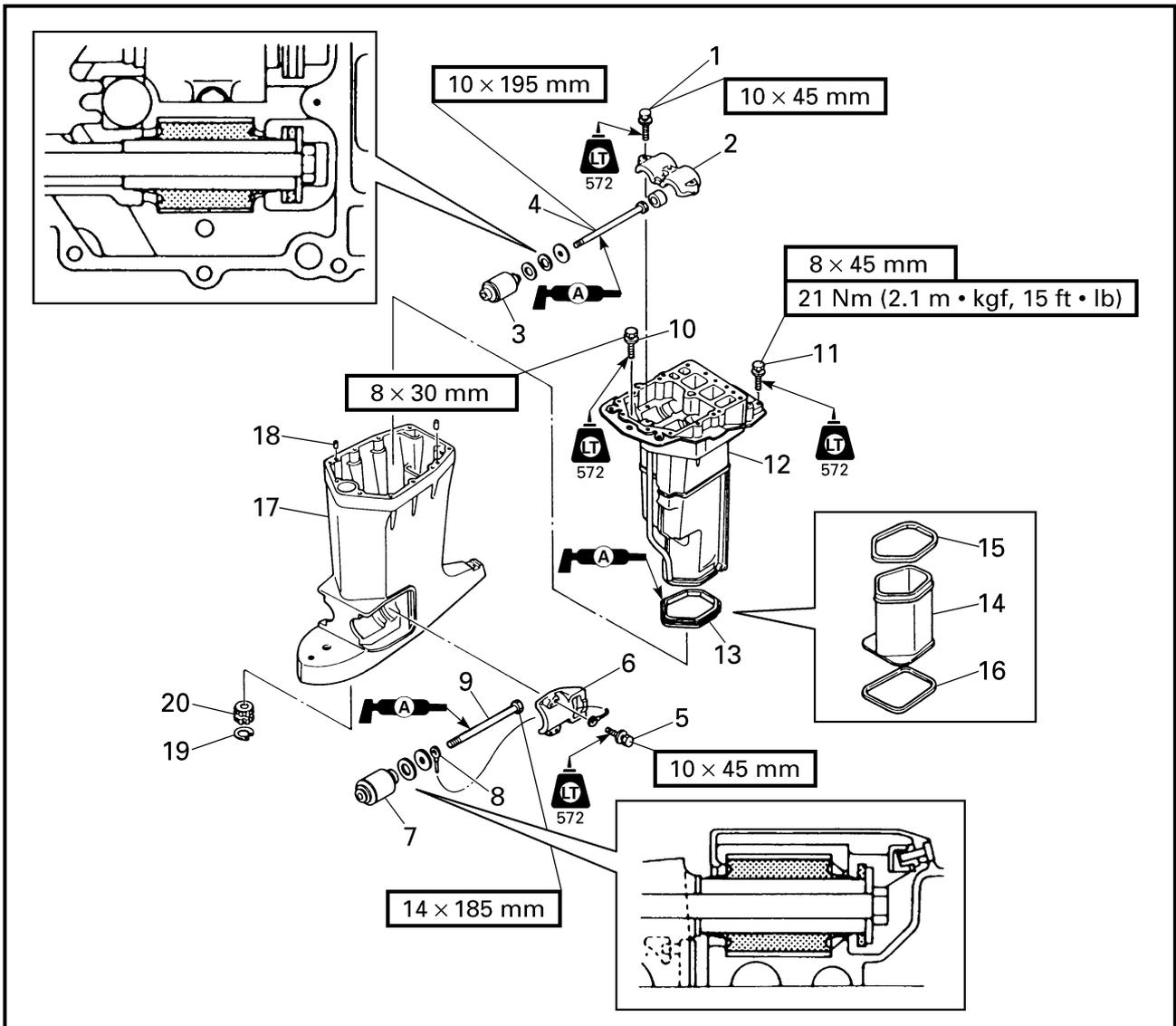
Order	Job/Part	Q'ty	Remarks
5	O-ring	2	For installation, reverse the removal procedure.
6	Nut	2	
7	Self-locking nut	2	
8	Upper case assembly	1	
9	Rubber seal	1	

**DISASSEMBLING/ASSEMBLING THE UPPER CASE ASSEMBLY**



Order	Job/Part	Q'ty	Remarks
1	Bolt	3	
2	Upper mount bracket	1	
3	Upper mount	2	
4	Bolt	2	
5	Bolt	4	
6	Lower mount bracket	2	
7	Lower mount	2	
8	Ground lead	1	
9	Bolt	2	
10	Bolt	2	

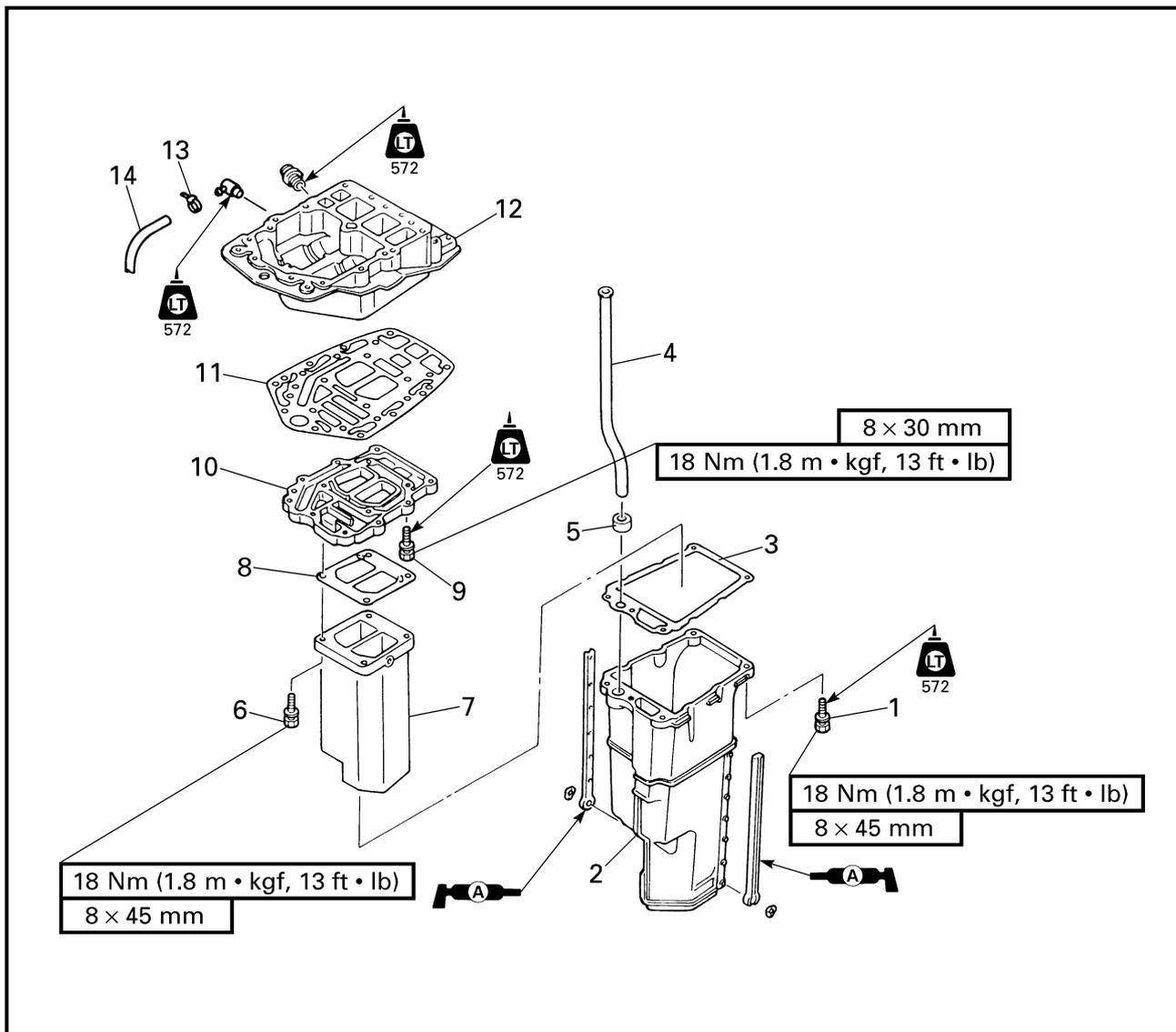
Continued on next page.



Order	Job/Part	Q'ty	Remarks
11	Bolt	2	
12	Muffler assembly	1	
13	Rubber seal	1	
14	Muffler	1	
15	Rubber seal	1	
16	Rubber seal	1	
17	Upper case	1	
18	Dowel pin	2	
19	Circlip	1	
20	Bushing	1	
			For assembly, reverse the disassembly procedure.

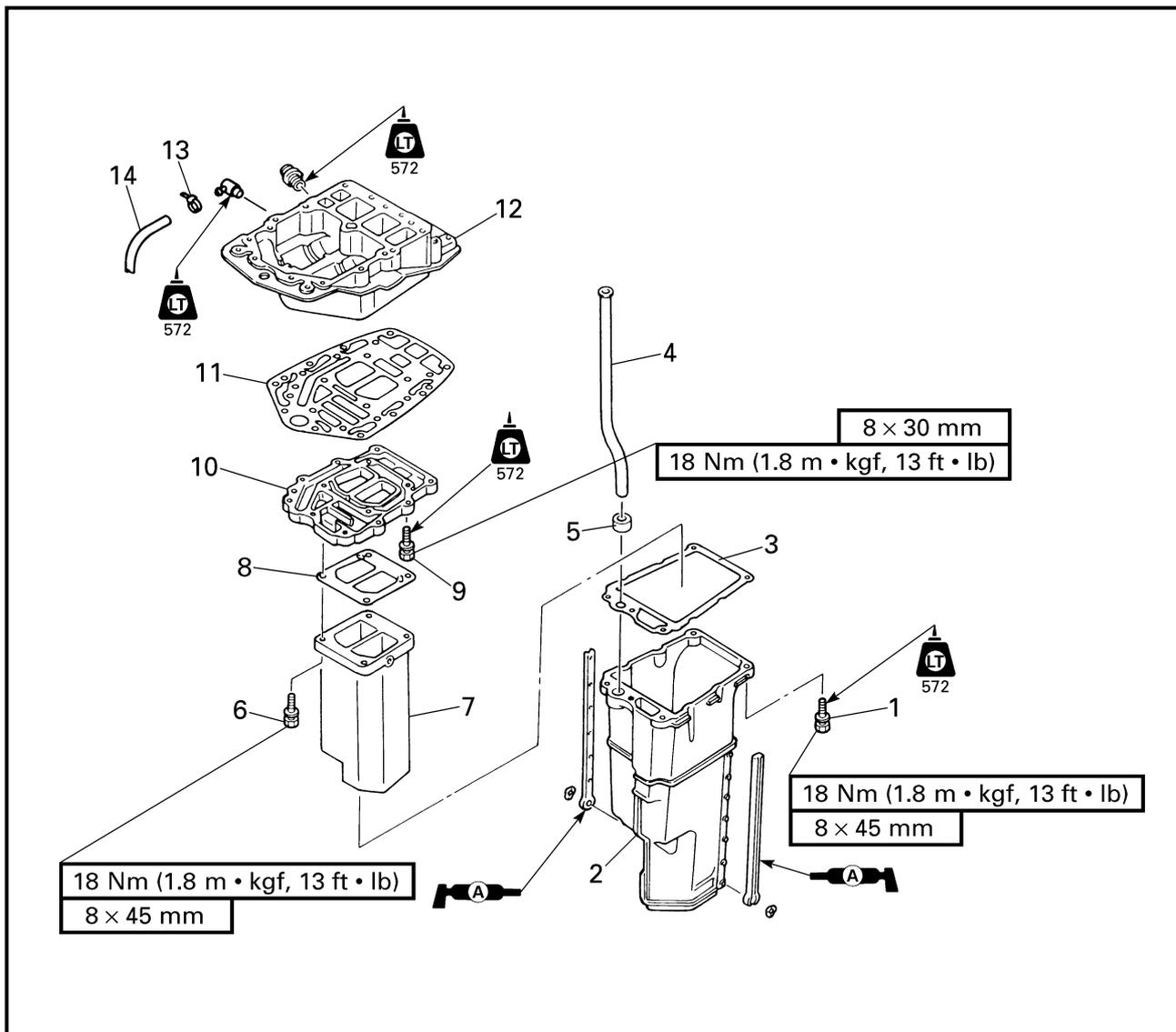
**EXHAUST MANIFOLD ASSEMBLY**

**DISASSEMBLING/ASSEMBLING THE EXHAUST MANIFOLD ASSEMBLY**



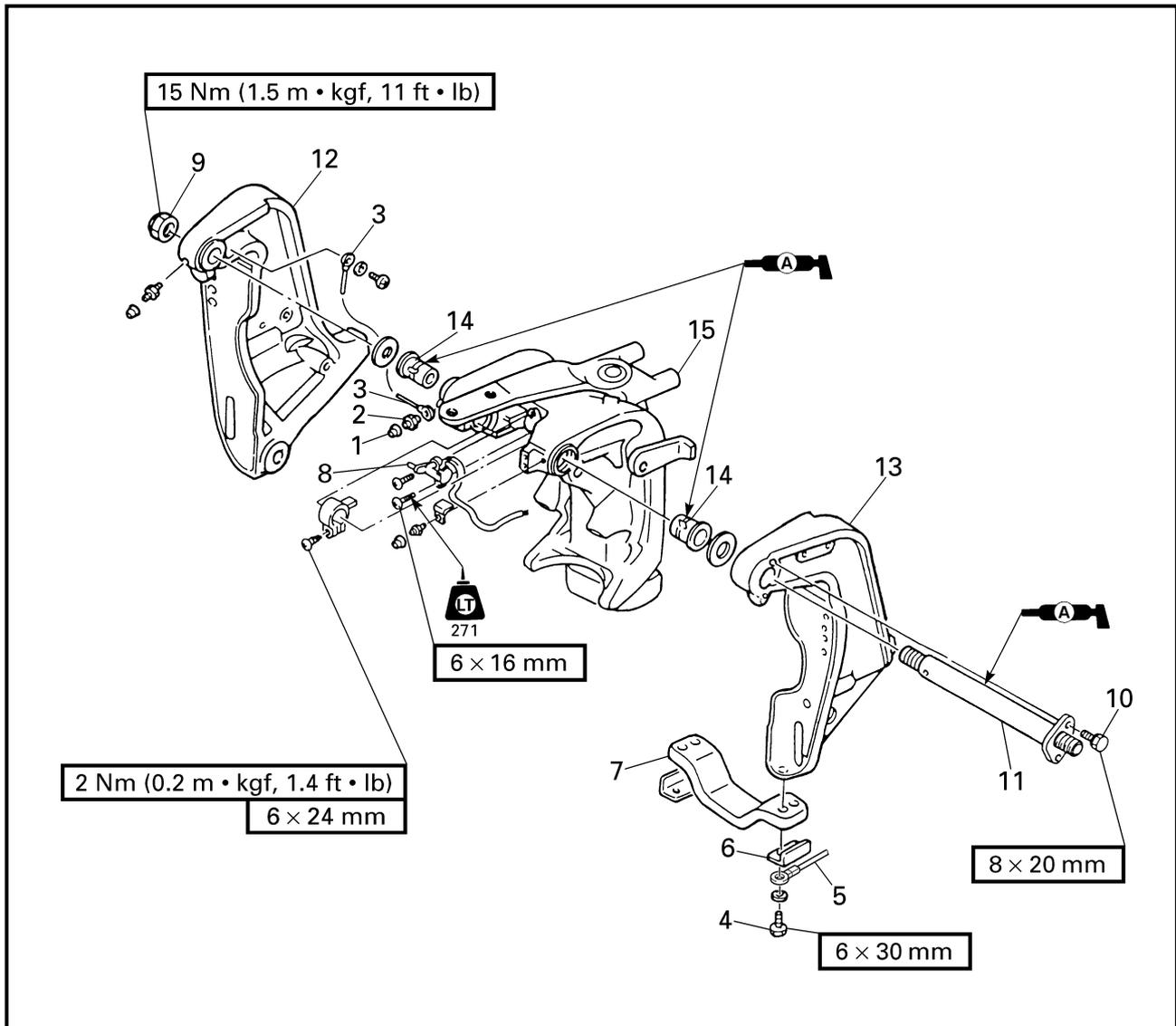
Order	Job/Part	Q'ty	Remarks
1	Bolt	5	
2	Muffler	1	
3	Gasket	1	<b>Not reusable</b>
4	Water tube	1	
5	Water seal	1	
6	Bolt	4	
7	Exhaust manifold	1	
8	Gasket	1	<b>Not reusable</b>

Continued on next page.



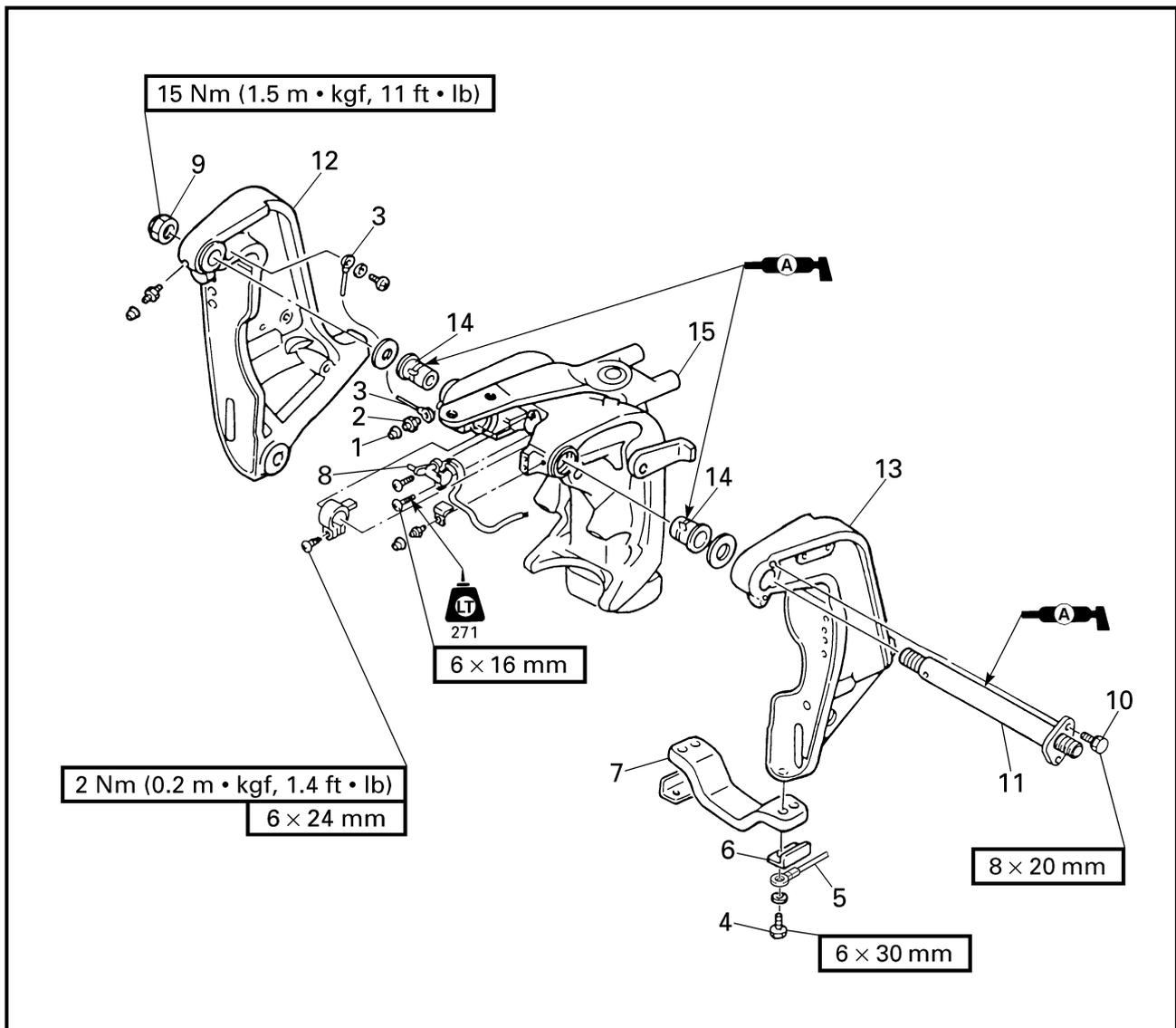
Order	Job/Part	Q'ty	Remarks
9	Bolt	4	
10	Lower exhaust manifold guide	1	
11	Gasket	1	<b>Not reusable</b>
12	Upper exhaust manifold guide	1	
13	Plastic locking tie	1	<b>Not reusable</b> Salt water models
14	Flushing hose	1	Salt water models For assembly, reverse the disassembly procedure.

**CLAMP BRACKETS**  
**REMOVING/INSTALLING THE CLAMP BRACKETS**



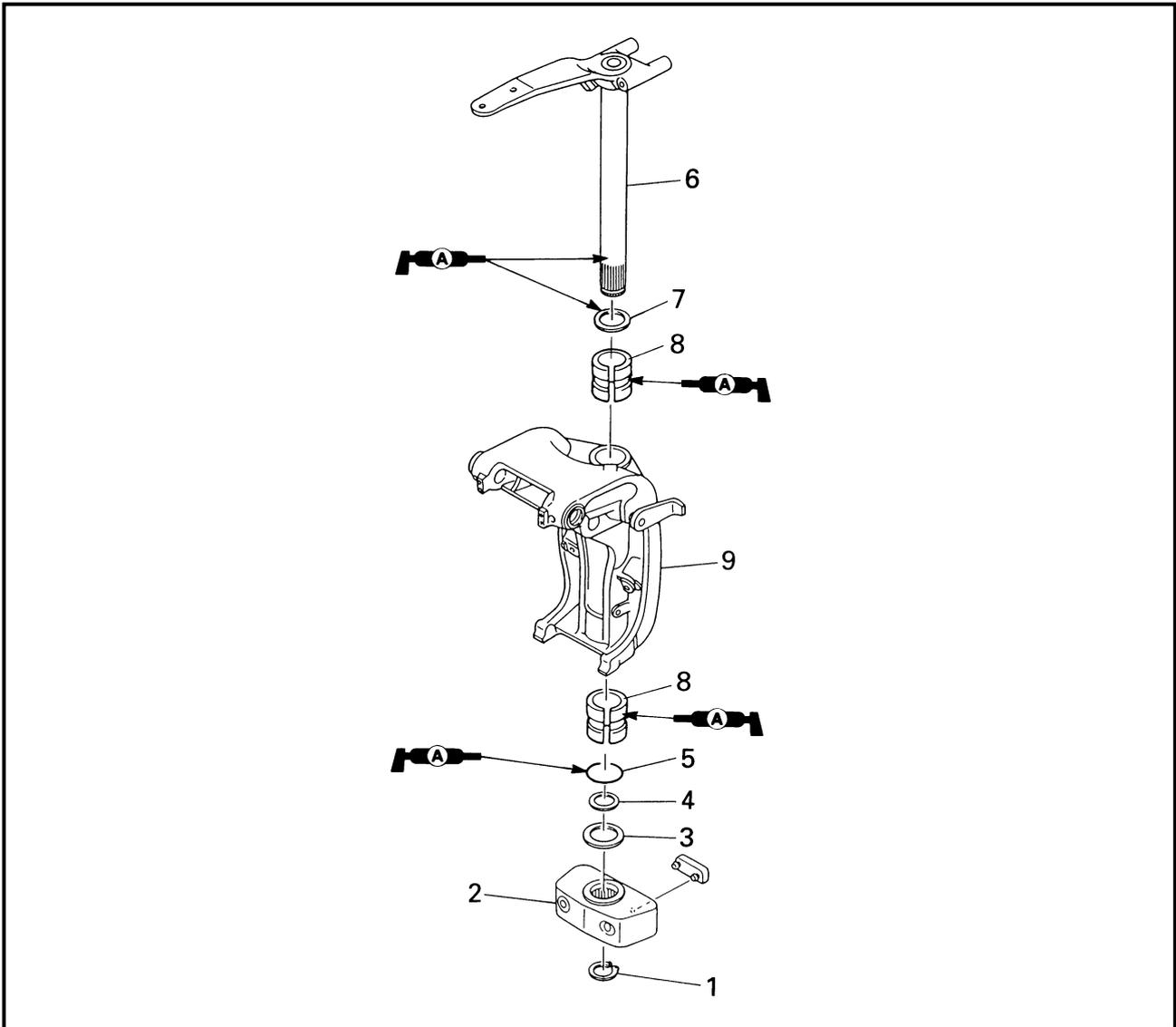
Order	Job/Part	Q'ty	Remarks
	Upper case assembly		Refer to "UPPER CASE ASSEMBLY" on page 7-7.
1	Rubber cap	3	
2	Grease nipple	3	
3	Ground lead	1	
4	Bolt	4	
5	Ground lead	1	
6	Anode bracket	2	
7	Anode	1	
8	Trim sensor	1	Refer to "ADJUSTING THE TRIM SENSOR CAM" on page 3-16.

Continued on next page.



Order	Job/Part	Q'ty	Remarks
9	Self-locking nut	1	For installation, reverse the removal procedure.
10	Bolt	2	
11	Clamp bracket bolt	1	
12	Starboard clamp bracket	1	
13	Port clamp bracket	1	
14	Bushing	2	
15	Swivel bracket assembly	1	

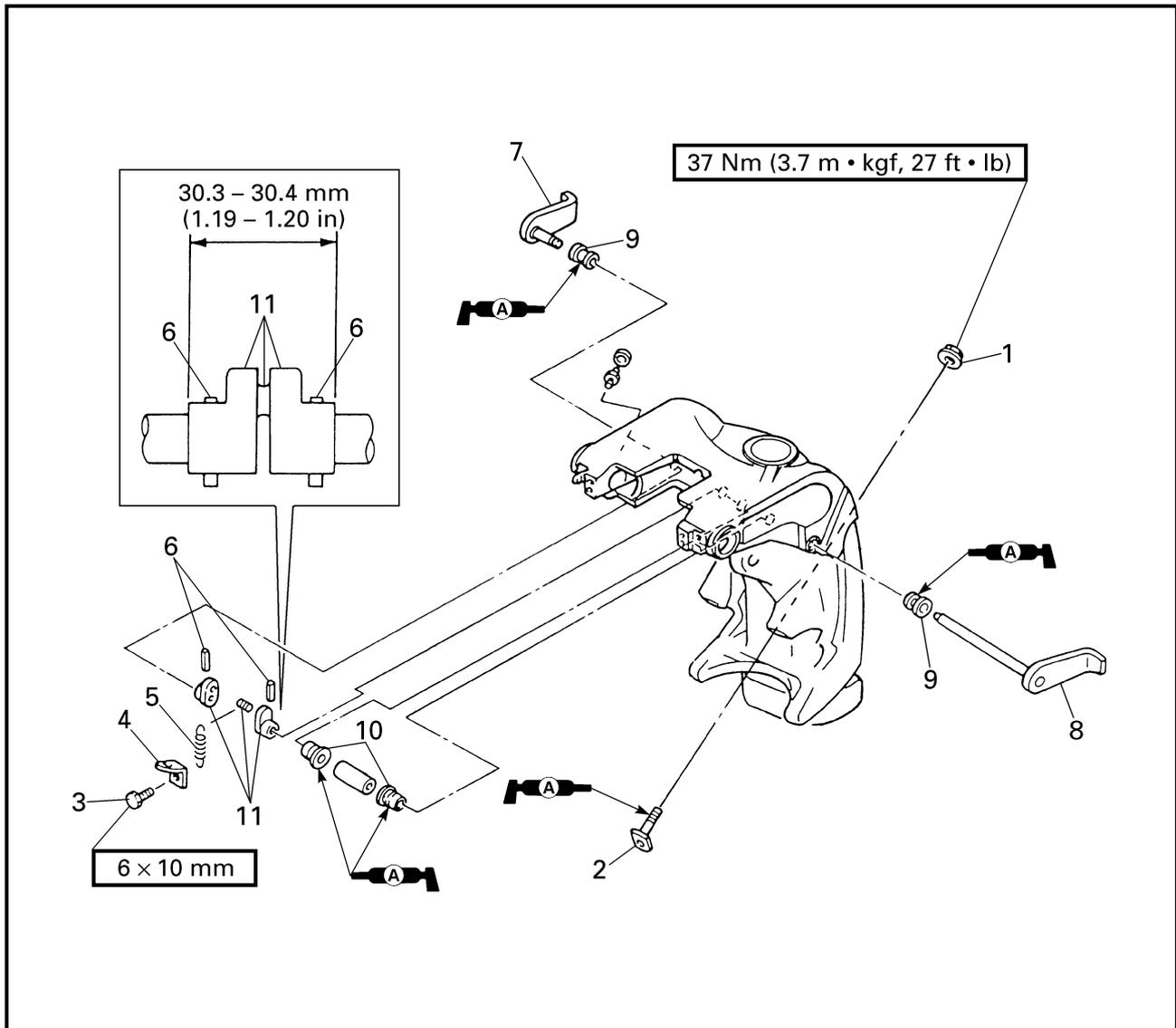
**STEERING ARM  
REMOVING/INSTALLING THE STEERING ARM**



Order	Job/Part	Q'ty	Remarks
	Upper case assembly		Refer to "UPPER CASE ASSEMBLY" on page 7-7.
1	Circlip	1	
2	Steering arm yoke	1	
3	Washer	1	
4	Washer	1	
5	O-ring	1	
6	Steering arm	1	
7	Washer	1	
8	Bushing	2	
9	Swivel bracket assembly	1	
			For installation, reverse the removal procedure.

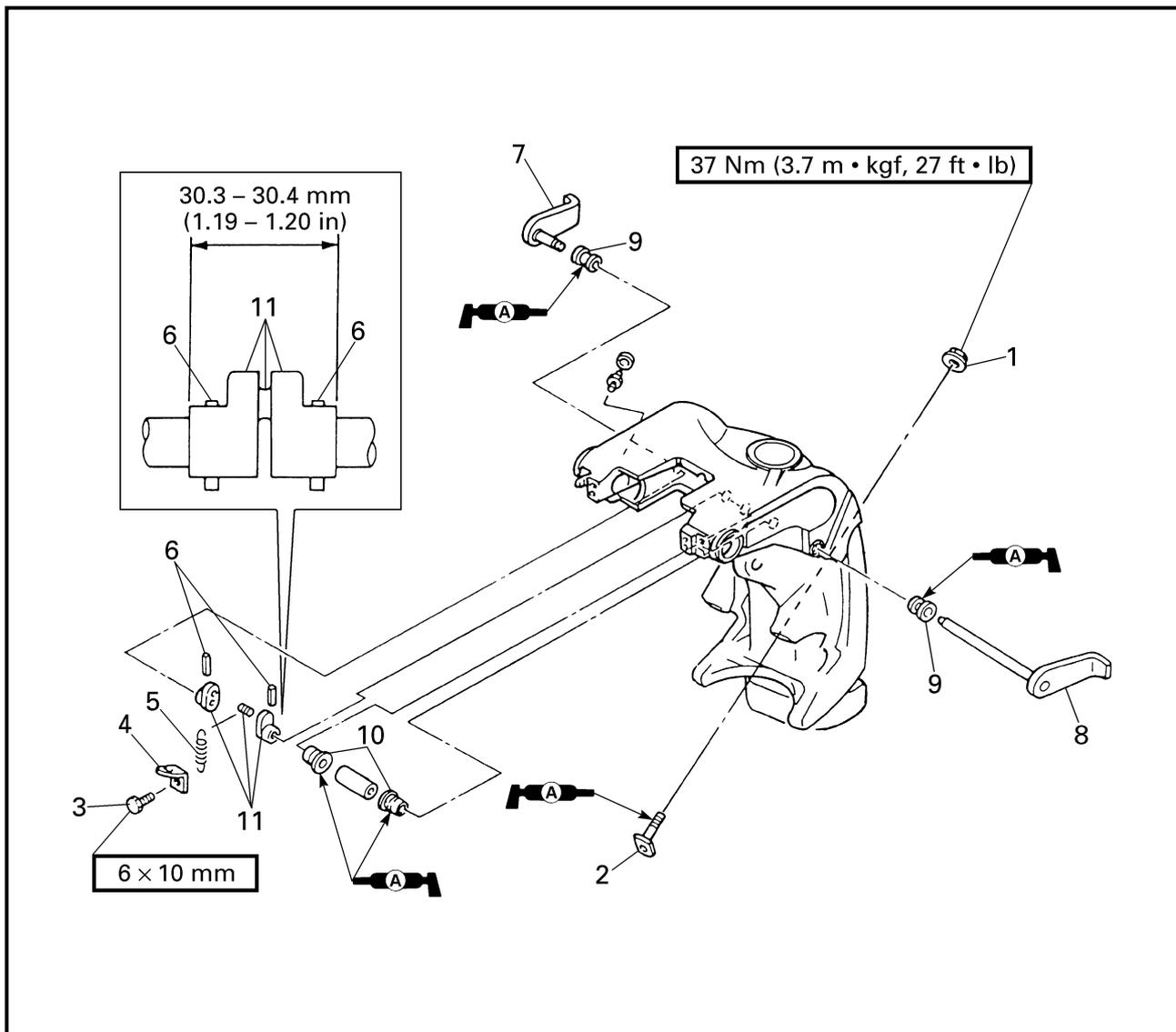
**SWIVEL BRACKET ASSEMBLY**

**DISASSEMBLING/ASSEMBLING THE SWIVEL BRACKET ASSEMBLY**



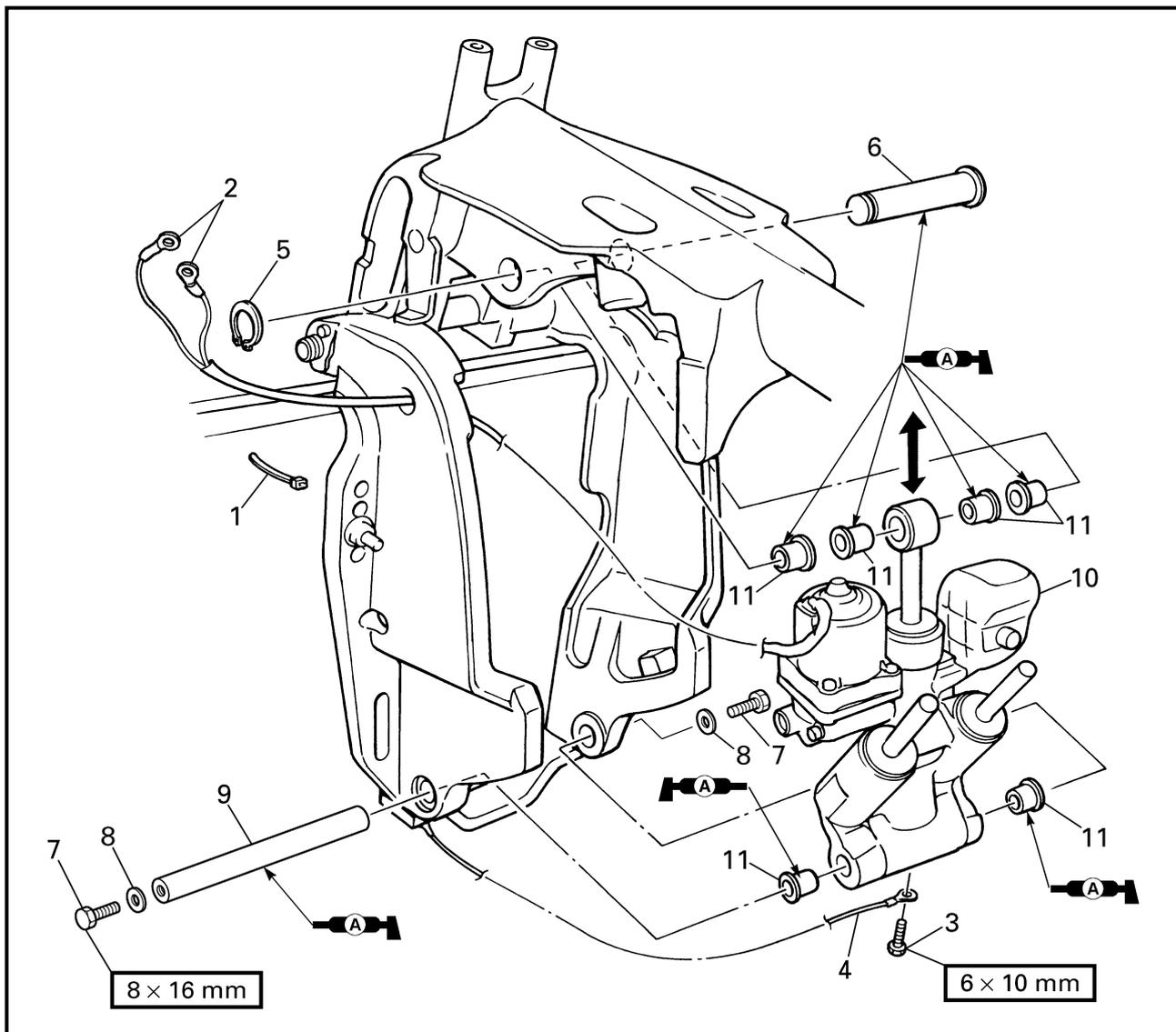
Order	Job/Part	Q'ty	Remarks
	Steering arm		Refer to "STEERING ARM" on page 7-15.
1	Nut	2	
2	Trim stopper	2	
3	Bolt	1	
4	Spring holder	1	
5	Spring	1	
6	Pin	2	

Continued on next page.

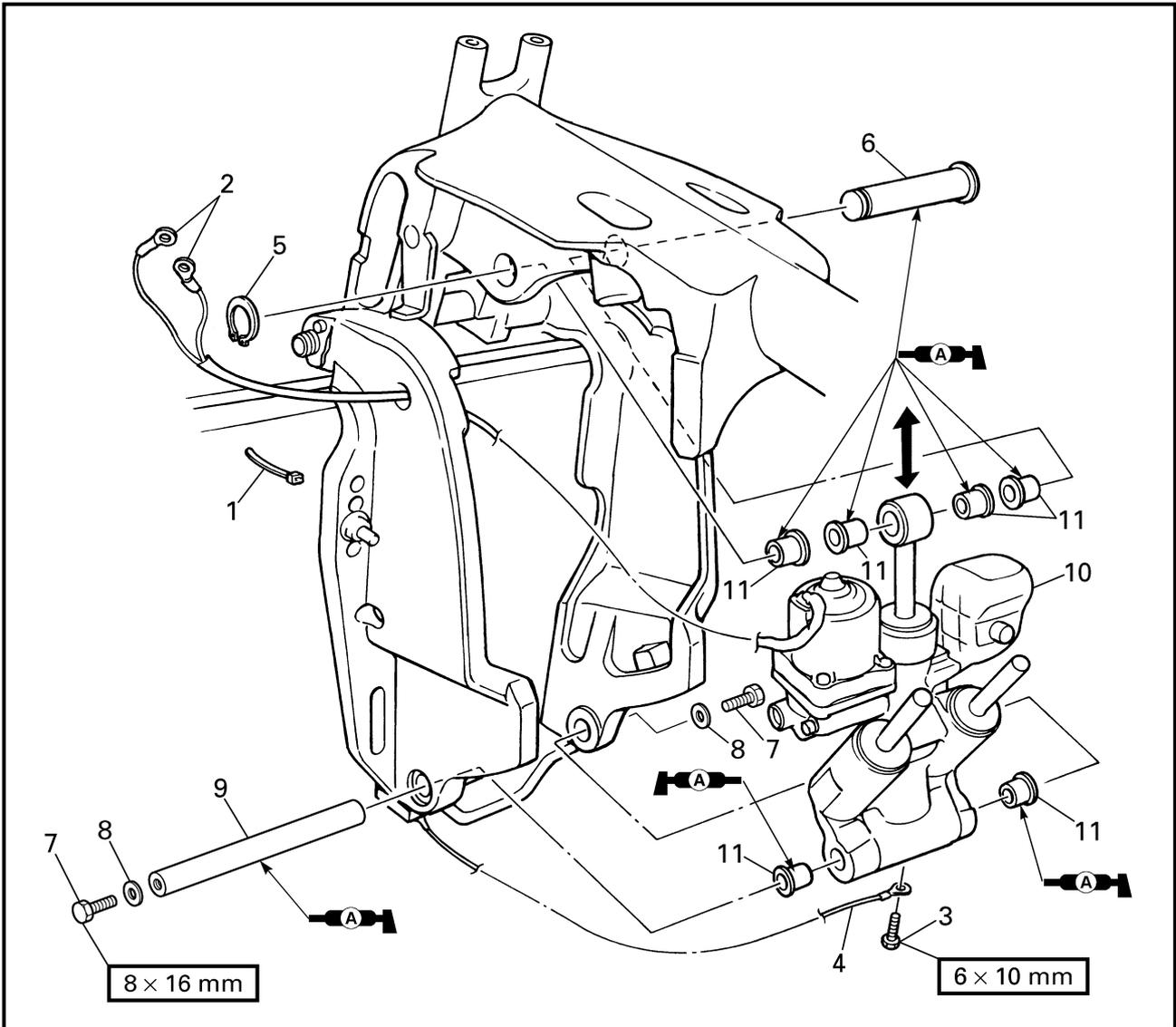


Order	Job/Part	Q'ty	Remarks
7	Starboard tilt stop lever	1	For assembly, reverse the disassembly procedure.
8	Port tilt stop lever	1	
9	Bushing	2	
10	Bushing	2	
11	Tilt stop lever joint assembly	1	

**POWER TRIM AND TILT UNIT  
REMOVING/INSTALLING THE POWER TRIM AND TILT UNIT**



Order	Job/Part	Q'ty	Remarks
	Tilt up the outboard		
1	Plastic locking tie	3	<b>Not reusable</b>
2	Power trim and tilt lead	2	
3	Bolt	1	
4	Ground lead	1	
5	Circlip	1	
6	Upper mounting pin	1	
			Continued on next page.

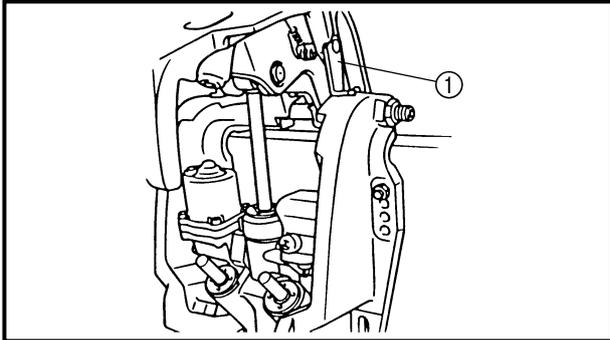


Order	Job/Part	Q'ty	Remarks
7	Bolt	2	For installation, reverse the removal procedure.
8	Washer	2	
9	Lower mounting pin	1	
10	Power trim and tilt unit	1	
11	Collar	6	

**REMOVING THE POWER TRIM AND TILT UNIT**

**⚠ WARNING**

After tilting up the outboard, be sure to support it with the tilt stop levers. Otherwise, the outboard could suddenly lower if the power trim and tilt unit should lose fluid pressure.



**NOTE:** Tilt up the outboard and then turn the tilt stop levers ① to support it.

- Remove:
- Power trim and tilt unit

**NOTE:** Slightly lower the tilt ram assembly and then remove the power trim and tilt unit.

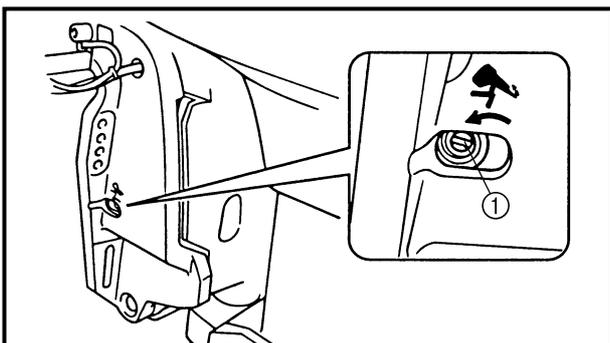
**BLEEDING THE POWER TRIM AND TILT UNIT (ON OUTBOARD)**

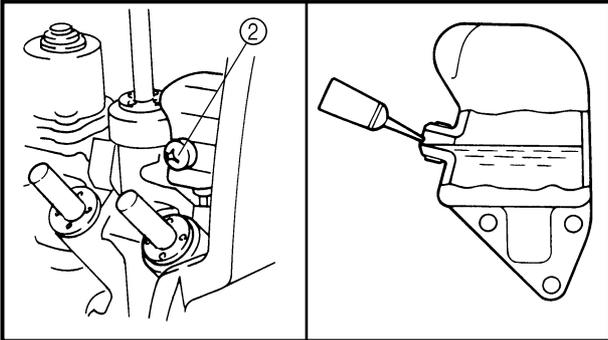
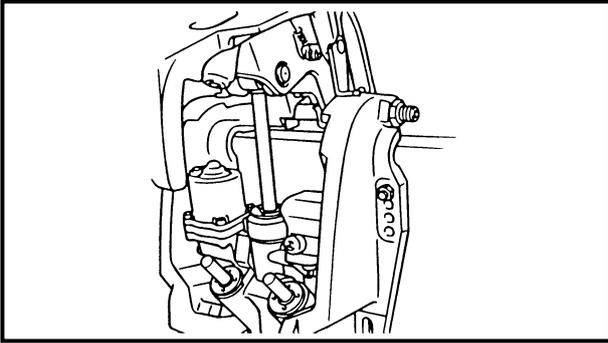
**NOTE:** Install the power trim and tilt unit onto the outboard before bleeding.

- Bleed:
- Air bubbles (from the power trim and tilt unit)

**Bleeding steps**

- (1) Connect the battery leads to the battery.
- (2) Loosen the manual valve ① by turning it counterclockwise until it stops.

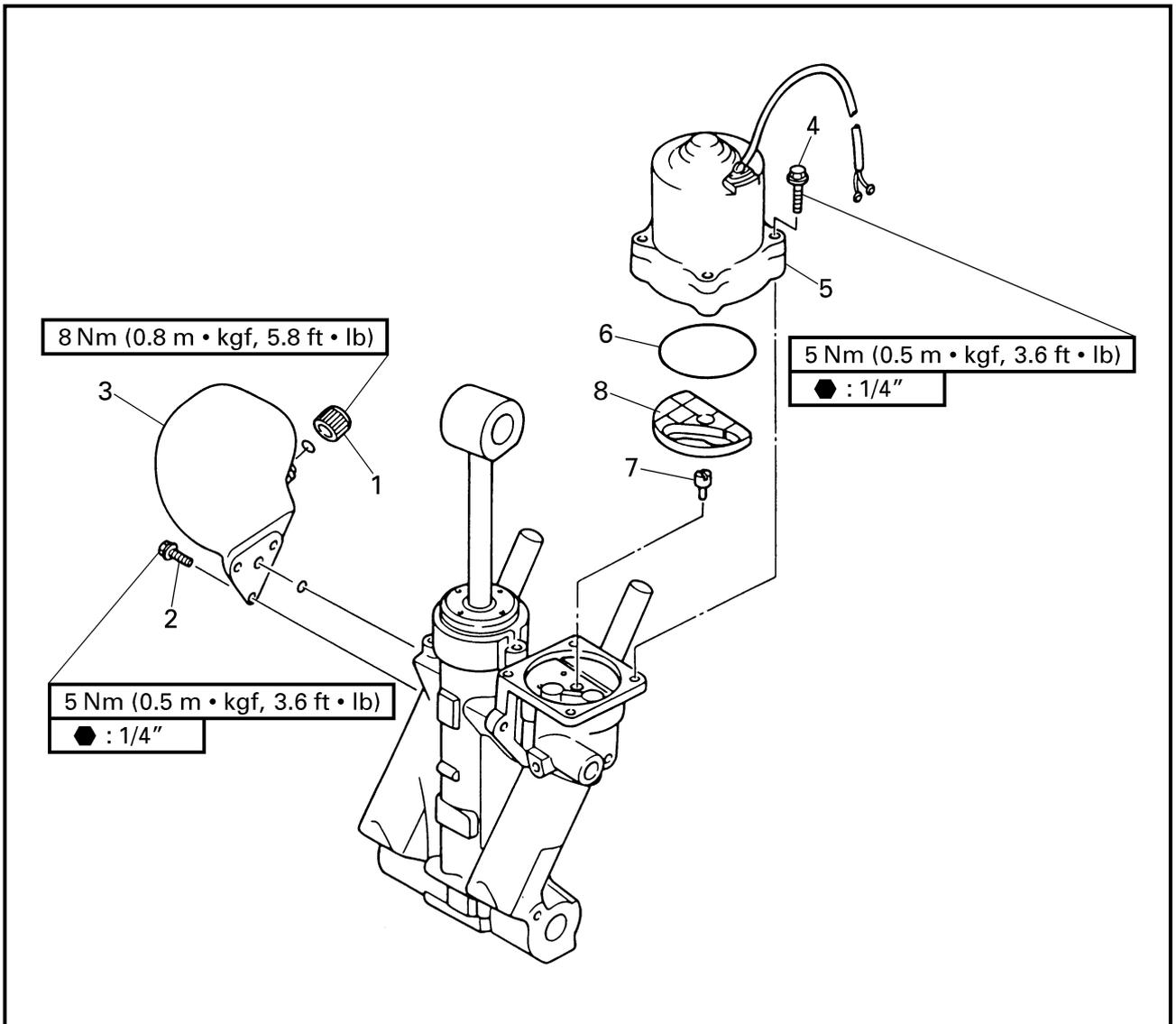




- (3) Tilt up the outboard fully, then release it, and let it lower by its own weight.
- (4) Tighten the manual valve by turning it clockwise.
- (5) Let the power trim and tilt fluid settle for about 5 minutes.
- (6) Push and hold the power trim and tilt switch in the up position until the outboard is fully tilted up.
- (7) Turn the tilt stop levers to support the outboard. Then, let the power trim and tilt fluid settle for about 5 minutes.
- (8) Remove the reservoir cap ② and check that fluid is up to the brim as shown. Add fluid if the level is below the brim.
- (9) Install the power trim and tilt reservoir cap.
- (10) Repeat the above steps two or three times until the power trim and tilt fluid is at the correct level.

**RESERVOIR AND POWER TRIM AND TILT MOTOR**

**REMOVING/INSTALLING THE RESERVOIR AND POWER TRIM AND TILT MOTOR**



Order	Job/Part	Q'ty	Remarks
	Power trim and tilt unit		Refer to "POWER TRIM AND TILT UNIT" on page 7-18.
1	Reservoir cap	1	
2	Bolt	3	
3	Reservoir	1	
4	Bolt	4	
5	Power trim and tilt motor	1	
6	O-ring	1	
7	Drive pin	1	
8	Gear pump housing filter	1	
			For installation, reverse the removal procedure.

**⚠ WARNING**

- To prevent the hydraulic fluid from spurt-  
ing out due to internal pressure, the out-  
board should be kept fully tilted up (the  
tilt rod at full length).
- After removing the power trim and tilt  
motor or reservoir, do not push the tilt  
ram down. This may cause hydraulic fluid  
to spurt out from the port.

**CAUTION:**

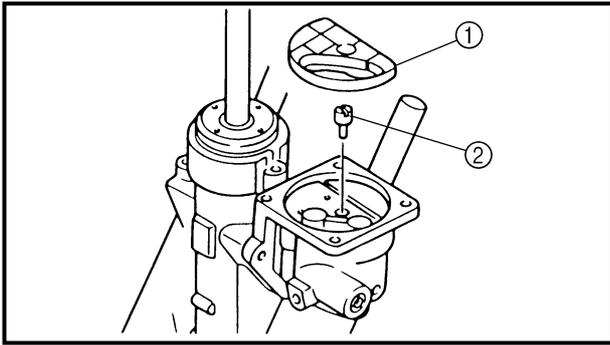
Do not wipe hydraulic system components  
with rags, paper, tissues, or the like, as  
fibers from such material will cause mal-  
functions if they enter the system.

**CHECKING THE RESERVOIR**

1. Drain:
  - Power trim and tilt fluid
2. Check:
  - Reservoir  
Cracks/damage/leaks → Replace.

**CHECKING THE GEAR PUMP  
HOUSING FILTER**

- Check:
- Gear pump housing filter  
Damage/tears → Replace.  
Foreign matter → Clean.



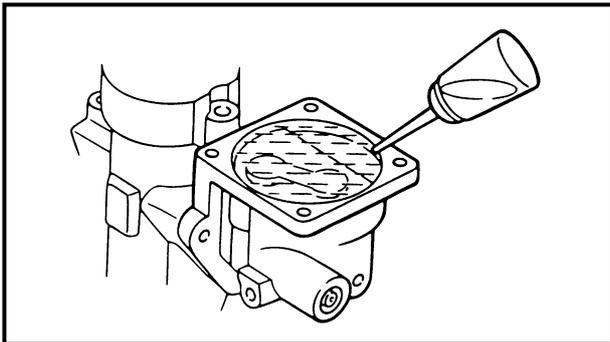
## INSTALLING THE POWER TRIM AND TILT MOTOR

1. Install:
  - Gear pump housing filter ①
  - Drive pin ②
2. Fill:
  - Gear pump housing



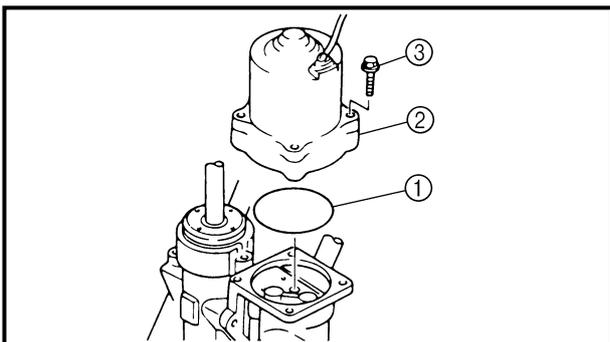
**Recommended power trim and tilt fluid**  
ATF Dexron II

**NOTE:** \_\_\_\_\_  
Add power trim and tilt fluid until it reaches the top of the gear pump housing.



3. Bleed:
  - Air bubbles

**NOTE:** \_\_\_\_\_  
• Remove all of the air bubbles with a syringe or suitable tool as shown.  
• Turn the gear pump gears with a screwdriver and then remove any air between the gear teeth.



4. Install:
  - O-ring ①
  - Power trim and tilt motor ②
  - Bolts ③

**NOTE:** \_\_\_\_\_  
Align the armature shaft with the recess in the drive pin.

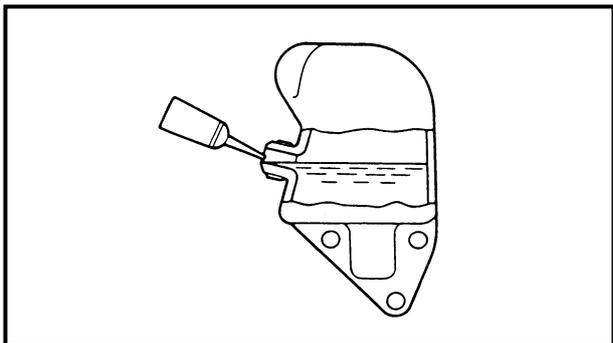


## FILLING THE RESERVOIR

### ⚠ WARNING

To prevent the hydraulic fluid from spurt-  
ing out due to internal pressure, the tilt  
ram should be kept at full length.

1. Fill:
  - Reservoir



**Recommended power trim and  
tilt fluid**  
ATF Dexron II

2. Check:
  - Power trim and tilt fluid level  
Level is low → Add power trim and tilt  
fluid to the proper level.

## BLEEDING THE POWER TRIM AND TILT UNIT

### NOTE:

This bleeding must be done before install-  
ing the power trim and tilt unit onto the out-  
board.

1. Bleed:
  - Air bubbles  
(from the power trim and tilt unit)

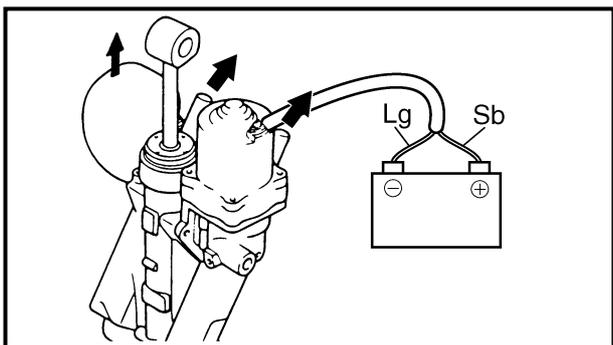
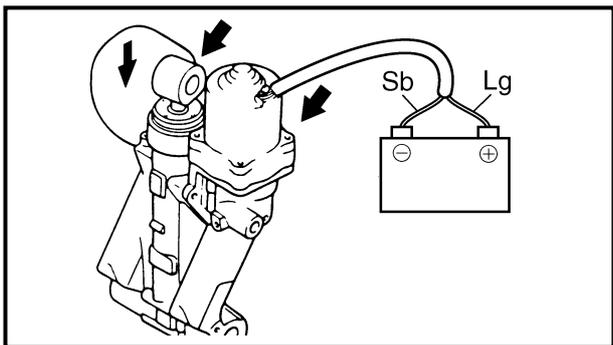
### Bleeding steps

- (1) Set the power trim and tilt unit upright.
- (2) Connect the leads of the power trim and tilt on the battery terminals until the trim and tilt ram assemblies are fully compressed.

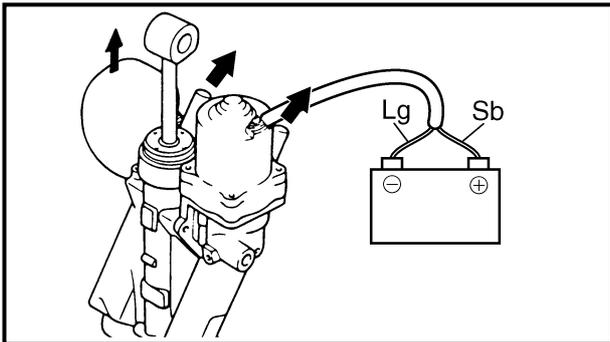
### NOTE:

If the rams will not go down, refer to the fol-  
lowing.

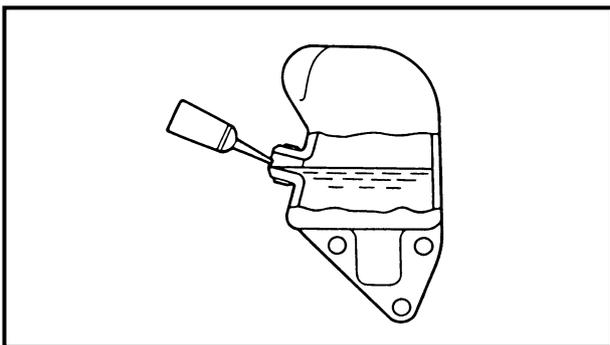
- A. Connect the leads of the power trim and tilt on the battery terminals until the trim and tilt ram assemblies are fully extended. Then, reverse the leads on the battery terminals until the trim and tilt ram assemblies are fully compressed.



- B. If step A was unsuccessful, connect the leads on the battery terminals and fully compress the tilt ram assembly by hand.
- C. If step B was unsuccessful, loosen the manual valve, compress the trim and tilt ram assemblies fully by hand, and then tighten the manual valve. Then, compress and extend the trim and tilt ram assemblies by connecting the leads on the battery terminals in the up and down positions.
- D. If step C was unsuccessful, disassemble, check, and correct any problems with the power trim and tilt unit.



- (3) Connect the leads on the battery terminals in the up position until the trim and tilt ram assemblies are fully extended.



- (4) Remove the power trim and tilt reservoir cap and check that fluid is up to the brim as shown. Add power trim and tilt fluid if the level is below the brim.
- (5) Repeat the above steps two or three times until the fluid is at the correct level.

**2. Check:**

- Power trim and tilt unit operation  
Unsmooth operation → Bleed the power trim and tilt unit again.

**MEASURING THE HYDRAULIC PRESSURE**

Check:

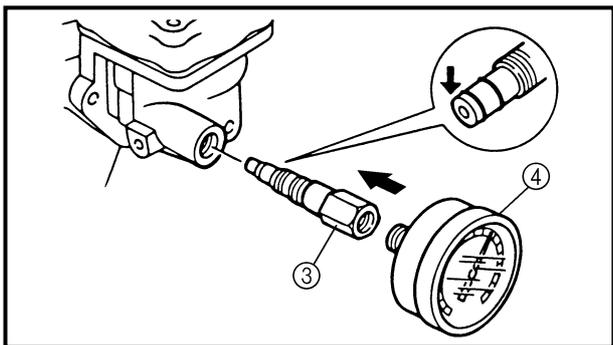
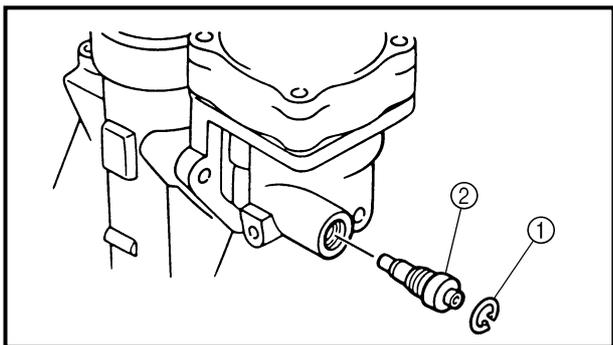
- Hydraulic pressure  
Out of specification → Repair.



**Hydraulic pressure  
(with the power trim and tilt ram  
assemblies fully extended)  
9.8 - 11.8 MPa  
(100 - 120 kg/cm<sup>2</sup>)  
(with the power trim and tilt ram  
assemblies fully compressed)  
5.9 - 8.8 MPa (60 - 90 kg/cm<sup>2</sup>)**

**NOTE:**

Before measuring the hydraulic pressure, bleed the power trim and tilt unit.



**Measuring steps**

- (1) Fully tilt up the power trim and tilt ram assemblies.
- (2) Remove the circlip ①.
- (3) Remove the manual valve ② and install the up-relief valve attachment and hydraulic pressure gauge and tighten them to the specified torque.



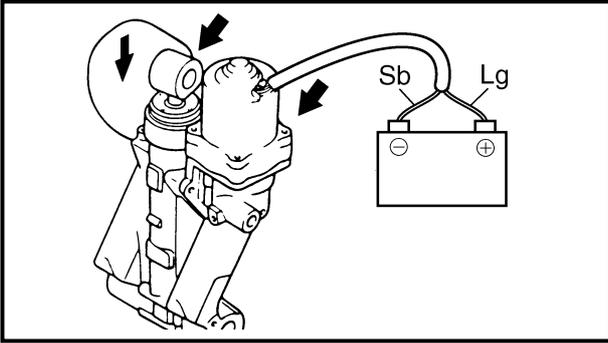
**Up-relief valve attachment..... ③  
90890-06773  
Hydraulic pressure gauge..... ④  
90890-06776**



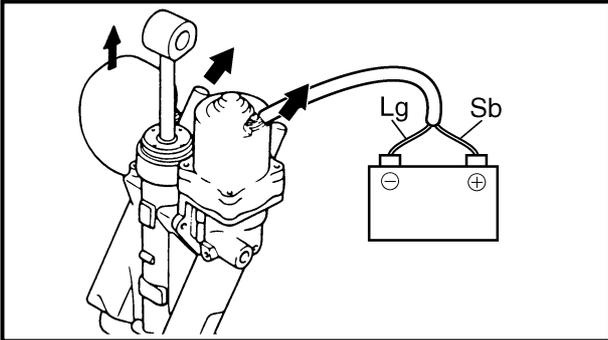
**Hydraulic pressure gauge  
9 Nm (0.9 m • kgf, 6.5 ft • lb)  
Up-relief valve attachment  
4 Nm (0.4 m • kgf, 2.9 ft • lb)**

**NOTE:**

Remove the manual valve and then quickly attach the special tools before any fluid comes out.



- (4) Connect the leads on the battery terminals in the down position until the power trim and tilt ram assemblies are fully compressed.

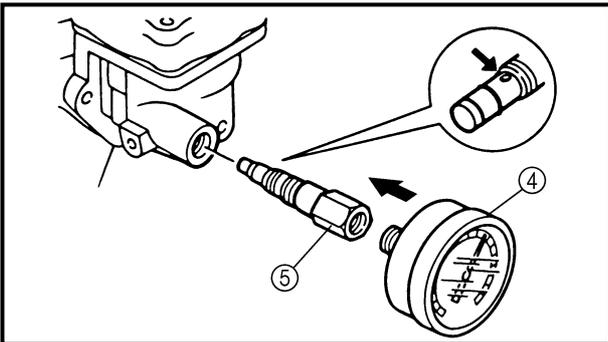


- (5) Connect the leads on the battery terminals in the up position until the power trim and tilt ram assemblies are fully extended. Then, measure the hydraulic pressure.



**Hydraulic pressure  
(with the power trim and tilt ram  
assemblies fully extended)**

**9.8 - 11.8 MPa  
(100 - 120 kg/cm<sup>2</sup>)**



- (6) After measuring the hydraulic pressure, remove the special tools and quickly attach the down-relief valve attachment.



**Hydraulic pressure gauge ..... ④**

**90890-06776**

**Down-relief valve attachment. ⑤**

**90890-06774**

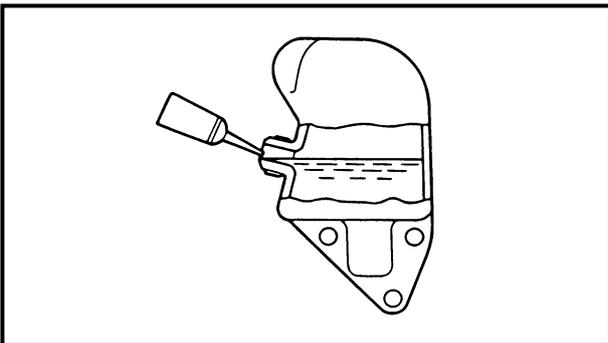


**Hydraulic pressure gauge**

**9 Nm (0.9 m • kgf, 6.5 ft • lb)**

**Down-relief valve attachment**

**4 Nm (0.4 m • kgf, 2.9 ft • lb)**

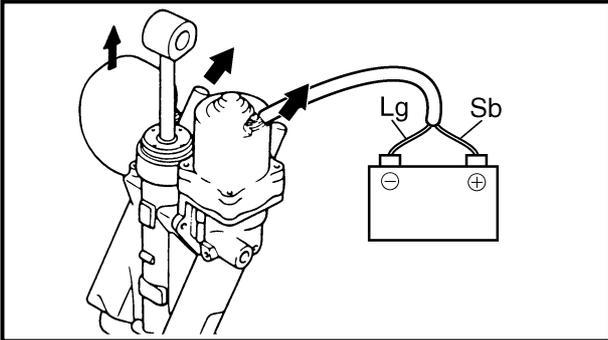
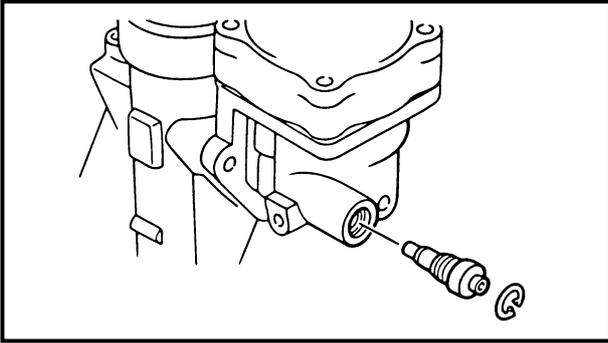


- (7) Remove the reservoir cap and check that fluid is up to the brim as shown. Add fluid if the level is below the brim.
- (8) Install the reservoir cap.
- (9) Connect the leads on the battery terminals in the down position until the power trim and tilt ram assemblies are fully compressed. Then, measure the hydraulic pressure.



**Hydraulic pressure  
(with the power trim and tilt ram  
assemblies fully compressed)**

**5.9 - 8.8 MPa (60 - 90 kg/cm<sup>2</sup>)**



(10) After measuring the hydraulic pressure, connect the leads on the battery terminals in the up position until the power trim and tilt ram assemblies are fully extended.

(11) Remove the special tools.

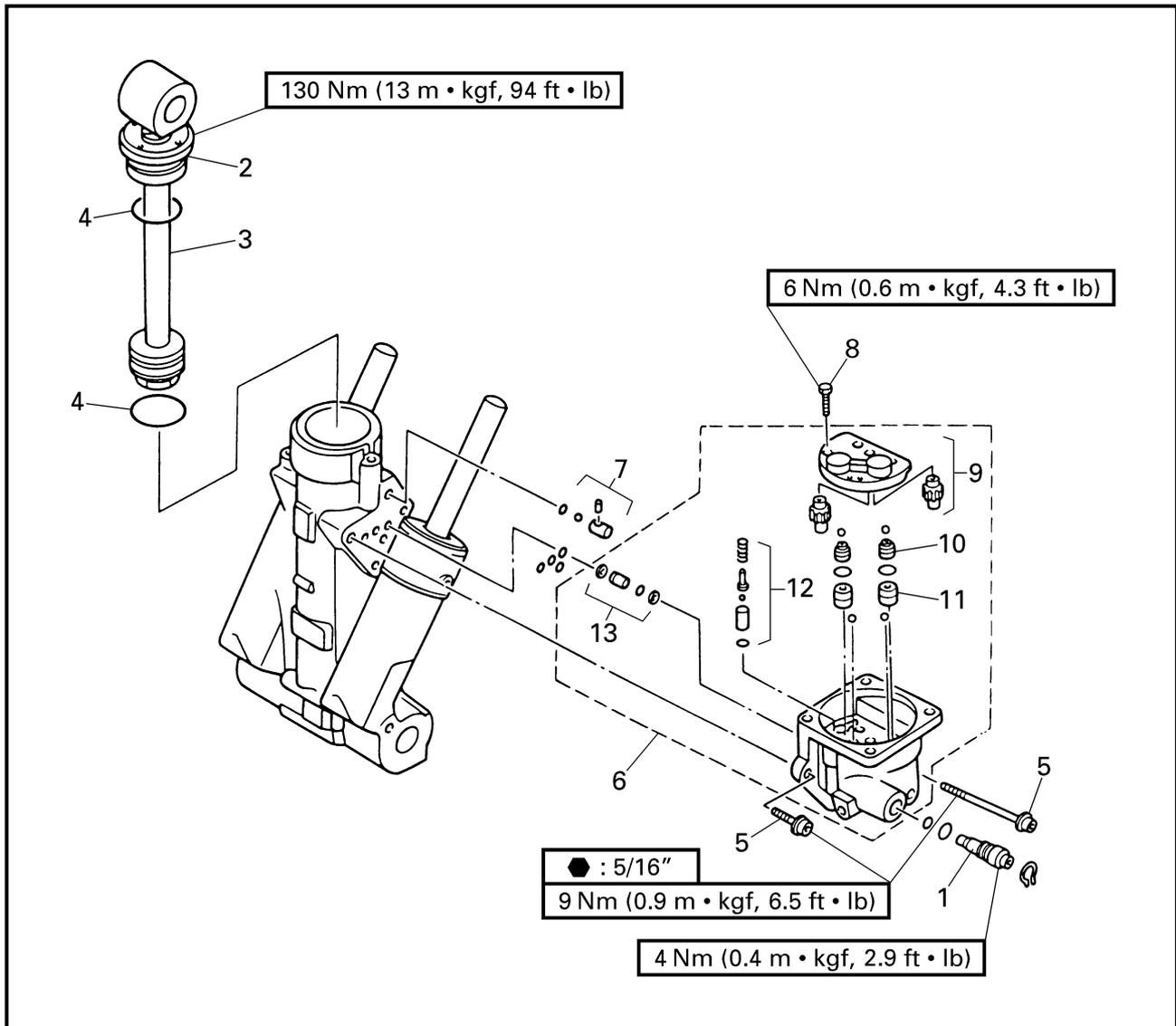
(12) Install the manual valve and circlip.

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

After measuring the hydraulic pressure, bleed the power trim and tilt unit.

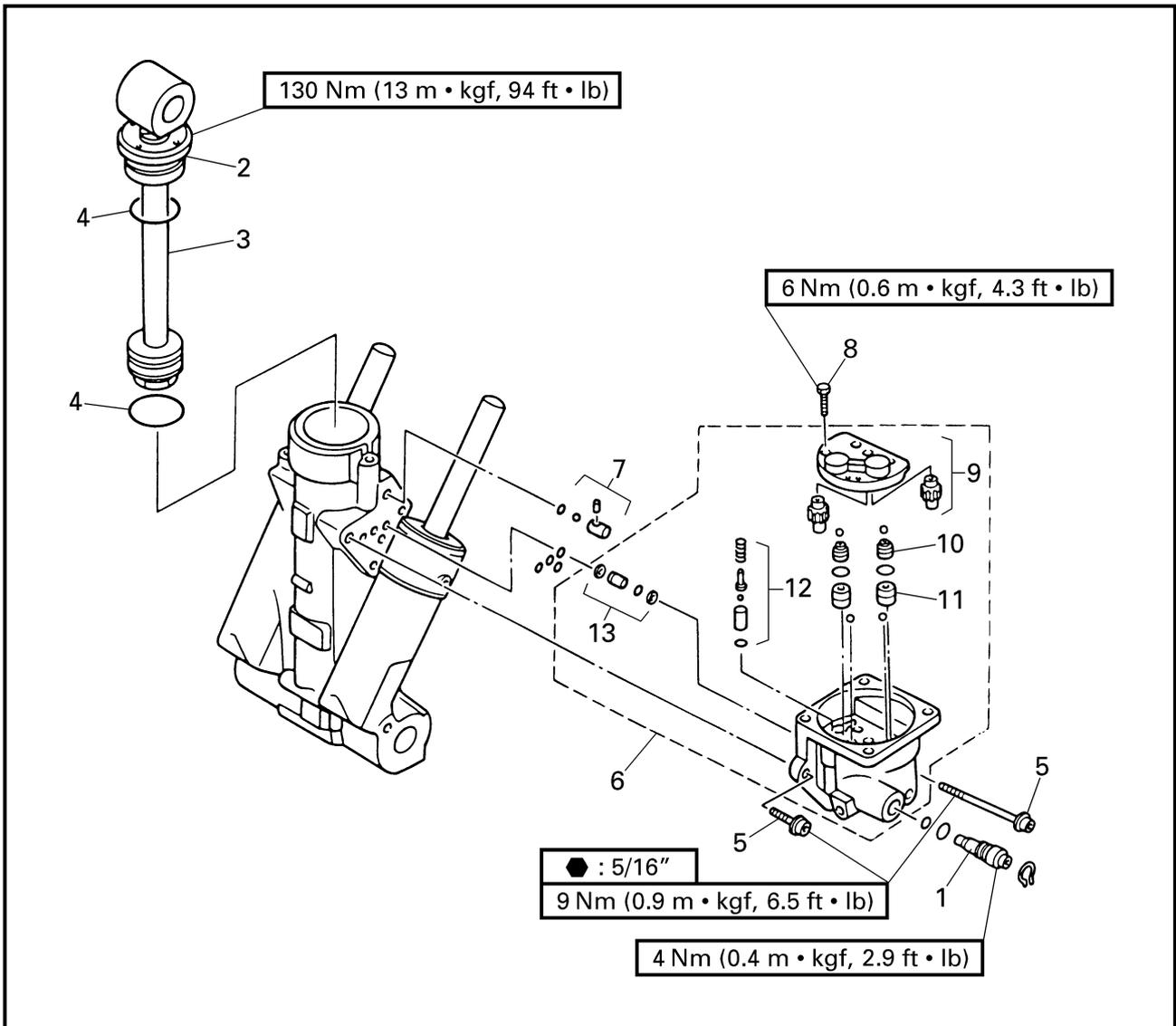
\_\_\_\_\_

**TILT RAM ASSEMBLY AND GEAR PUMP UNIT  
REMOVING/INSTALLING THE TILT RAM ASSEMBLY AND GEAR PUMP UNIT**

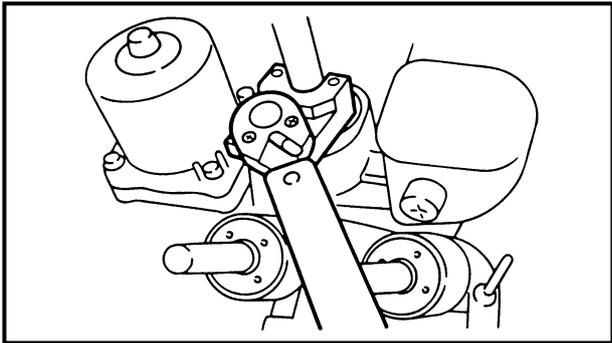


Order	Job/Part	Q'ty	Remarks
	Reservoir and power trim and tilt motor		Refer to "RESERVOIR AND POWER TRIM AND TILT MOTOR" on page 7-22.
1	Manual valve	1	
2	Tilt ram end screw	1	
3	Tilt ram assembly	1	
4	O-ring	2	
5	Bolt	3	
6	Gear pump unit	1	

Continued on next page.



Order	Job/Part	Q'ty	Remarks
7	Check valve assembly	1	
8	Bolt	2	
9	Gear pump	1	
10	Shuttle valve	2	
11	Check valve	2	
12	Up-relief valve assembly	1	
13	Down-relief valve assembly	1	
			For installation, reverse the removal procedure.



## REMOVING THE TILT RAM END SCREW

Loosen:

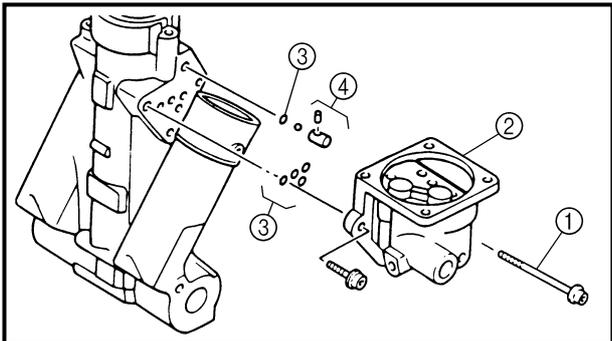
- Tilt ram end screw



**End screw wrench**  
YB-06548 / 90890-06548

### NOTE:

Hold the power trim and tilt unit in a vise using aluminum plates on both sides.



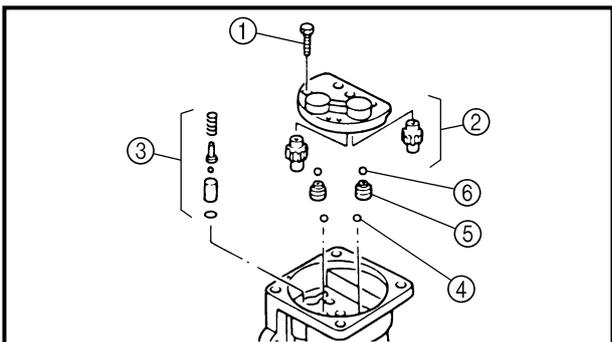
## REMOVING THE GEAR PUMP UNIT

Remove:

- Bolts ①
- Gear pump unit ②
- O-rings ③
- Check valve ④

### NOTE:

Place a container under the power trim and tilt unit.



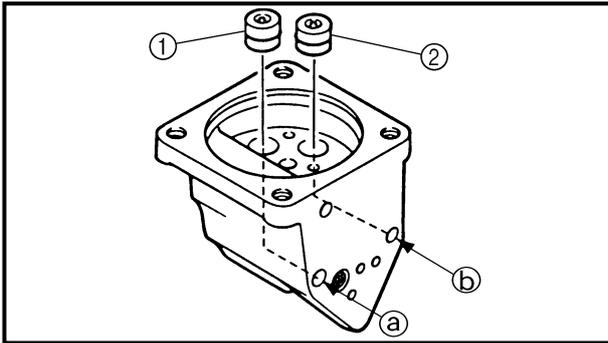
## DISASSEMBLING THE GEAR PUMP UNIT

1. Remove:

- Bolts ①
- Pump gears ②
- Up-relief valve assembly ③
- Balls (4.76 mm/0.187 in) ④
- Shuttle valves ⑤
- Balls (3.18 mm/0.125 in) ⑥

### NOTE:

When removing the pump gears, note their original direction and position for proper assembly.



2. Remove:

- Check valves ① and ②

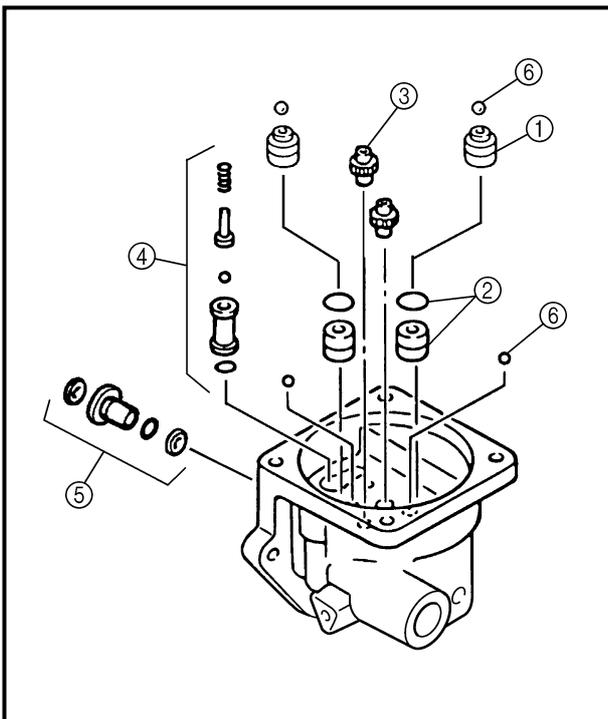
**NOTE:** \_\_\_\_\_

To remove the check valves, cover the gear pump housing with a clean cloth and then blow compressed air through holes ① and ②.

### CHECKING THE TILT RAM

Check:

- Tilt ram  
Excessive scratches → Replace.  
Bends/excessive corrosion → Replace.  
Rust → Polish.  
(with 400 - 600 grit sandpaper)



### CHECKING THE GEAR PUMP UNIT

Check:

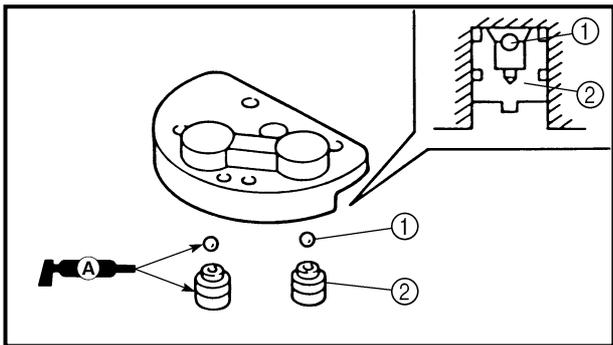
- Shuttle valves ①
- Check valve assemblies ②  
Clogs/damage/wear → Replace.
- Pump gears ③  
Damage/wear → Replace the gear pump unit.
- Up-relief valve assembly ④
- Down-relief valve assembly ⑤  
Damage/wear → Replace the gear pump unit.
- Balls ⑥  
Damage/wear → Replace.

**ASSEMBLING THE GEAR PUMP UNIT**

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

Install all components in their original direction and position for proper assembly and operation.

---

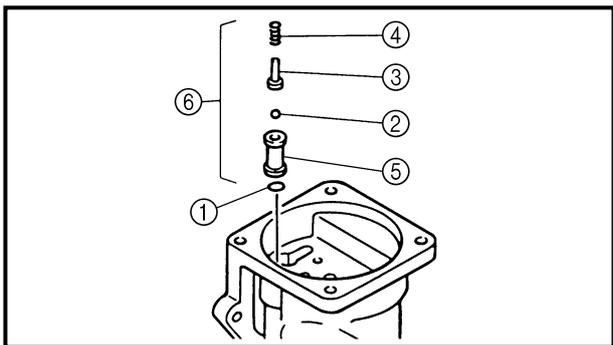


1. Install:
- Balls (3.18 mm/0.125 in) ①
  - Shuttle valves ②

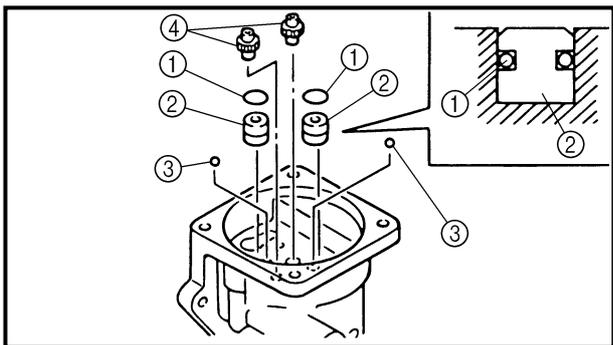
**NOTE:** \_\_\_\_\_

Apply grease to the balls to prevent them from falling out of the gear pump.

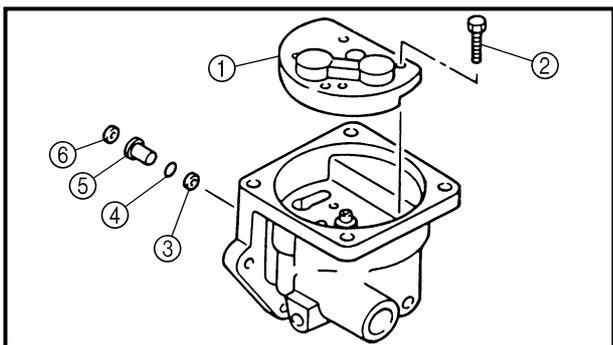
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2. Install:
- O-ring ①
  - Ball (3.18 mm/0.125 in) ②
  - Up-relief valve pin ③
  - Spring ④
  - Up-relief valve ⑤
  - Up-relief valve assembly ⑥



3. Install:
- O-rings ①
  - Check valves ②
  - Balls (4.76 mm/0.187 in) ③
  - Pump gears ④

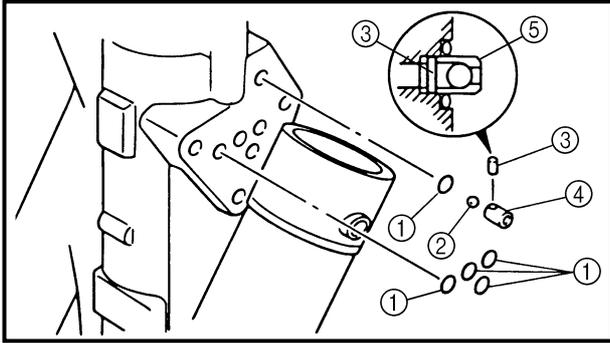


4. Install:
- Gear pump ①
  - Bolts ②
  - Filter ③
  - O-ring ④
  - Down-relief valve ⑤
  - Filter ⑥

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

Tighten the bolts evenly and make sure the pump gears turn smoothly.

---



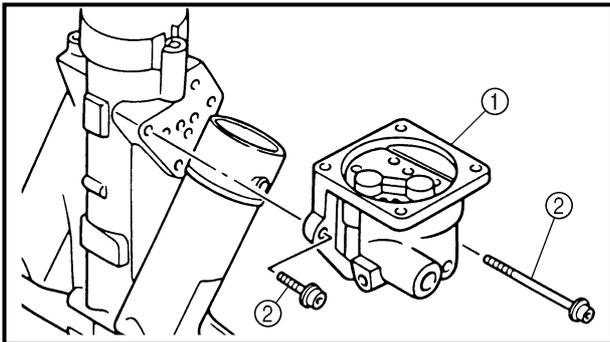
### INSTALLING THE GEAR PUMP UNIT

#### 1. Install:

- O-rings ①
- Ball ②
- Pin ③
- Check valve ④
- Check valve assembly ⑤

#### NOTE:

When installing the check valve assembly, make sure the pin is on the tilt ram cylinder side as shown.



#### 2. Install:

- Gear pump unit ①
- Bolts ②

### INSTALLING THE TILT RAM ASSEMBLY

#### ⚠ WARNING

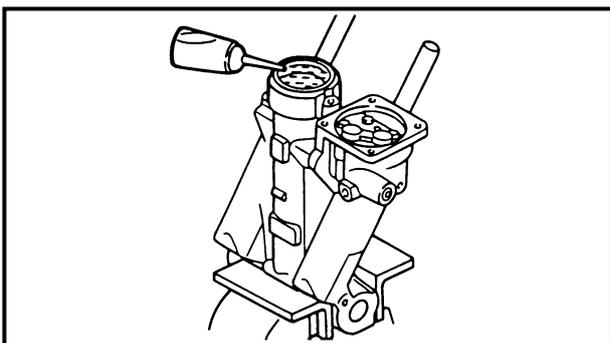
To prevent the hydraulic fluid from spurt- ing out due to internal pressure, the tilt ram should be kept at full length.

#### 1. Fill:

- Tilt ram cylinder

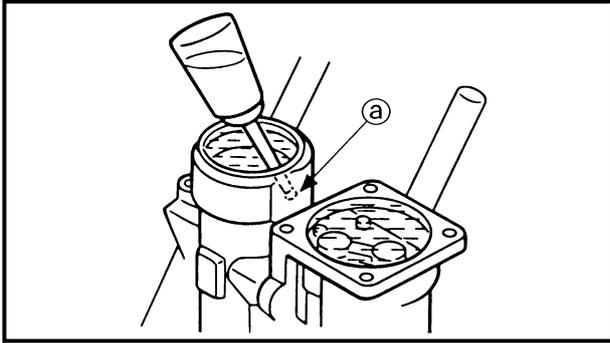


**Recommended power trim and  
tilt fluid  
ATF Dexron II**



#### NOTE:

Hold the power trim and tilt unit in a vise using aluminum plates on both sides.



## 2. Fill:

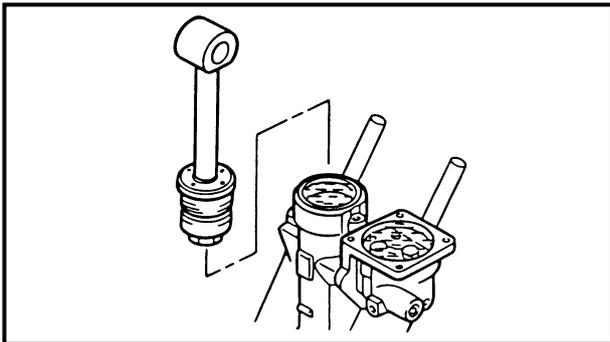
- Gear pump housing



**Recommended power trim and tilt fluid**  
ATF Dexron II

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

Add power trim and tilt fluid through the hole ① until the fluid level is to the top of the gear pump unit.

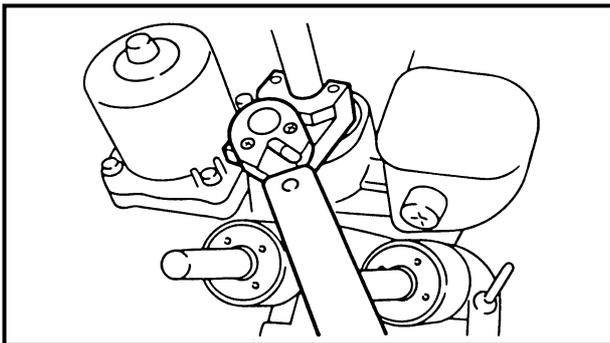


## 3. Install:

- Tilt ram assembly

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

Place the tilt ram end screw at the bottom of the tilt ram and install the tilt ram assembly into the tilt ram cylinder.



## 4. Tighten:

- Tilt ram end screw



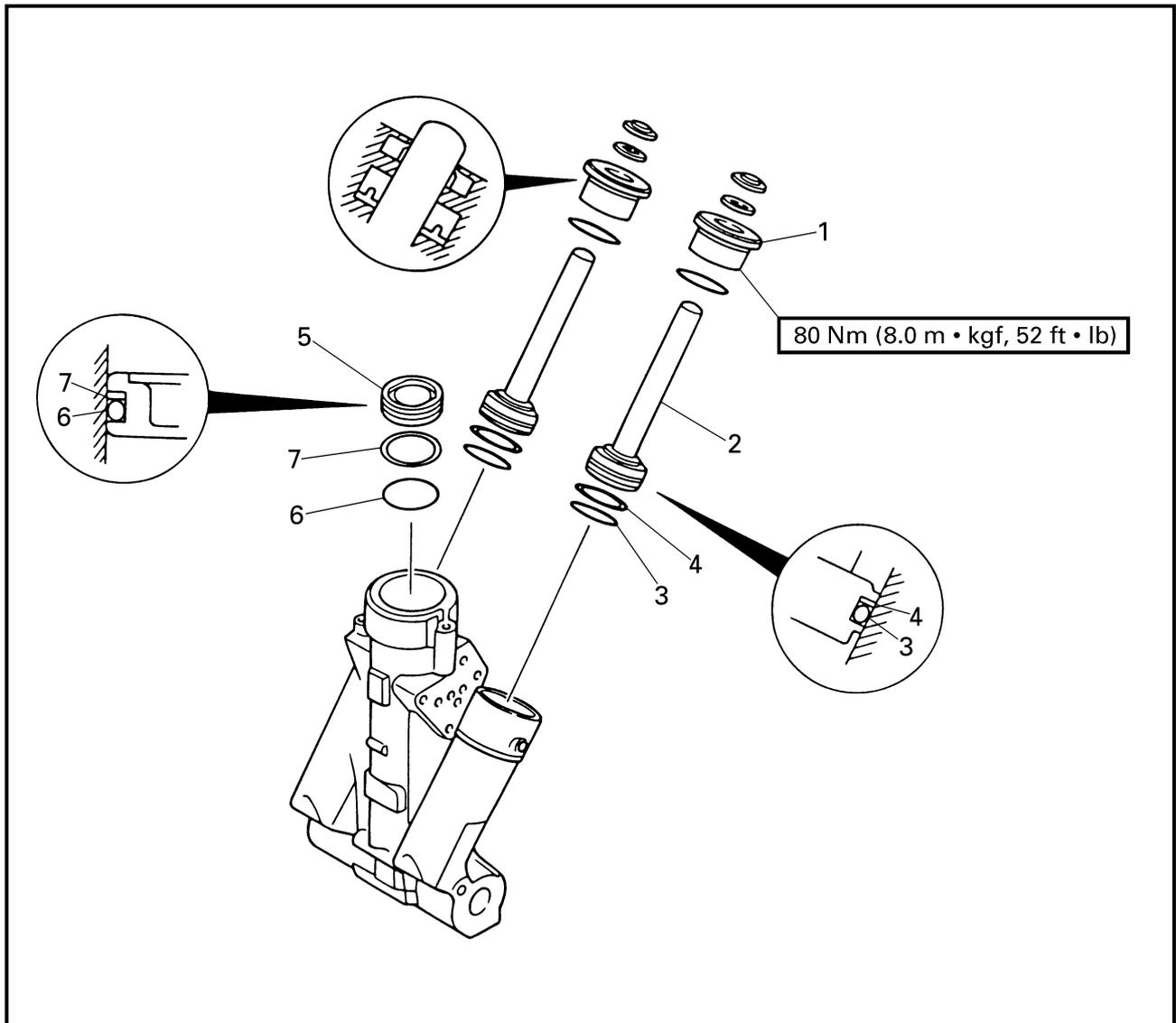
**End screw wrench**  
YB-06548 / 90890-06548



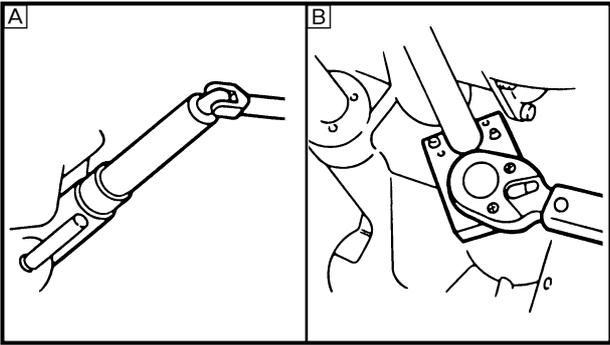
**Tilt ram end screw**  
130 Nm (13 m • kgf, 94 ft • lb)

**TRIM RAM ASSEMBLIES AND FREE PISTON**

**REMOVING/INSTALLING THE TRIM RAM ASSEMBLIES AND FREE PISTON**



Order	Job/Part	Q'ty	Remarks
	Tilt ram assembly and gear pump unit		Refer to "TILT RAM ASSEMBLY AND GEAR PUMP UNIT" on page 7-30.
1	Trim ram end screw	2	
2	Trim ram	2	
3	O-ring	2	
4	Seal ring	2	
5	Free piston	1	
6	O-ring	1	
7	Piston ring	1	
			For installation, reverse the removal procedure.



**REMOVING THE TRIM RAM END SCREWS**

Loosen:

- Trim ram end screws

	<p><b>End screw wrench</b> YB-06175-1A / 90890-06548</p>
---	--

- A** For USA and Canada
- B** For worldwide

**NOTE:**

Hold the power trim and tilt unit in a vise using aluminum plates on both sides.

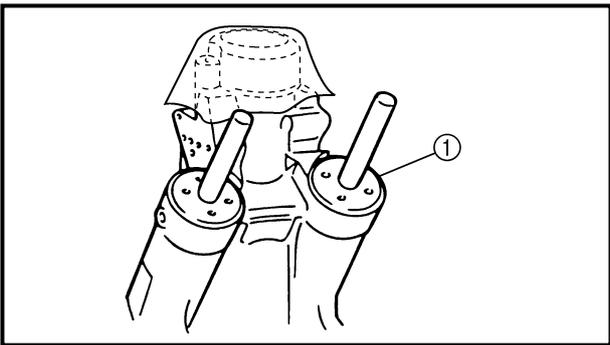
**REMOVING THE FREE PISTON**

1. Drain:

- Power trim and tilt fluid

**NOTE:**

After removing the trim ram assemblies, drain the fluid from the power trim and tilt unit.

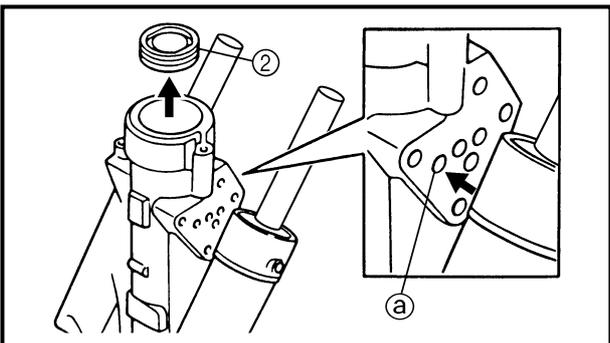


2. Install:

- Trim ram assemblies ①

**NOTE:**

Finger-tighten the trim ram assemblies and then cover the tilt cylinder openings with a clean cloth.



3. Remove:

- Free piston ②

**⚠ WARNING**

**Never look into the tilt cylinder opening because the free piston and hydraulic fluid may be expelled out forcefully.**

**NOTE:**

Remove the free piston by blowing compressed air through the hole ②.

**CHECKING THE TRIM RAMS**

Check:

- Trim rams  
Excessive scratches → Replace.  
Bends/excessive corrosion → Replace.  
Rust → Polish.  
(with 400 - 600 grit sandpaper)

**CHECKING THE FREE PISTON**

Check:

- Free piston  
Excessive scratches → Replace.

**CHECKING THE TRIM RAM CYLINDERS**

Check:

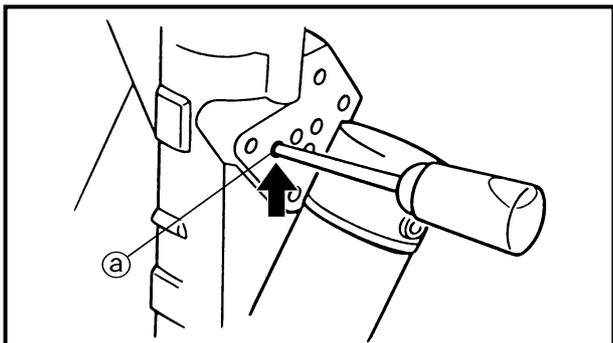
- Trim ram cylinders  
Cracks/excessive scratches → Replace the power trim and tilt unit.

**INSTALLING THE FREE PISTON**

1. Fill:

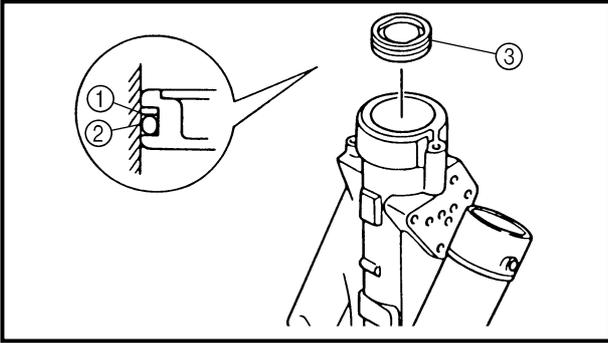
- Fluid passages

	<p><b>Recommended power trim and tilt fluid</b> <b>ATF Dexron II</b> <b>Quantity</b> <b>30 cm<sup>3</sup> (1.0 US oz, 1.1 Imp oz)</b></p>
---	---



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

- Hold the power trim and tilt unit in a vise using aluminum plates on both sides.
- Add power trim and tilt fluid through the hole ①.



## 2. Install:

- Piston ring ①
- O-ring ②
- Free piston ③

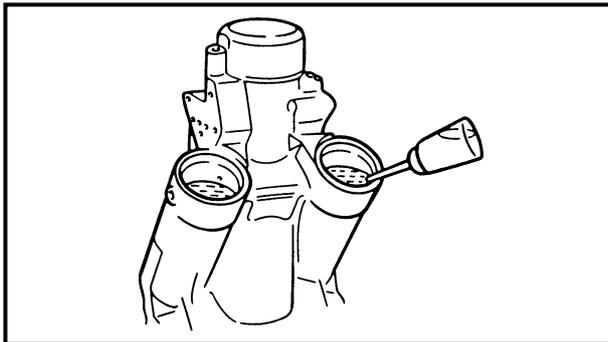
**NOTE:**

Push the free piston into the trim ram cylinder until it bottoms out.

## INSTALLING THE TRIM RAMS

**⚠ WARNING**

Do not push the trim rams down while installing them into the trim ram cylinders. Otherwise, the hydraulic fluid may spurt out from the unit.



## 1. Fill:

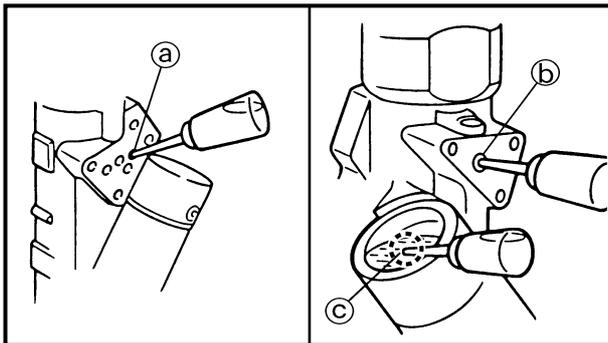
- Trim ram cylinders



**Recommended power trim and tilt fluid**  
ATF Dexron II

**NOTE:**

Hold the power trim and tilt unit in a vise using aluminum plates on both sides.



## 2. Fill:

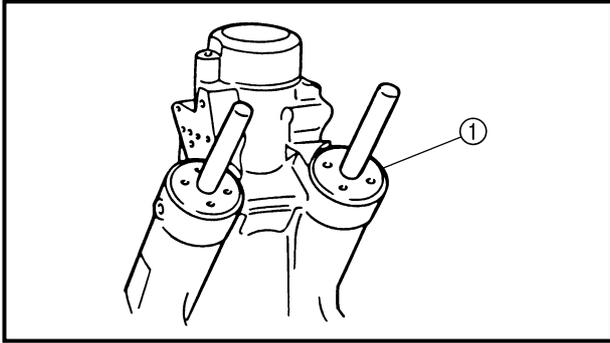
- Fluid passages



**Recommended power trim and tilt fluid**  
ATF Dexron II

**NOTE:**

Add power trim and tilt fluid through holes (a), (b) and (c) until all of the passages are filled.

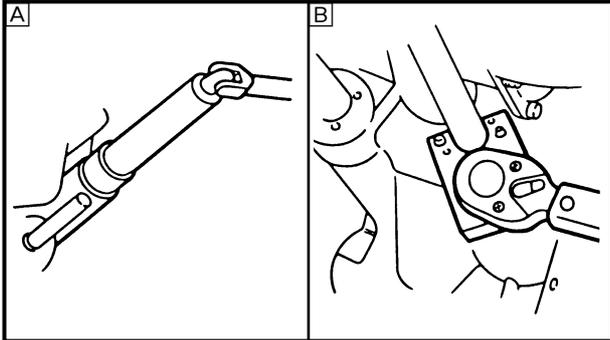


## 3. Install:

- Trim ram assemblies ①

**NOTE:**

Place each trim ram end screw at the bottom of each trim ram and install them into the trim ram cylinders.



## 4. Tighten:

- Trim ram end screws



**End screw wrench**  
YB-06175-1A / 90890-06548



**Trim ram end screw**  
80 Nm (8.0 m • kgf, 58 ft • lb)

A For USA and Canada

B For worldwide

## CHAPTER 8 ELECTRICAL SYSTEMS

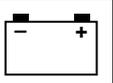
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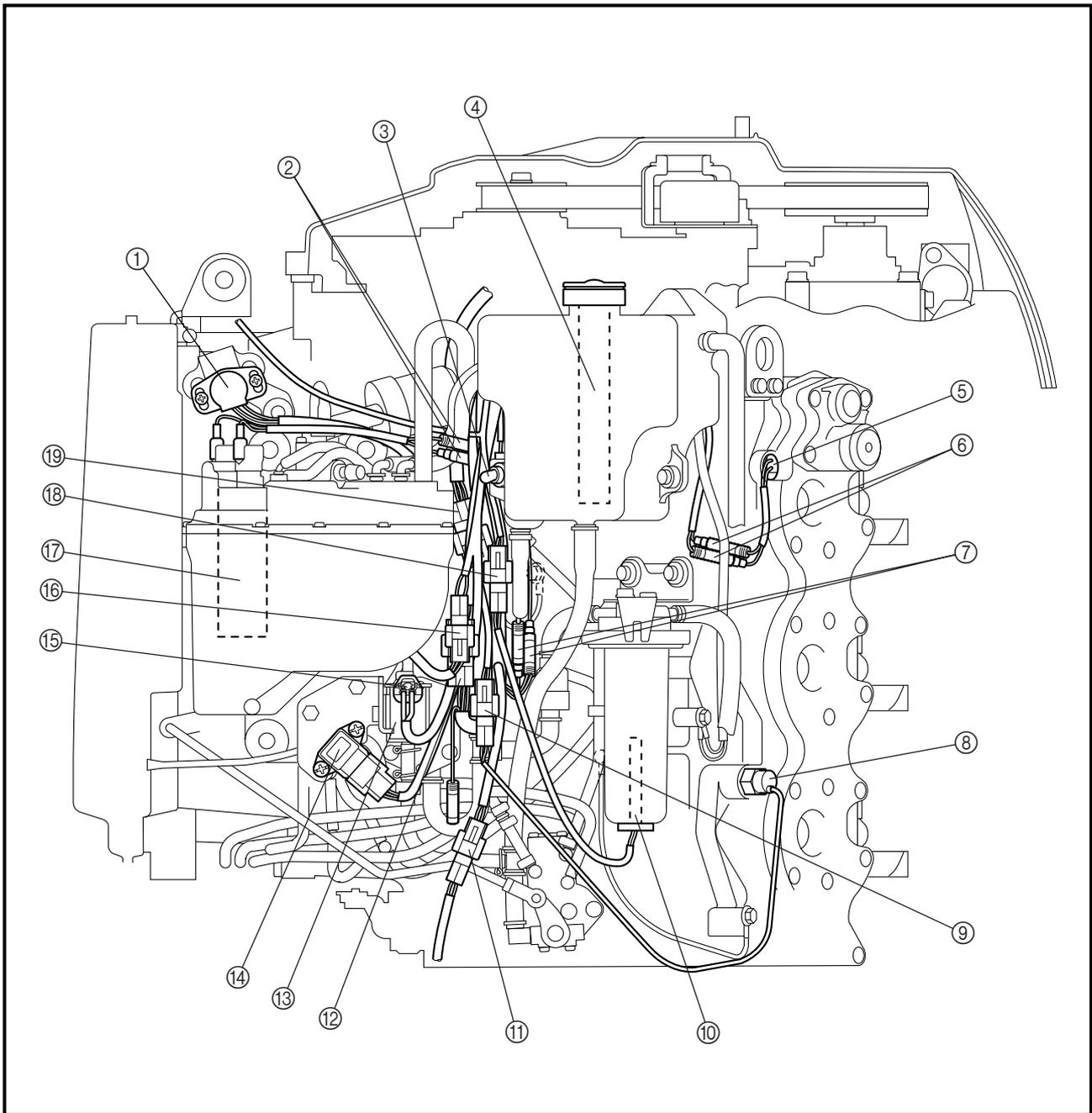
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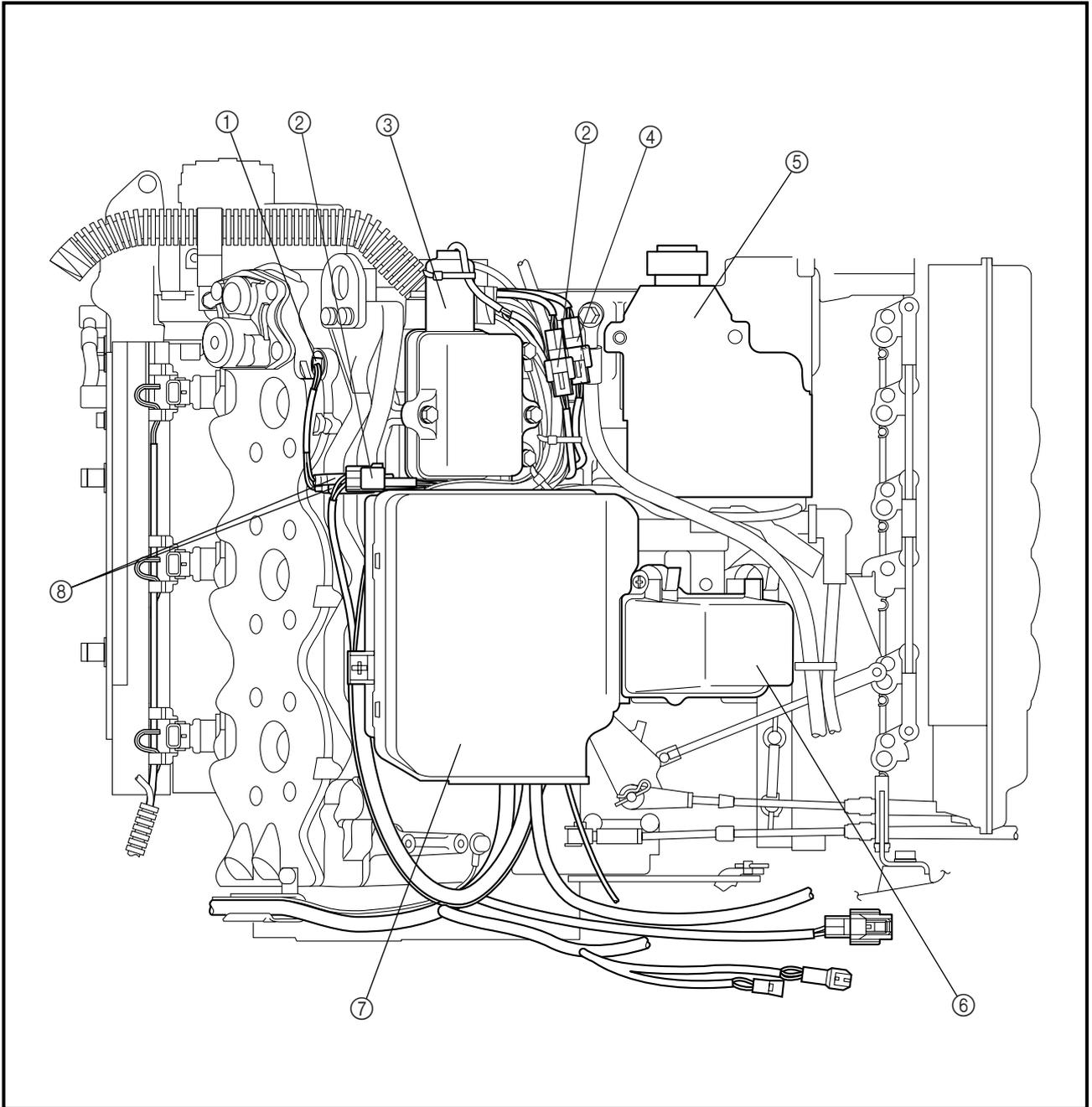


## ELECTRICAL COMPONENTS (Port view)

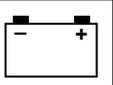


- |  |   |
|--|---|
| ① Throttle position sensor                             | ⑩ Water detection switch                |
| ② Electric fuel pump connectors                        | ⑪ Trailer switch coupler (3P)           |
| ③ Emergency switch                                     | ⑫ Oil level sensor coupler (6P)         |
| ④ Oil level sensor                                     | ⑬ Electric oil pump                     |
| ⑤ Thermo switch  | ⑭ Atmospheric pressure sensor           |
| ⑥ Thermo switch connectors                             | ⑮ Electric oil pump coupler (2P)        |
| ⑦ Emergency switch connectors                          | ⑯ Throttle position sensor coupler (3P) |
| ⑧ Engine cooling water temperature sensor              | ⑰ Electric fuel pump                    |
| ⑨ Engine cooling water temperature sensor coupler (2P) | ⑱ Water detection switch coupler (2P)   |
|  | ⑲ Pulser coil coupler (8P)              |

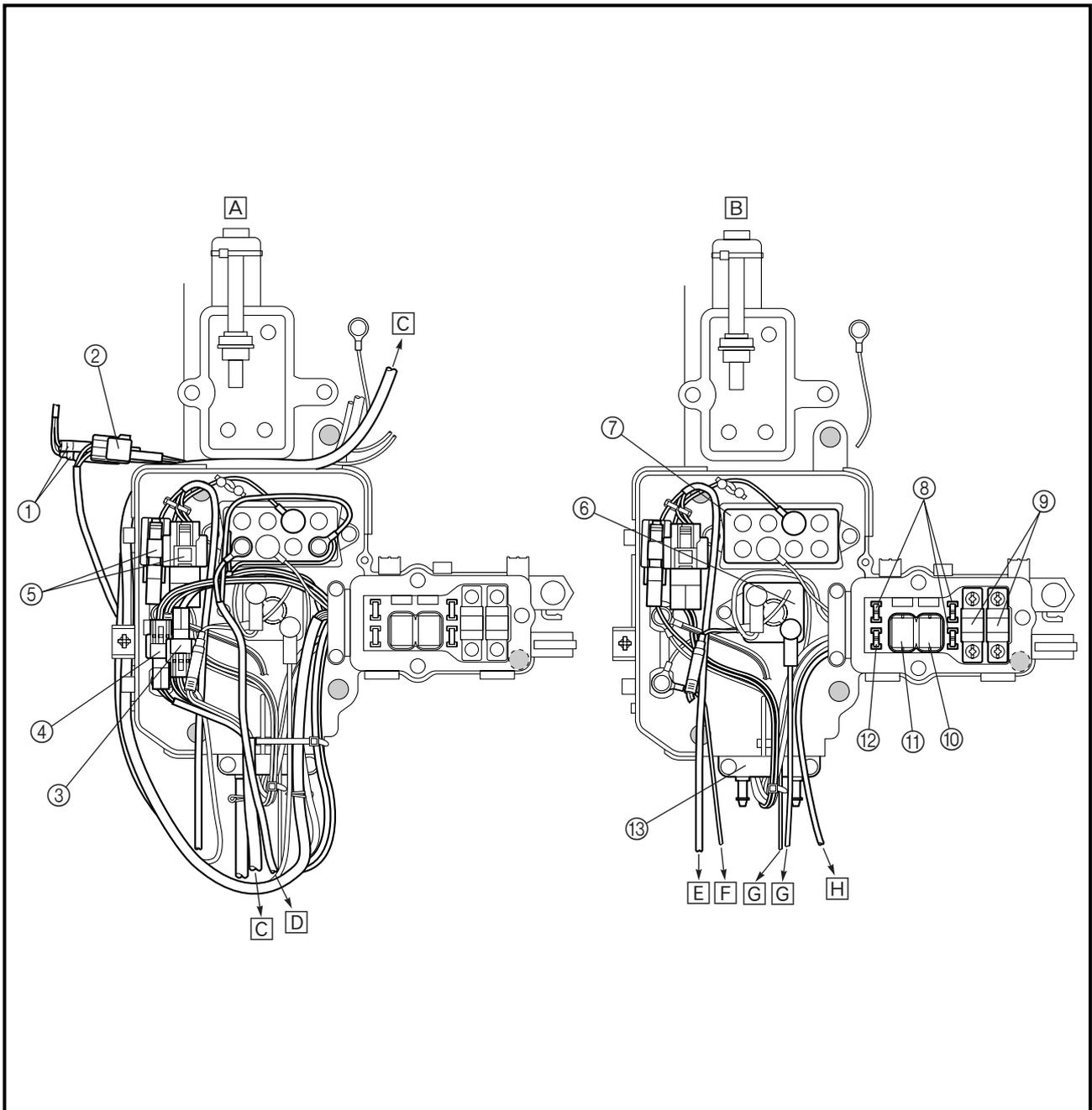
**(Starboard view)**



- ① Thermo switch
- ② Oxygen density sensor coupler (2P)
- ③ Oxygen density sensor
- ④ Crank position sensor coupler (2P)
- ⑤ Starter motor
- ⑥ Fuse holder
- ⑦ Junction box assembly
- ⑧ Thermo switch connectors

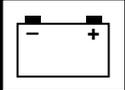


**(Junction box assembly)**

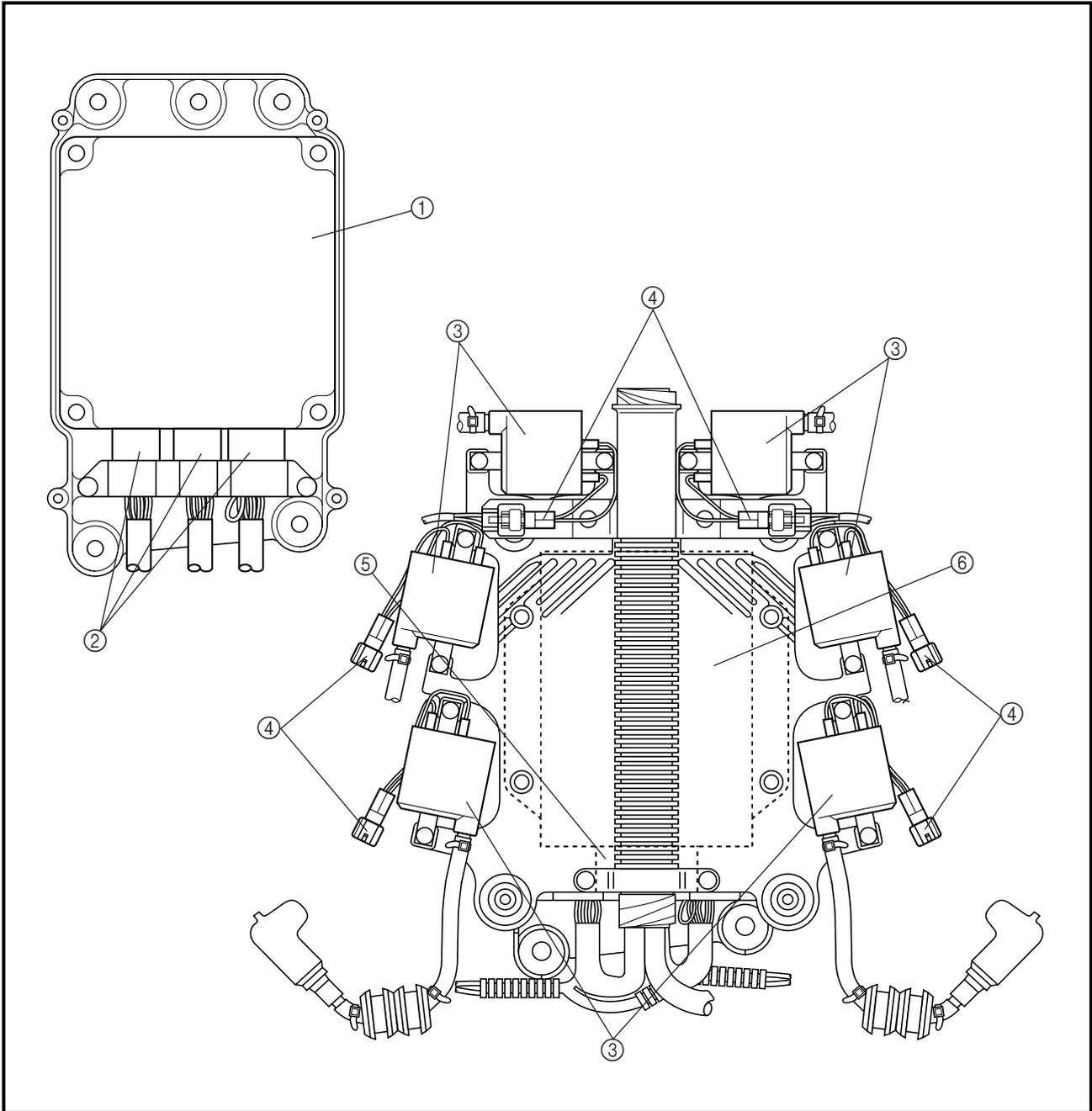


- ① Thermo switch connectors
- ② Oxygen density sensor coupler (2P)
- ③ Power trim and tilt relay coupler (2P)
- ④ Fuse holder coupler (3P)
- ⑤ Lighting coil couplers (1P, 2P)
- ⑥ Starter relay
- ⑦ Power trim and tilt relay
- ⑧ Fuse (20A)
- ⑨ Fuse (80A)
- ⑩ Main relay
- ⑪ Driver relay

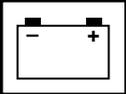
- ⑫ Fuse (30A)
- ⑬ Rectifier/regulator
- A** Complete assembly
- B** Sub-assembly
- C** To wire harness
- D** To power trim and tilt motor
- E** To lighting coil
- F** To ground
- G** To starter motor
- H** To electric fuel pump



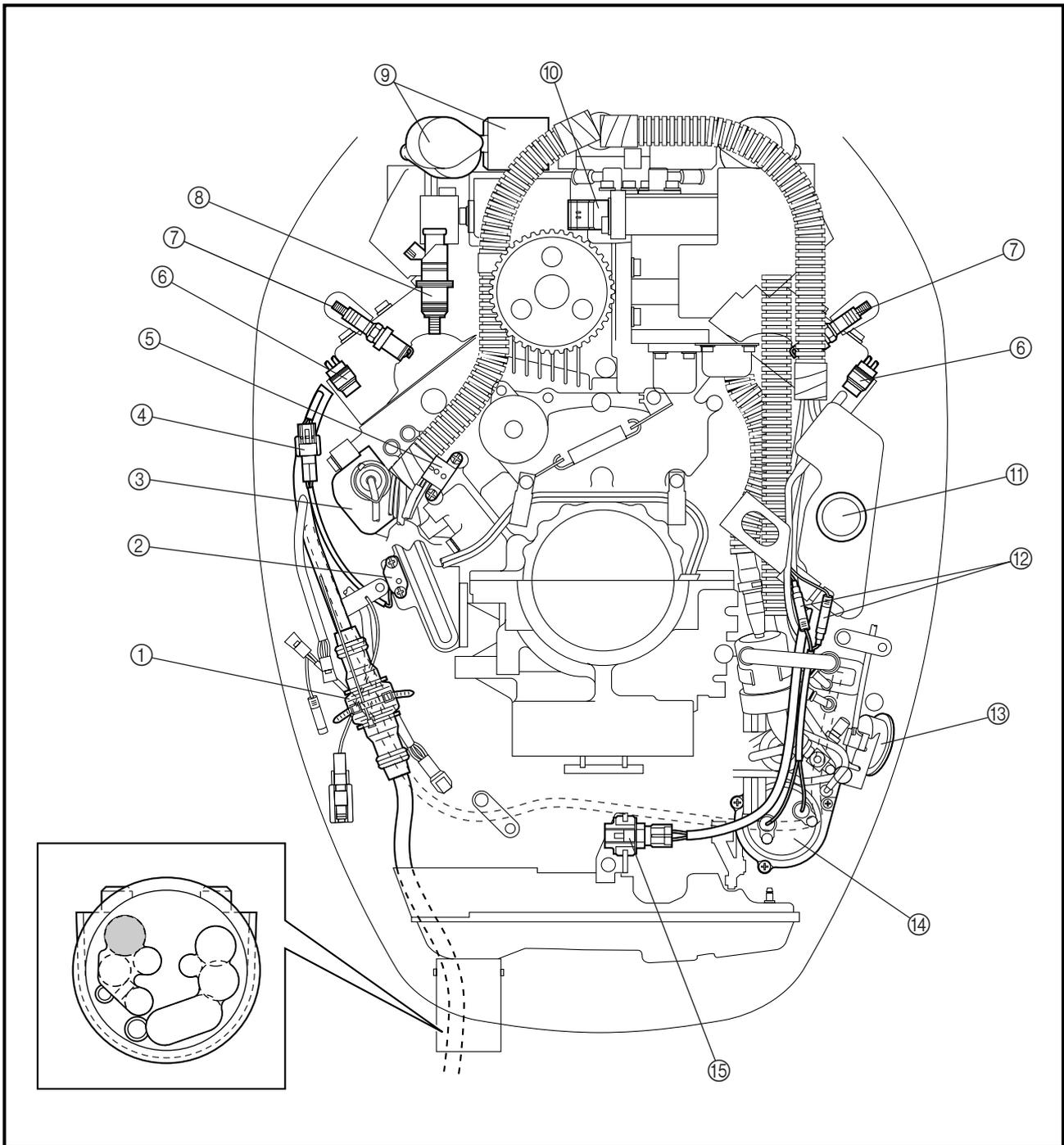
**(Aft view)**



- ① Control unit
- ② Control unit couplers (26P, 26P, 34P)
- ③ Ignition coils
- ④ Ignition coil couplers (2P)
- ⑤ Injector driver couplers (26P)
- ⑥ Injector driver

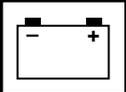


**(Top view)**

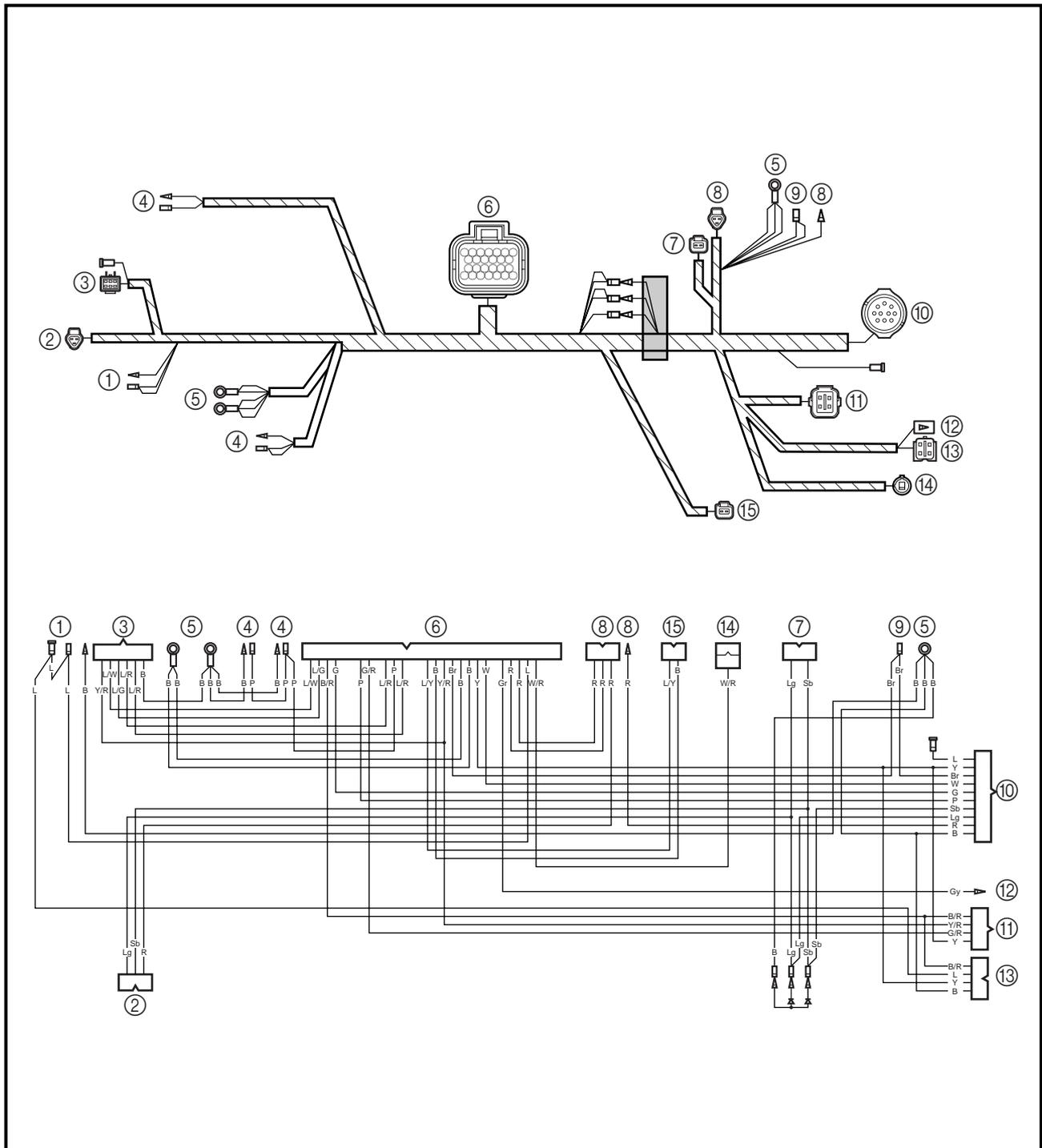


- ① Remote control coupler (10P)
- ② Shift position switch
- ③ Oxygen density sensor
- ④ Shift position switch coupler (2P)
- ⑤ Crank position sensor
- ⑥ Thermo switches
- ⑦ Spark plugs
- ⑧ Fuel injectors
- ⑨ Ignition coils

- ⑩ Fuel pressure sensor
- ⑪ Oil level sensor
- ⑫ Electric fuel pump connectors
- ⑬ Trailer switch
- ⑭ Electric fuel pump
- ⑮ Intake air temperature sensor



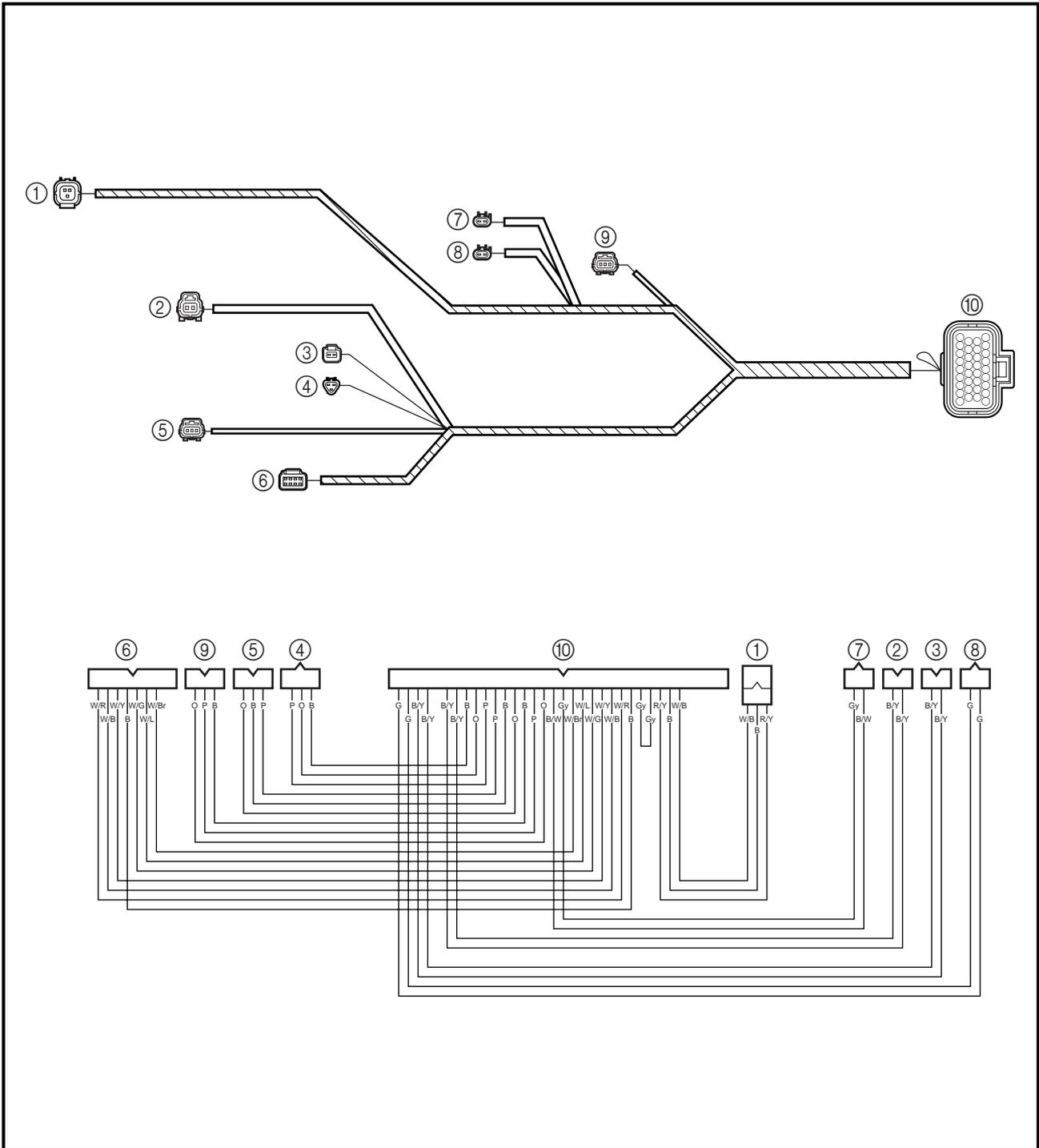
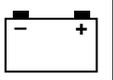
**WIRE HARNESS**



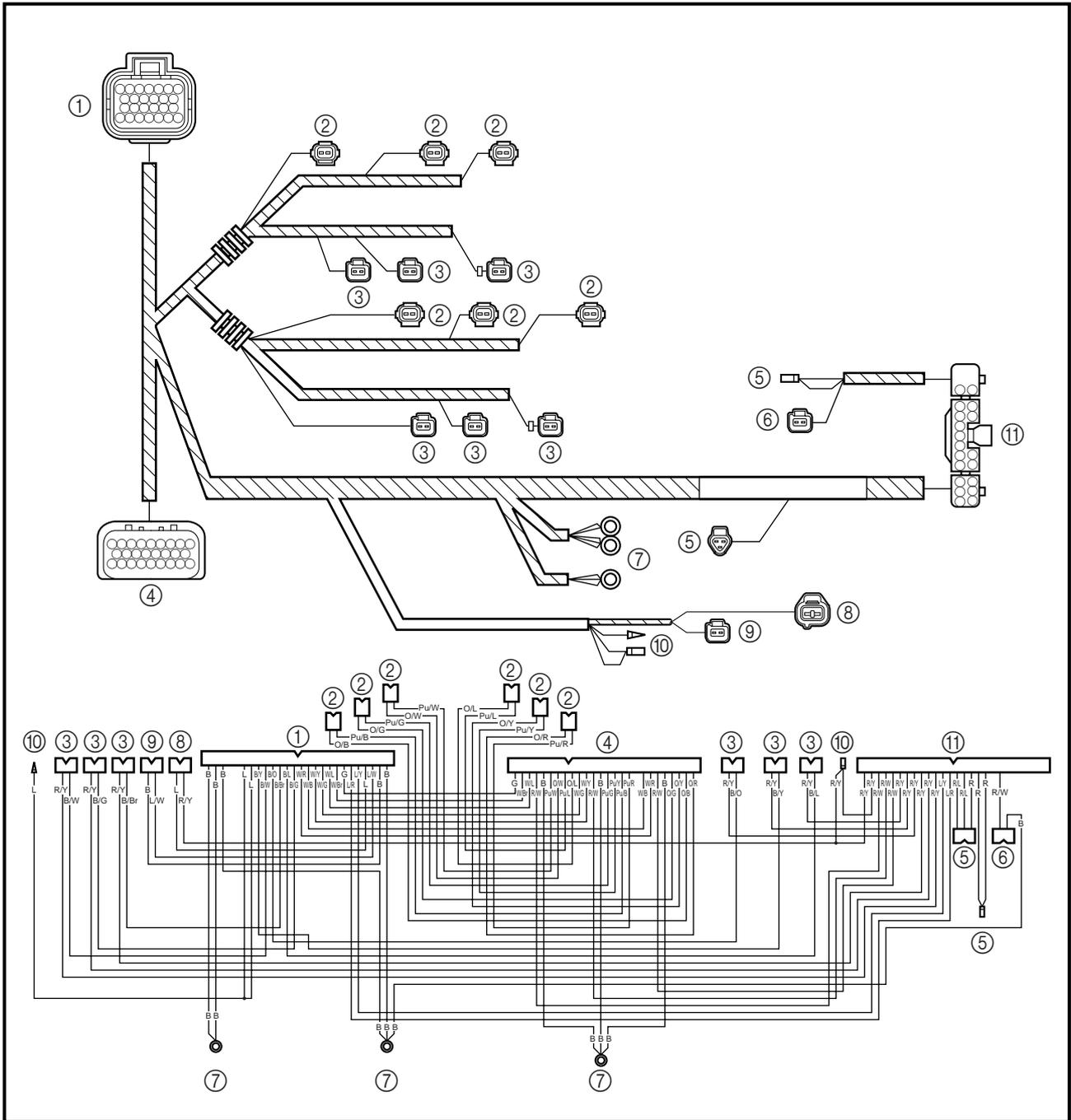
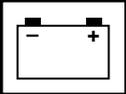
- Connect to:
- ① Emergency switch
  - ② Trailer switch
  - ③ Oil level sensor
  - ④ Thermo switch
  - ⑤ Ground
  - ⑥ Control unit
  - ⑦ Power trim and tilt relay

- ⑧ Fuse holder
- ⑨ Starter relay
- ⑩ Remote control
- ⑪ Oil level meter
- ⑫ Trim sensor
- ⑬ Sub-oil tank
- ⑭ Water detection meter
- ⑮ Shift position switch

- |                  |                  |
|------------------|------------------|
| B : Black        | W : White        |
| Br : Brown       | Y : Yellow       |
| G : Green        | B/R : Black/red  |
| Gy : Gray        | G/R : Green/red  |
| L : Blue         | L/G : Blue/green |
| Lg : Light green | L/R : Blue/red   |
| P : Pink         | L/W : Blue/white |
| R : Red          | W/R : White/red  |
| Sb : Sky blue    | Y/R : Yellow/red |



- |   |                               |                    |                    |
|---|-------------------------------|--------------------|--------------------|
| Connect to:                               | ⑤ Atmospheric pressure sensor | B : Black          | W/B : White/black  |
| ① Personal computer                       | ⑥ Pulser coil                 | G : Green          | W/Br : White/brown |
| ② Intake air temperature sensor           | ⑦ Oxygen density sensor       | Gy : Gray          | W/G : White/green  |
| ③ Engine cooling water temperature sensor | ⑧ Crank position sensor       | O : Orange         | W/L : White/blue   |
| ④ Throttle position sensor                | ⑨ Fuel pressure sensor        | P : Pink           | W/R : White/red    |
|   | ⑩ Control unit                | B/W : Black/white  | W/Y : White/yellow |
|   |                               | B/Y : Black/yellow |                    |
|   |                               | R/Y : Red/yellow   |                    |



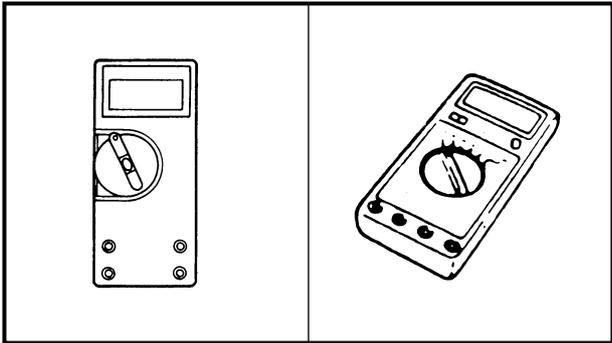
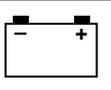
Connect to:

- ① Control unit
- ② Fuel injectors
- ③ Ignition coils
- ④ Injector driver
- ⑤ Wire harness
- ⑥ Oxygen density sensor
- ⑦ Ground
- ⑧ Electric oil pump
- ⑨ Water detection switch
- ⑩ Electric fuel pump
- ⑪ Fuse holder

- B : Black
- G : Green
- L : Blue
- R : Red
- B/Br : Black/brown
- B/G : Black/green
- B/L : Black/blue
- B/O : Black/orange
- B/W : Black/white
- B/Y : Black/yellow
- L/R : Blue/red
- L/W : Blue/white

- L/Y : Blue/yellow
- O/B : Orange/black
- O/G : Orange/green
- O/L : Orange/blue
- O/R : Orange/red
- O/W : Orange/white
- O/Y : Orange/yellow
- Pu/B : Purple/black
- Pu/G : Purple/green
- Pu/L : Purple/blue
- Pu/R : Purple/red
- Pu/W : Purple/white

- Pu/Y : Purple/yellow
- R/L : Red/blue
- R/W : Red/white
- R/Y : Red/yellow
- W/B : White/black
- W/Br : White/brown
- W/G : White/green
- W/L : White/blue
- W/R : White/red
- W/Y : White/yellow



**ELECTRICAL COMPONENTS ANALYSIS  
DIGITAL CIRCUIT TESTER**

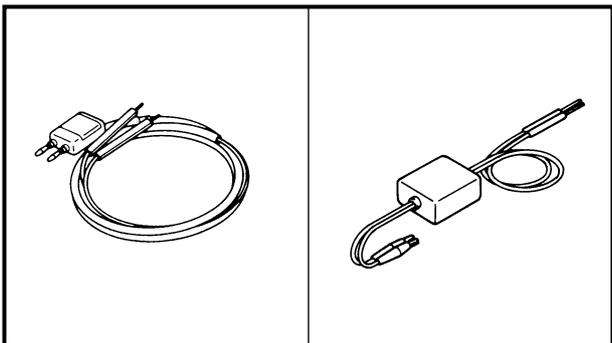


**Digital tester**  
**J-39299 / 90890-06752**

**NOTE:** \_\_\_\_\_  
" ○ — ○ " indicates a continuity of electric-  
ity which means a closed circuit at the  
respective switch position.

**MEASURING THE PEAK VOLTAGE**

- NOTE:** \_\_\_\_\_
- When checking the condition of the ignition system it is useful to know the peak voltage.
  - Cranking speed is dependant on many factors (e.g., fouled or weak spark plugs, a weak battery). If one of these is defective, the peak voltage will be lower than specification.
  - If the peak voltage measurement is not within specification the engine will not operate properly.

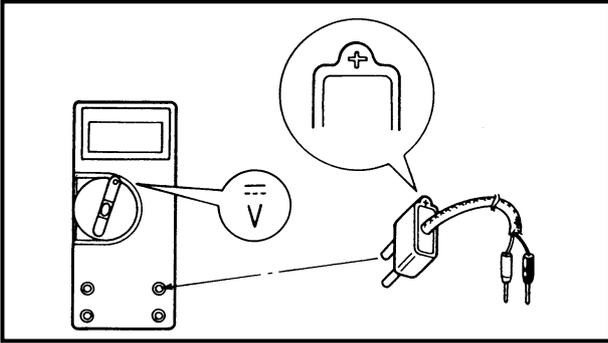
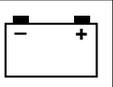


**PEAK VOLTAGE ADAPTOR**

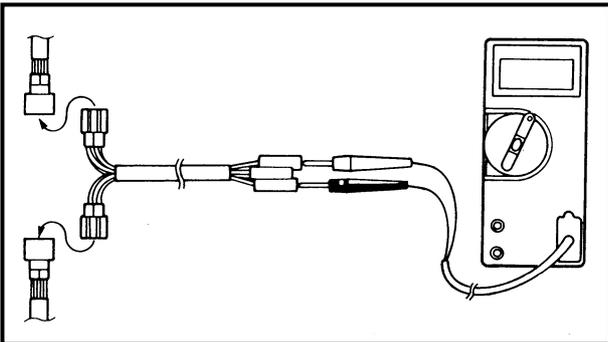
**NOTE:** \_\_\_\_\_  
The peak voltage adaptor should be used  
with the digital circuit tester.



**Peak voltage adaptor**  
**YU-39991 / 90890-03169**

**NOTE:**

- When measuring the peak voltage, set the selector to the DC voltage mode.
- Make sure the peak voltage adaptor leads are properly installed in the digital tester.
- Make sure the positive pin (the “+” mark facing up as shown) on the peak voltage adaptor is installed into the positive terminal of the digital tester.
- The test harness is needed for the following tests.

**Measuring steps**

- (1) Disconnect the coupler connections.
- (2) Connect the test harness between the couplers.
- (3) Connect the peak voltage adaptor probes to the connectors which are being checked.
- (4) Start or crank the engine and observe the measurement.

**MEASURING A LOW RESISTANCE**

When measuring a resistance of  $10\ \Omega$  or less with the digital tester, the correct measurement cannot be obtained because of the tester's internal resistance.

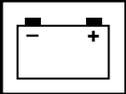
To obtain the correct value, subtract the internal resistance from the displayed measurement.



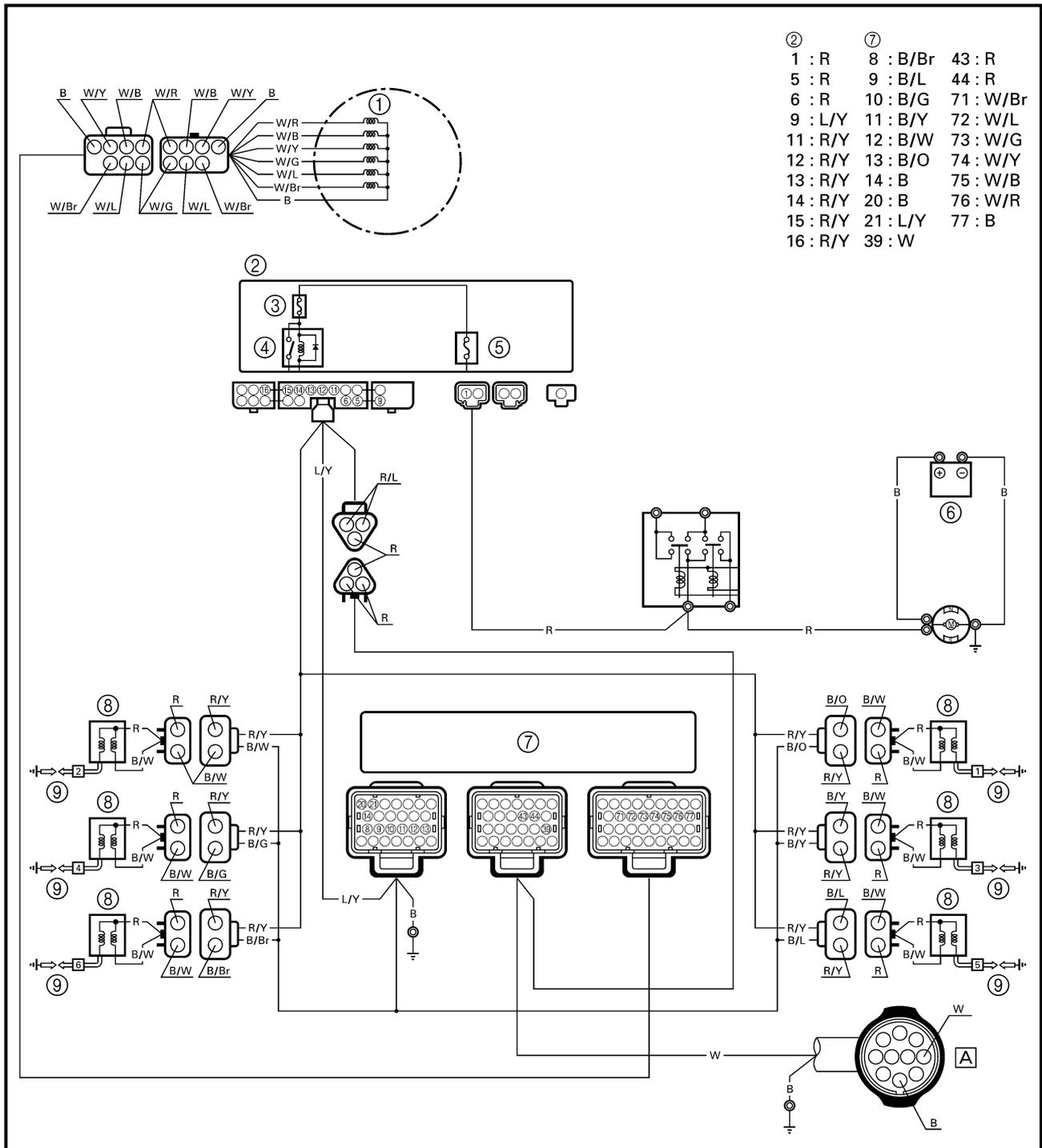
**Correct value**  
**Displayed measurement –**  
**internal resistance**

**NOTE:**

The internal resistance of the digital tester can be obtained by connecting both of its probes.



**IGNITION SYSTEM**



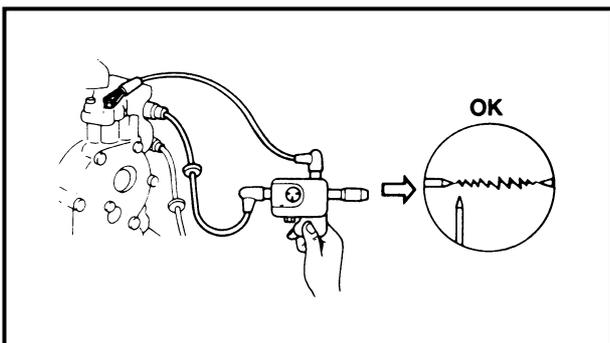
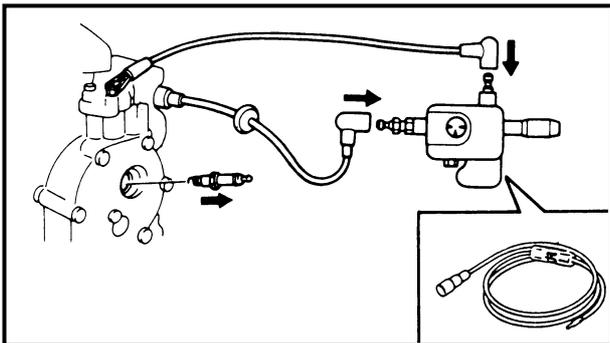
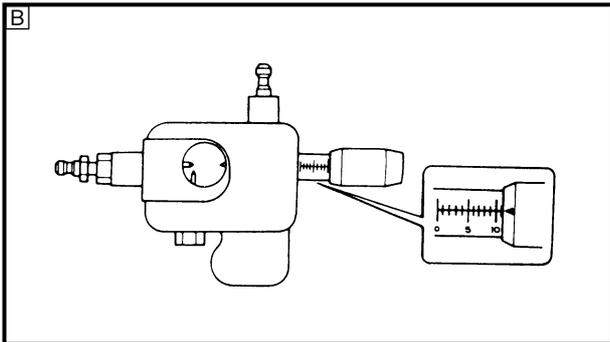
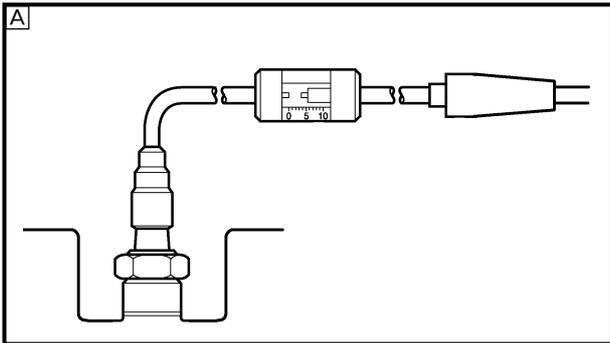
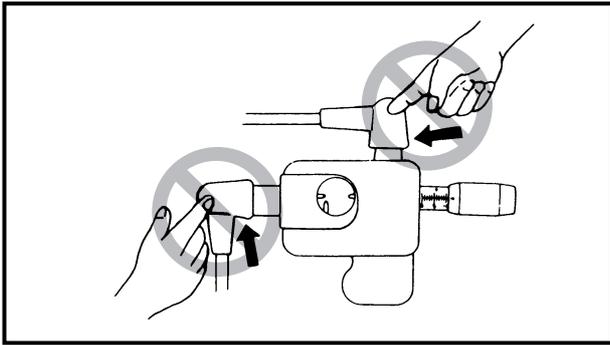
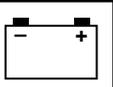
- |          |          |           |
|----------|----------|-----------|
| ②        | ⑦        |           |
| 1 : R    | 8 : B/Br | 43 : R    |
| 5 : R    | 9 : B/L  | 44 : R    |
| 6 : R    | 10 : B/G | 71 : W/Br |
| 9 : L/Y  | 11 : B/Y | 72 : W/L  |
| 11 : R/Y | 12 : B/W | 73 : W/G  |
| 12 : R/Y | 13 : B/O | 74 : W/Y  |
| 13 : R/Y | 14 : B   | 75 : W/B  |
| 14 : R/Y | 20 : B   | 76 : W/R  |
| 15 : R/Y | 21 : L/Y | 77 : B    |
| 16 : R/Y | 39 : W   |           |

- ① Pulser coil
- ② Fuse holder
- ③ Fuse (20A)
- ④ Main relay
- ⑤ Fuse (80A)
- ⑥ Battery
- ⑦ Control unit
- ⑧ Ignition coils
- ⑨ Spark plugs

- Ⓐ To remote control
- B : Black
- R : Red
- W : White
- B/Br : Black/brown
- B/G : Black/green
- B/L : Black/blue
- B/O : Black/orange

- B/W : Black/white
- B/Y : Black/yellow
- L/Y : Blue/yellow
- R/L : Red/blue
- R/Y : Red/yellow
- W/B : White/black
- W/Br : White/brown
- W/G : White/green
- W/L : White/blue

- W/R : White/red
- W/Y : White/yellow



## CHECKING THE IGNITION SPARK GAP

### ⚠ WARNING

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

#### Check:

- Ignition spark gap  
Above specification → Replace the spark plug.  
Below specification → Check the control unit output.



**Ignition spark gap**  
**9 mm (0.4 in)**

Ⓐ For USA and Canada

Ⓑ For worldwide

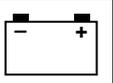
#### Checking steps

- (1) Remove the spark plugs from the engine.
- (2) Connect a spark plug cap to the spark gap tester.
- (3) Set the spark gap length on the adjusting knob.



**Spark gap tester**  
**YM-34487 / 90890-06754**

- (4) Crank the engine and observe the spark through the discharge window of the spark gap tester.



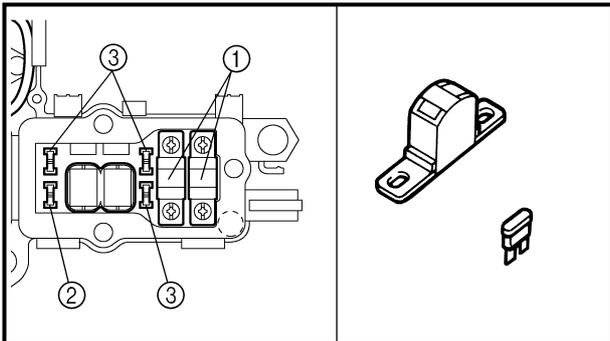
## CHECKING THE BATTERY

Refer to "CHECKING THE BATTERY" on page 3-19.

## CHECKING THE FUSES

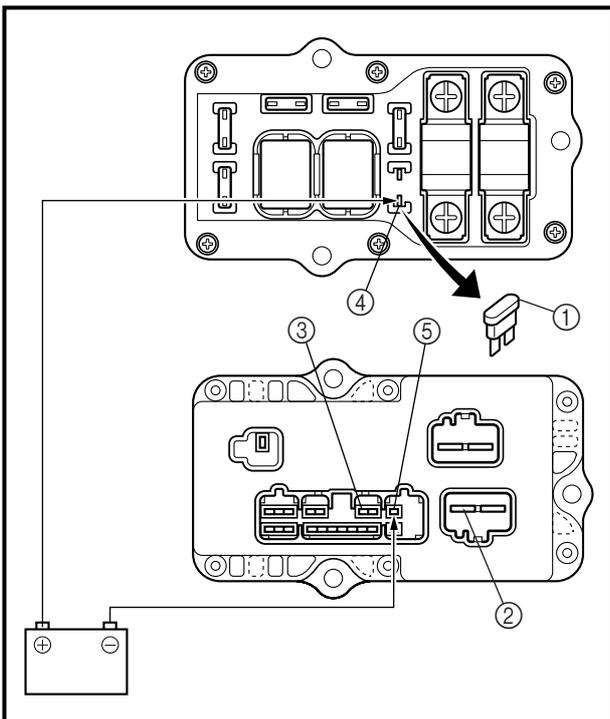
Check:

- Fuse continuity  
No continuity → Replace.
- Fuse rating  
Out of specification → Replace.



### Fuse rating

- ①: 12 V - 80 A
- ②: 12 V - 30 A
- ③: 12 V - 20 A



## CHECKING THE FUSE HOLDER

1. Check:

- Main relay continuity  
No continuity → Replace the fuse holder.

### Checking steps

- (1) Remove the fuse ①.
- (2) Connect the tester and battery as shown.

**Positive digital tester probe** →

**Fuse holder terminal ②**

**Negative digital tester probe** →

**Fuse holder terminal ③**

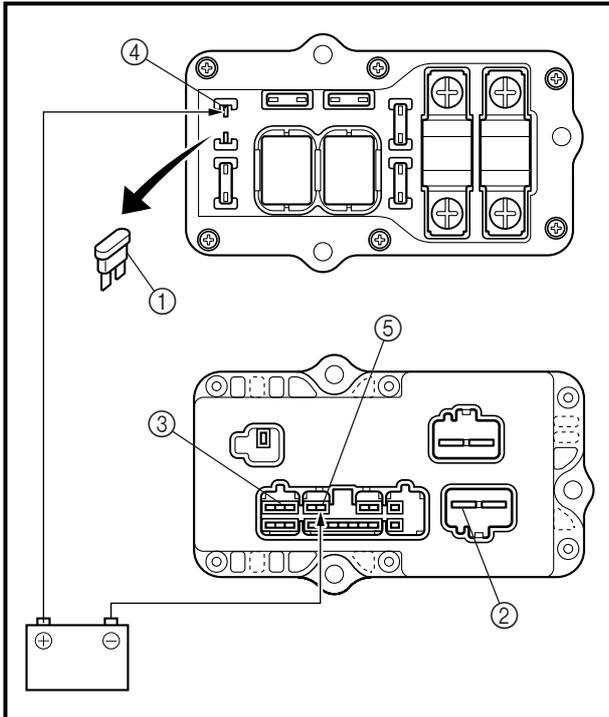
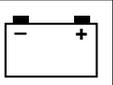
**Positive battery terminal** →

**Fuse holder terminal ④**

**Negative battery terminal** →

**Fuse holder terminal ⑤**

- (3) Check that there is continuity between the main relay terminals.



## 2. Check:

- Driver relay continuity  
No continuity → Replace the fuse holder.

**Checking steps**

- (1) Remove the fuse ①.
- (2) Connect the tester and battery as shown.

**Positive digital tester probe** →

**Fuse holder terminal** ②

**Negative digital tester probe** →

**Fuse holder terminal** ③

**Positive battery terminal** →

**Fuse holder terminal** ④

**Negative battery terminal** →

**Fuse holder terminal** ⑤

- (3) Check that there is continuity between the driver relay terminals.

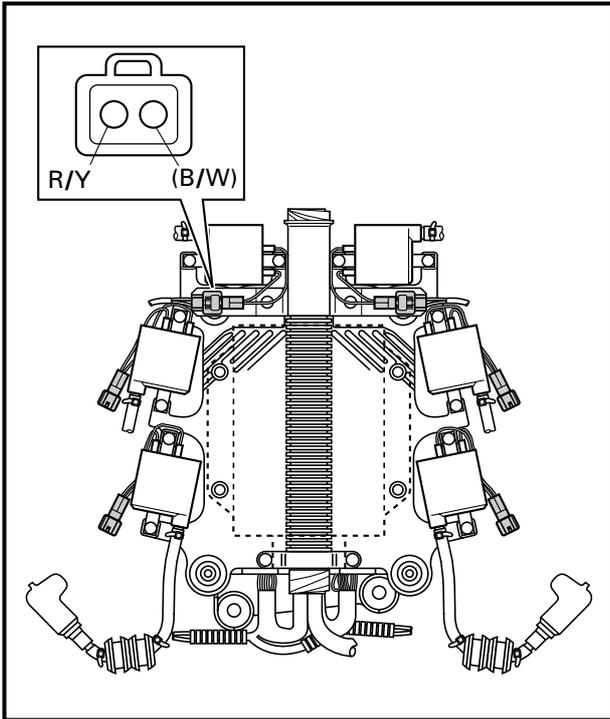
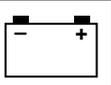
## MEASURING THE CONTROL UNIT OUTPUT PEAK VOLTAGE

### ⚠ WARNING

When checking the peak voltage do not touch any of the connections of the digital tester lead wires.

### NOTE:

- If there is no spark or the spark is weak, continue with the ignition system test.
- If a good spark is obtained, the problem is not with the ignition system, but possibly with the spark plug(s) or another component.



Measure:

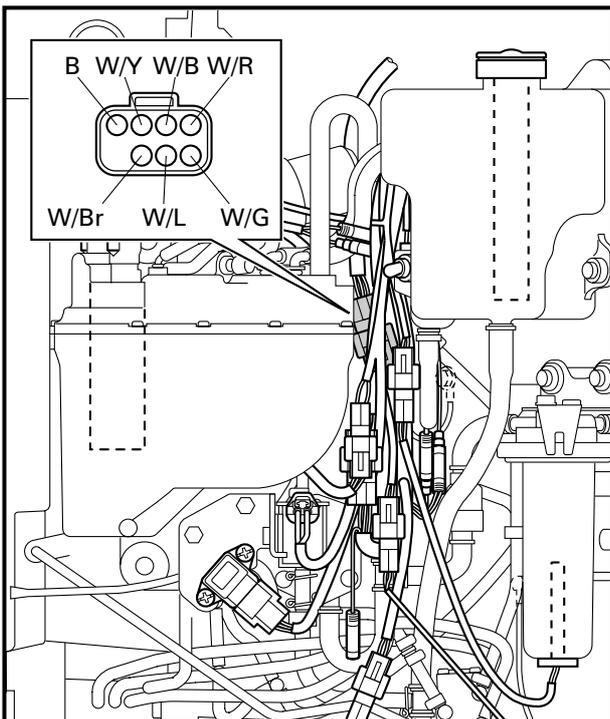
- Control unit output peak voltage  
Below specification → Replace the control unit.

	<b>Control unit output peak voltage</b>		
	Black/white (B/W) – Red/yellow (R/Y) Black/green (B/G) – Red/yellow (R/Y) Black/brown (B/Br) – Red/yellow (R/Y) Black/orange (B/O) – Red/yellow (R/Y) Black/yellow (B/Y) – Red/yellow (R/Y) Black/blue (B/L) – Red/yellow (R/Y)		
r/min	Circuit	Loaded	
	Cranking	1,500	3,500
V	—	140	220

	<b>Test harness (2-pin)</b> YB-06767 / 90890-06767
--	---

**NOTE:**

Before measuring the control unit output peak voltage, measure the pulser coil output peak voltage.



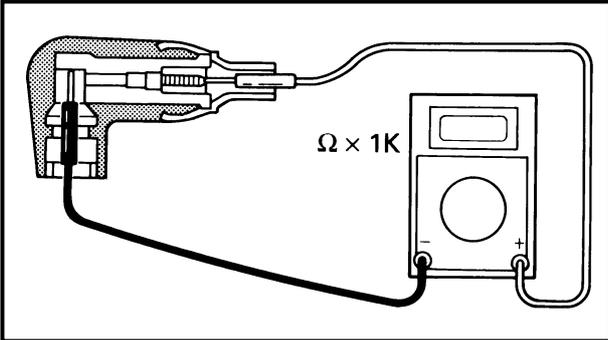
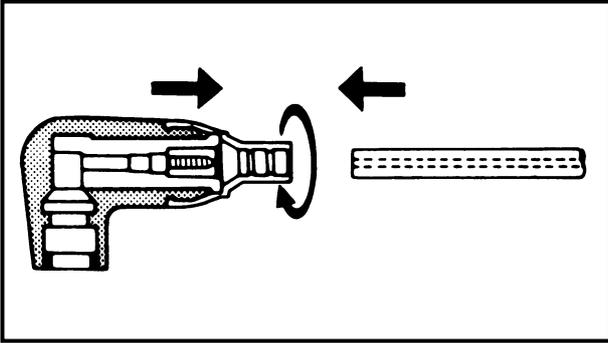
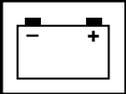
**MEASURING THE PULSER COIL OUTPUT PEAK VOLTAGE**

Measure:

- Pulser coil output peak voltage  
Below specification → Replace the pulser coil.

	<b>Pulser coil output peak voltage</b>		
	White/red (W/R) – Black (B) White/black (W/B) – Black (B) White/yellow (W/Y) – Black (B) White/green (W/G) – Black (B) White/blue (W/L) – Black (B) White/brown (W/Br) – Black (B)		
r/min	Circuit	Loaded	
	Cranking	1,500	3,500
V	5.0	5.0	35

	<b>Test harness (8-pin)</b> YB-06779 / 90890-06779
--	---



## CHECKING THE SPARK PLUG CAPS

### 1. Check:

- Spark plug cap  
Loose connection → Tighten.  
Cracks/damage → Replace.

### Replacement steps

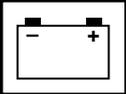
- (1) To remove the spark plug cap turn it counterclockwise.
- (2) To install the spark plug cap turn it clockwise until it is tight.

### 2. Measure:

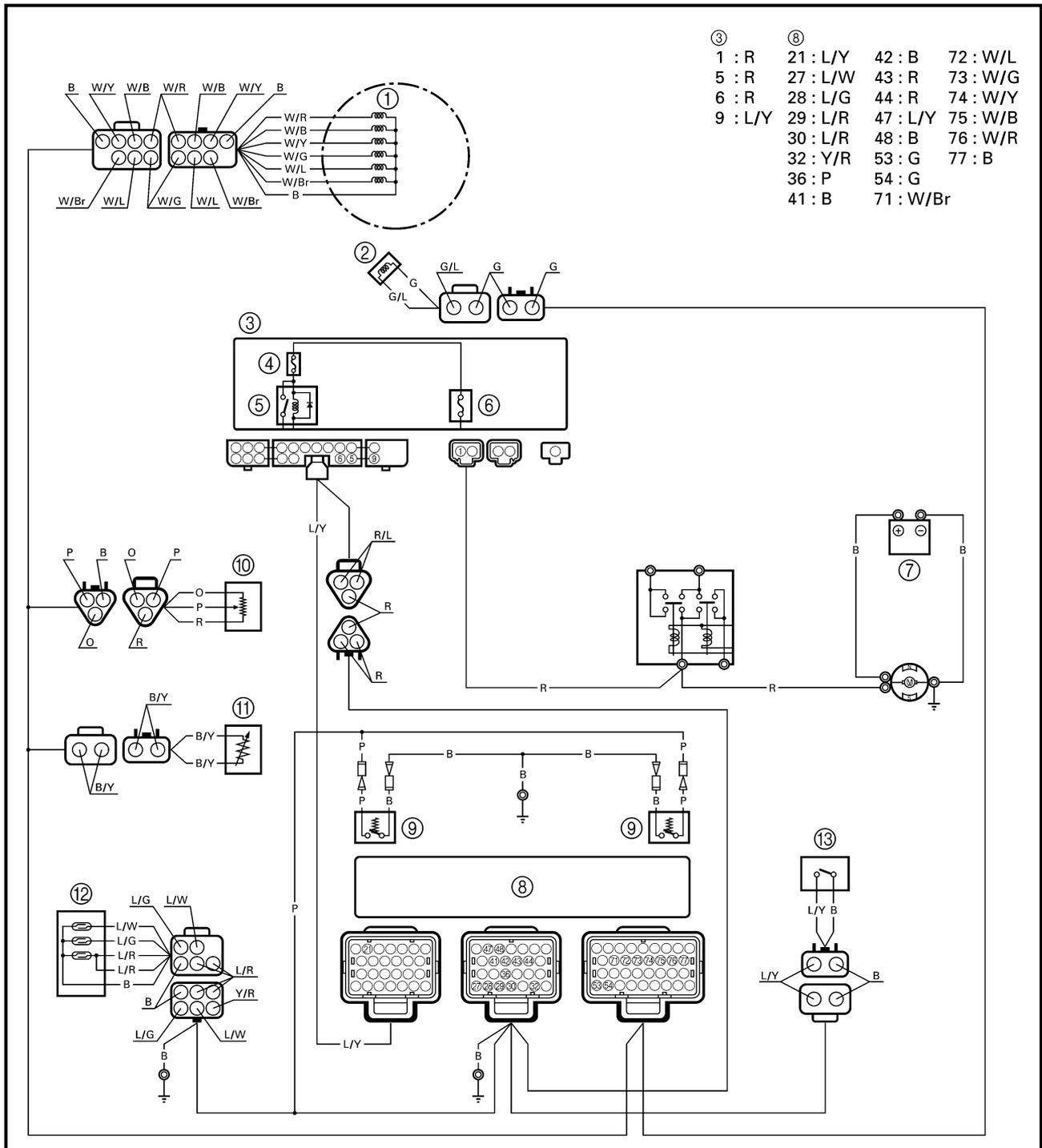
- Spark plug cap resistance  
Out of specification → Replace.



**Spark plug cap resistance**  
**4.0 - 6.0 kΩ**

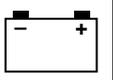


**IGNITION CONTROL SYSTEM**



③	⑧		
1 : R	21 : L/Y	42 : B	72 : W/L
5 : R	27 : L/W	43 : R	73 : W/G
6 : R	28 : L/G	44 : R	74 : W/Y
9 : L/Y	29 : L/R	47 : L/Y	75 : W/B
	30 : L/R	48 : B	76 : W/R
	32 : Y/R	53 : G	77 : B
	36 : P	54 : G	
	41 : B	71 : W/Br	

- |                         |   |                    |                    |
|-------------------------|---|--------------------|--------------------|
| ① Pulser coil           | ⑩ Throttle position sensor                | B : Black          | R/L : Red/blue     |
| ② Crank position sensor | ⑪ Engine cooling water temperature sensor | O : Orange         | W/B : White/black  |
| ③ Fuse holder           | ⑫ Oil level sensor                        | P : Pink           | W/Br : White/brown |
| ④ Fuse (20A)            | ⑬ Shift position switch                   | R : Red            | W/G : White/green  |
| ⑤ Main relay            |   | B/Y : Black/yellow | W/L : White/blue   |
| ⑥ Fuse (80A)            |   | G/L : Green/blue   | W/R : White/red    |
| ⑦ Battery               |   | L/G : Blue/green   | W/Y : White/yellow |
| ⑧ Control unit          |   | L/R : Blue/red     | Y/R : Yellow/red   |
| ⑨ Thermo switches       |   | L/W : Blue/white   |                    |
|                         |   | L/Y : Blue/yellow  |                    |



**CHECKING THE BATTERY**

Refer to “CHECKING THE BATTERY” on page 3-19.

**CHECKING THE FUSES**

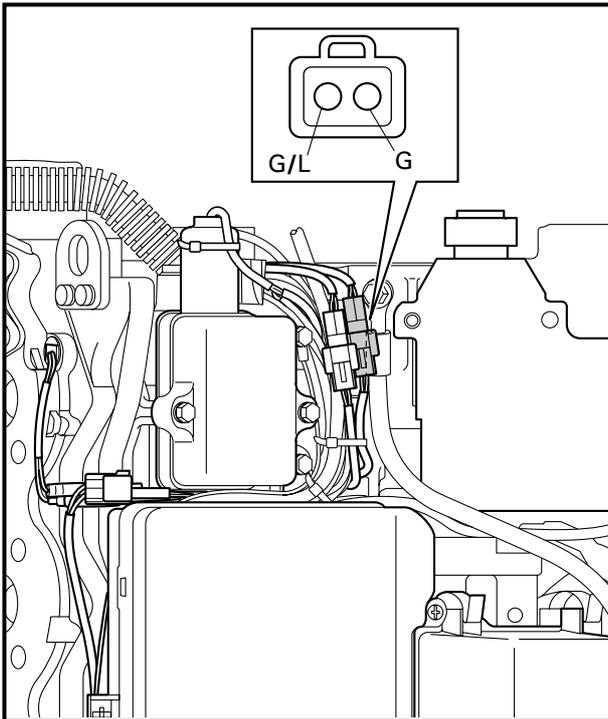
Refer to “CHECKING THE FUSES” on page 8-13.

**CHECKING THE FUSE HOLDER**

Refer to “CHECKING THE FUSE HOLDER” on page 8-13.

**MEASURING THE PULSER COIL OUTPUT PEAK VOLTAGE**

Refer to “MEASURING THE PULSER COIL OUTPUT PEAK VOLTAGE” on page 8-15.



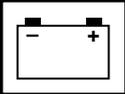
**MEASURING THE CRANK POSITION SENSOR OUTPUT PEAK VOLTAGE**

Measure:

- Crank position sensor output peak voltage

Below specification → Replace.

	<b>Crank position sensor output peak voltage</b> Green (G) – Green/blue (G/L)			
	<b>r/min</b>	<b>Circuit</b>	<b>Loaded</b>	
		<b>Cranking</b>	<b>1,500</b>	<b>3,500</b>
<b>V</b>	<b>4.5</b>	<b>4.0</b>	<b>13</b>	<b>20</b>
	<b>Test harness (2-pin)</b> YB-06767 / 90890-06767			

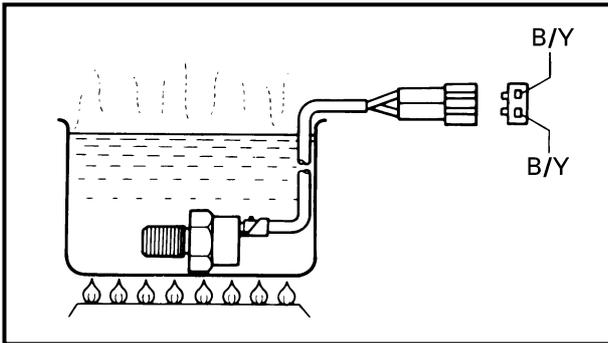


### MEASURING THE ENGINE COOLING WATER TEMPERATURE SENSOR RESISTANCE

Measure:

- Engine cooling water temperature sensor resistance

Out of specification → Replace.



#### Engine cooling water temperature sensor resistance

Black/yellow (B/Y) –  
Black/yellow (B/Y)

5 °C (41 °F): 128 kΩ

20 °C (68 °F): 54 - 69 kΩ

100 °C (212 °F): 3.02 - 3.48 kΩ

#### Measuring steps

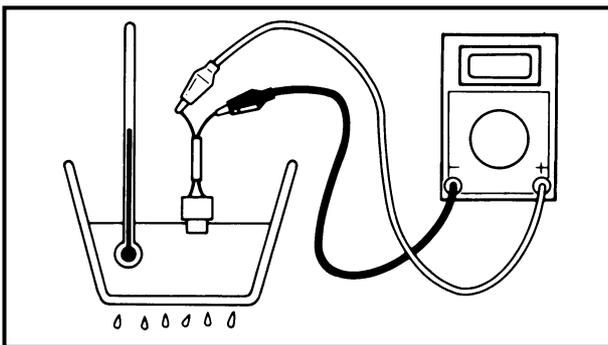
- (1) Place the engine cooling water temperature sensor in a container filled with water.
- (2) Place a thermometer in the water.
- (3) Slowly heat the water.
- (4) Measure the resistance when the specified temperature is reached.

### CHECKING THE THERMO SWITCH CONTINUITY

Check:

- Thermo switch continuity

Out of specification → Replace.



#### Thermo switch continuity temperature

Pink (P) – Black (B)

Ⓐ 84 - 90 °C (183 - 194 °F)

Ⓑ 60 - 74 °C (140 - 165 °F)

① No continuity

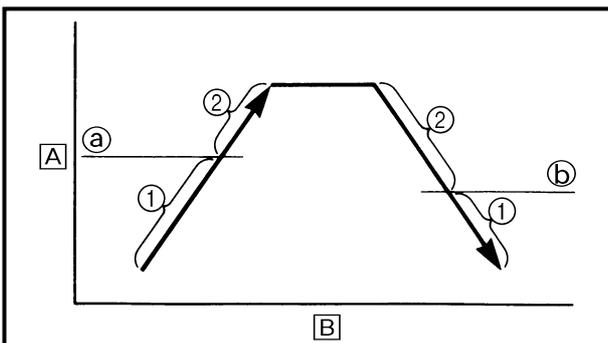
Ⓐ Temperature

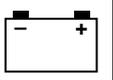
② Continuity

Ⓑ Time

#### Measuring steps

- (1) Place the thermo switch in a container filled with water.
- (2) Place a thermometer in the water.
- (3) Slowly heat the water.
- (4) Measure the continuity when the specified temperature is reached.





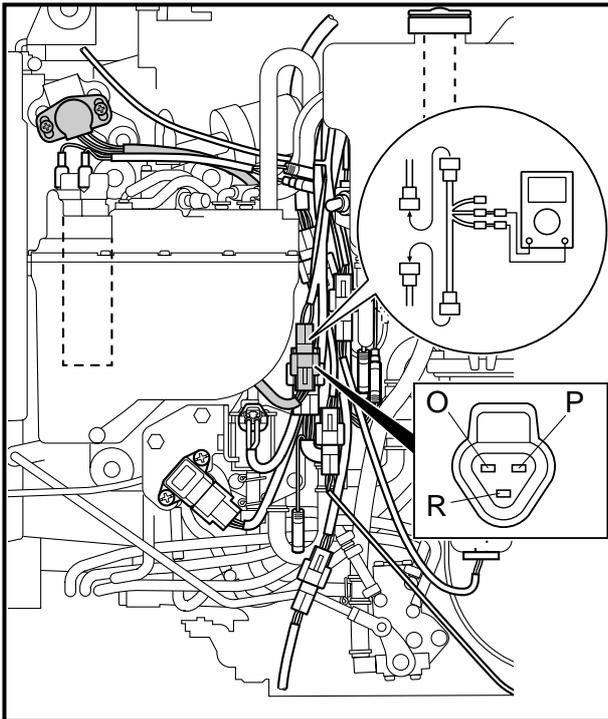
## CHECKING THE OIL LEVEL SENSOR CONTINUITY

Refer to "CHECKING THE OIL LEVEL SENSOR/SWITCH CONTINUITY" on page 8-45.

## MEASURING THE THROTTLE POSITION SENSOR OUTPUT VOLTAGE

Measure:

- Throttle position sensor output voltage
- Out of specification → Check the control unit.



**Throttle position sensor output voltage**  
Orange (O) – Pink (P)  
0.48 - 5.25 V

### Measuring steps

- (1) Connect the test harness (3-pin) as shown.

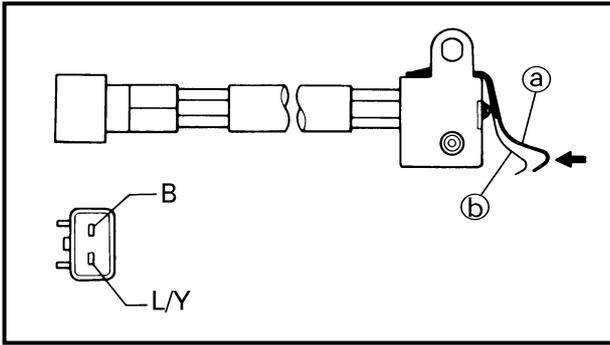
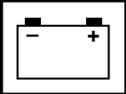


**Test harness (3-pin)**  
YB-06443 / 90890-06757

- (2) Connect the battery leads to a 12-V battery.
- (3) Turn the engine switch to the on position.
- (4) Measure the throttle position sensor output voltage.

### NOTE:

Make sure the throttle position sensor output voltage is within specification when the throttle is fully closed and fully opened.



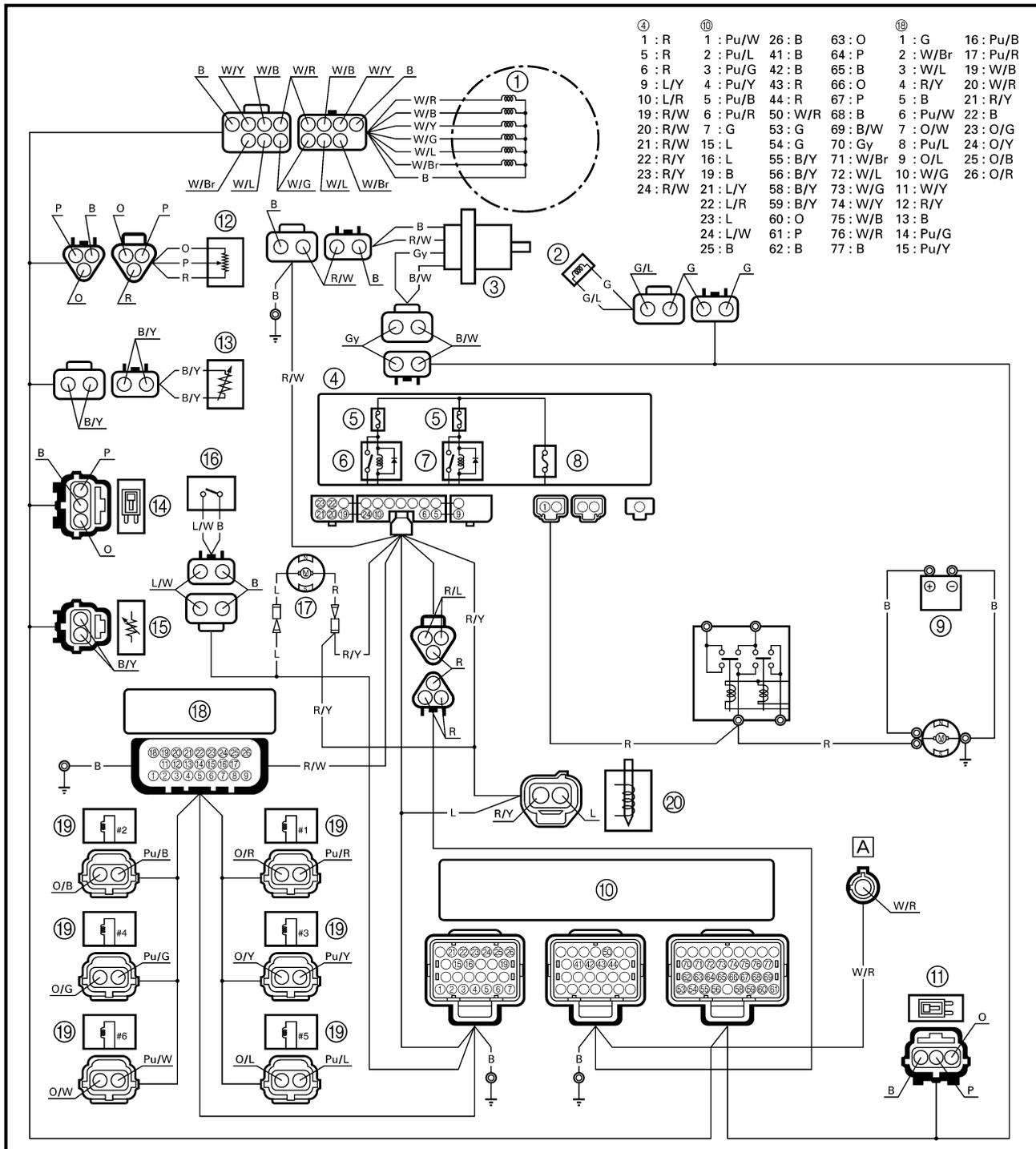
**CHECKING THE SHIFT POSITION SWITCH**

1. Check:
- Shift position switch continuity
- Out of specification → Replace.

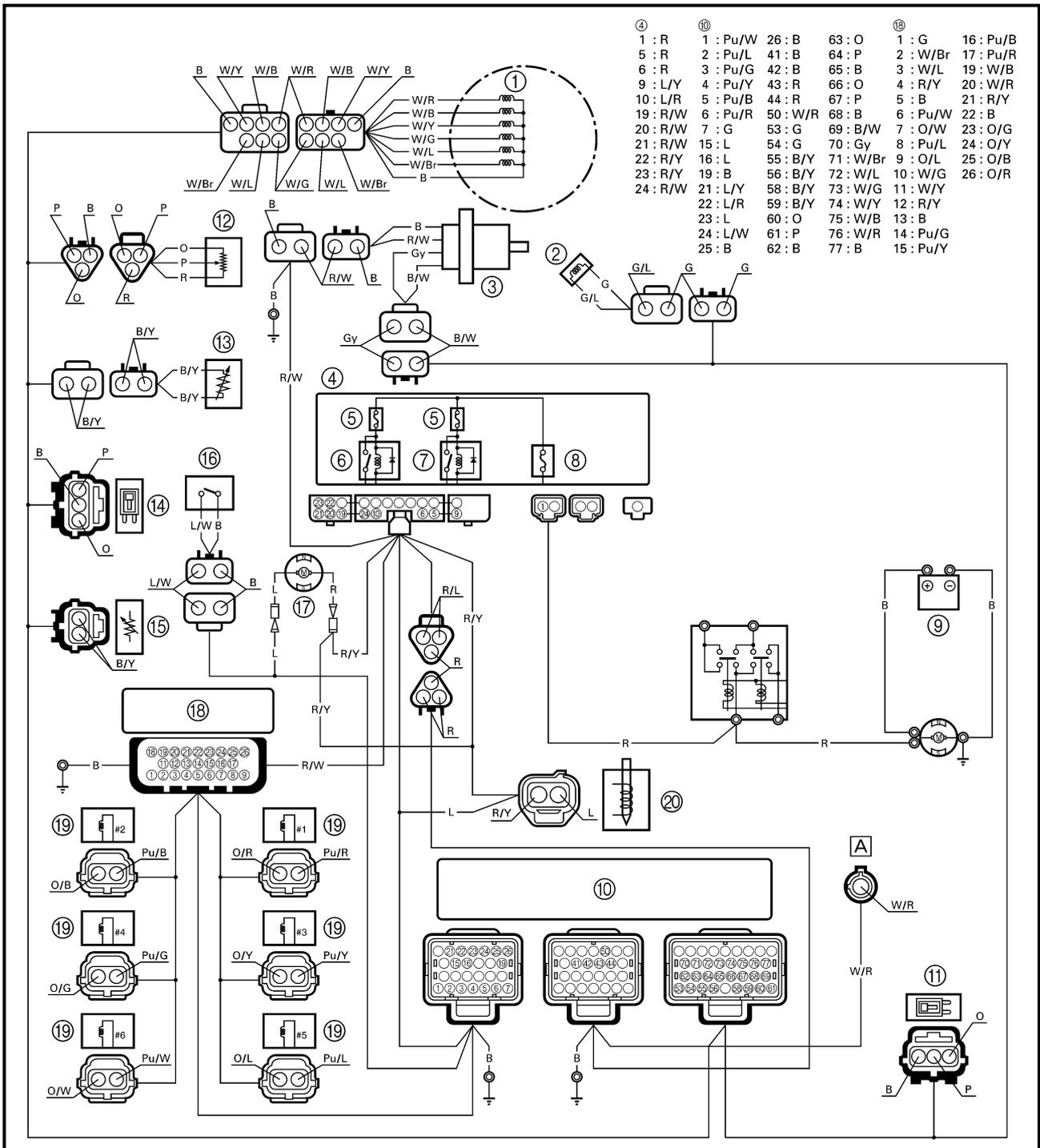
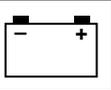
 <b>Switch position</b>	<b>Lead color</b>
<b>Home (a)</b>	<b>No continuity</b>
<b>On (b)</b>	<b>Continuity</b>

2. Check:
- Shift position switch
- Does not return to the home position  
→ Replace

**FUEL CONTROL SYSTEM**

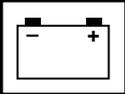


- ① Pulser coil
  - ② Crank position sensor
  - ③ Oxygen density sensor
  - ④ Fuse holder
  - ⑤ Fuse (20A)
  - ⑥ Main relay
  - ⑦ Driver relay
  - ⑧ Fuse (80A)
  - ⑨ Battery
  - ⑩ Control unit
  - ⑪ Fuel pressure
  - ⑫ Throttle position sensor
  - ⑬ Engine cooling water temperature sensor
  - ⑭ Atmospheric pressure sensor
  - ⑮ Intake air temperature sensor
  - ⑯ Water detection switch
  - ⑰ Electric fuel pump
  - ⑱ Injector driver
  - ⑲ Fuel injectors
  - ⑳ Electric oil pump
- Ⓐ To water detection meter



④ 1 : R	⑩ 1 : Pu/W	26 : B	63 : O	⑮ 1 : G	16 : Pu/B
5 : R	2 : Pu/L	41 : B	64 : P	2 : W/Br	17 : Pu/R
6 : R	3 : Pu/G	42 : B	65 : B	3 : W/L	19 : W/B
9 : L/Y	4 : Pu/Y	43 : R	66 : O	4 : R/Y	20 : W/R
10 : L/R	5 : Pu/B	44 : R	67 : P	5 : B	21 : R/Y
19 : R/W	6 : Pu/R	50 : W/R	68 : B	6 : Pu/W	22 : B
20 : R/W	7 : G	53 : G	69 : B/W	7 : O/W	23 : O/G
21 : R/W	15 : L	54 : G	70 : Gy	8 : Pu/L	24 : O/Y
22 : R/Y	16 : L	55 : B/Y	71 : W/Br	9 : O/L	25 : O/B
23 : R/Y	19 : B	56 : B/Y	72 : W/L	10 : W/G	26 : O/R
24 : R/W	21 : L/Y	58 : B/Y	73 : W/G	11 : W/Y	
	22 : L/R	59 : B/Y	74 : W/Y	12 : R/Y	
	23 : L	60 : O	75 : W/B	13 : B	
	24 : L/W	61 : P	76 : W/R	14 : Pu/G	
	25 : B	62 : B	77 : B	15 : Pu/Y	

- |                    |                     |                      |                    |
|--------------------|---------------------|----------------------|--------------------|
| B : Black          | L/R : Blue/red      | Pu/B : Purple/black  | W/B : White/black  |
| Gy : Gray          | L/W : Blue/white    | Pu/G : Purple/green  | W/Br : White/brown |
| L : Blue           | L/Y : Blue/yellow   | Pu/L : Purple/blue   | W/G : White/green  |
| O : Orange         | O/B : Orange/black  | Pu/R : Purple/red    | W/L : White/blue   |
| P : Pink           | O/G : Orange/green  | Pu/W : Purple/white  | W/R : White/red    |
| R : Red            | O/L : Orange/blue   | Pu/Y : Purple/yellow | W/Y : White/yellow |
| B/W : Black/white  | O/R : Orange/red    | R/L : Red/blue       |                    |
| B/Y : Black/yellow | O/W : Orange/white  | R/W : Red/white      |                    |
| G/L : Green/blue   | O/Y : Orange/yellow | R/Y : Red/yellow     |                    |

**CHECKING THE BATTERY**

Refer to "CHECKING THE BATTERY" on page 3-19.

**CHECKING THE FUSES**

Refer to "CHECKING THE FUSES" on page 8-13.

**CHECKING THE FUSE HOLDER**

Refer to "CHECKING THE FUSE HOLDER" on page 8-13.

**MEASURING THE PULSER COIL OUTPUT PEAK VOLTAGE**

Refer to "MEASURING THE PULSER COIL OUTPUT PEAK VOLTAGE" on page 8-15.

**MEASURING THE CRANK POSITION SENSOR OUTPUT PEAK VOLTAGE**

Measure:

- Crank position sensor output peak voltage

Below specification → Replace.

**MEASURING THE THROTTLE POSITION SENSOR OUTPUT VOLTAGE**

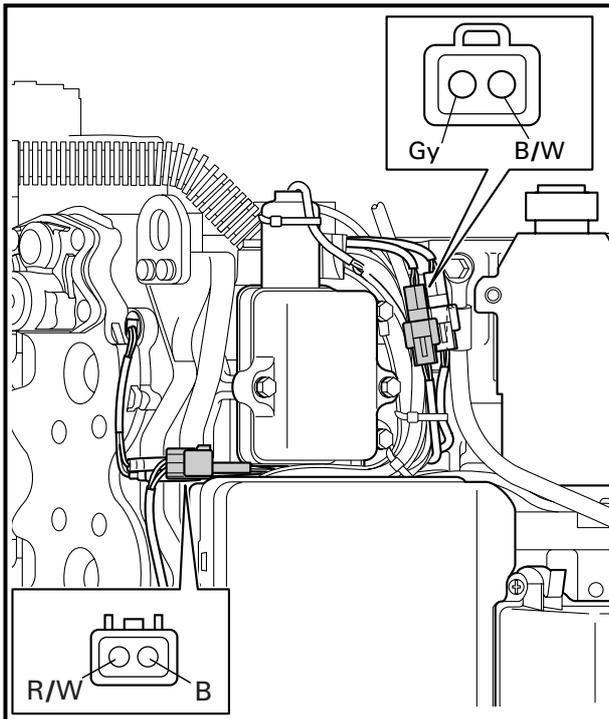
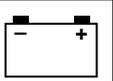
Refer to "MEASURING THE THROTTLE POSITION SENSOR OUTPUT VOLTAGE" on page 8-20.

**MEASURING THE ENGINE COOLING WATER TEMPERATURE SENSOR RESISTANCE**

Refer to "MEASURING THE ENGINE COOLING WATER TEMPERATURE SENSOR RESISTANCE" on page 8-19.

**CHECKING THE ELECTRICAL OIL PUMP**

Refer to "CHECKING THE ELECTRIC OIL PUMP" on page 3-14.



## CHECKING THE OXYGEN DENSITY SENSOR

### 1. Measure:

- Oxygen density sensor heater resistance

Out of specification → Replace.



### Oxygen density sensor heater resistance

Red/white (R/W) – Black (B)

2 - 100 Ω

### 2. Measure:

- Oxygen density sensor output voltage

Out of specification → Replace.



### Oxygen density sensor output voltage

Gray (Gy) – Black/white (B/W)

0.0 - 1.0 V

## Measuring steps

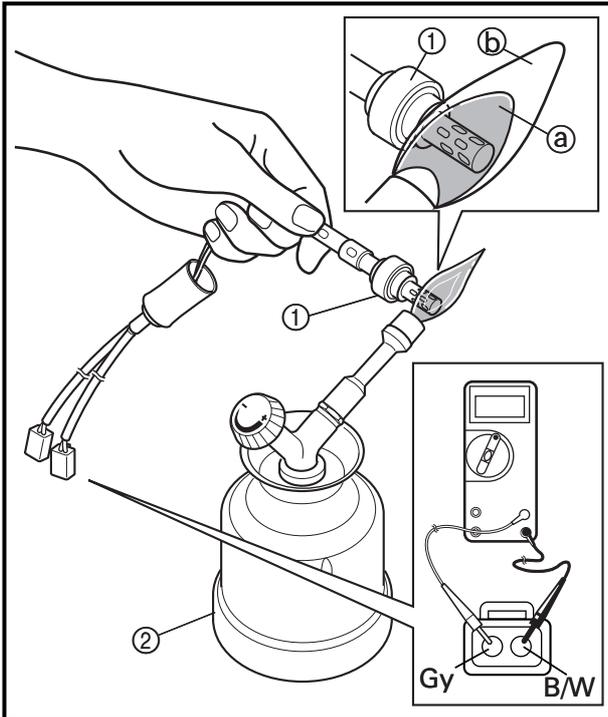
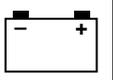
### ⚠ WARNING

To prevent an explosion when performing this procedure, keep all flammable products (e.g., gasoline) away from the testing area and make sure there is proper ventilation.

### CAUTION:

Do not let any silicon anticorrosion solvent touch the oxygen density sensor or its accuracy will be affected.

- (1) Remove the oxygen density sensor. Refer to "OXYGEN DENSITY SENSOR" on page 5-29.



(2) Remove any oil from the oxygen density sensor with acetone or a similar solvent and allow the sensor to thoroughly dry.

(3) Heat the front end of the oxygen density sensor ① with a gas torch ② (in the center of its blue flame ③) for 10 - 15 seconds. Then, remove the oxygen density sensor from the flame and check the voltage change and time.

#### CAUTION:

- Do not heat the oxygen density sensor above 800 °C (1,472 °F) or continuously for more than 1 minute at a time or the sensor will be damaged.
- Do not use a burner with an oxygen tank. The sensor may be damaged by a flame of high temperature.

- ③ Inner cone
- ③ Outer cone

#### NOTE:

If the instantaneous change in the output voltage is 0.6 V or greater the oxygen density sensor is OK.

## CHECKING THE ATMOSPHERIC PRESSURE SENSOR

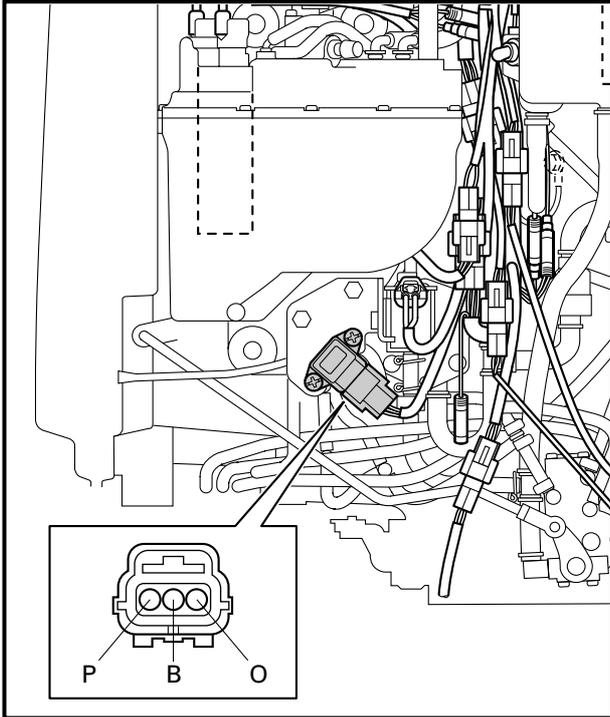
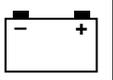
Measure:

- Atmospheric pressure sensor output voltage

Out of specification → Replace.



**Atmospheric pressure sensor output voltage**  
**Pink (P) – Black (B)**  
**3.2 - 4.6 V**

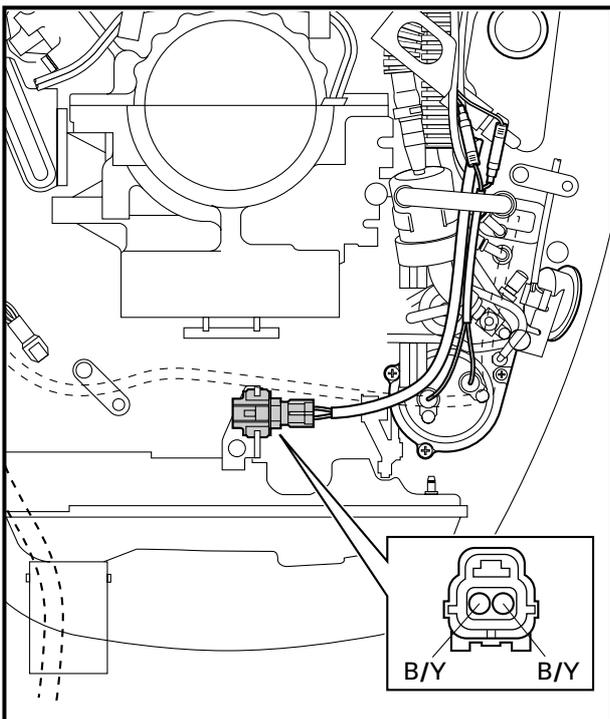
**Measuring steps**

- (1) Connect the test harness between the atmospheric pressure sensor and the wire harness as shown.



**Test harness (3-pin)**  
**YB-06769 / 90890-06769**

- (2) Turn the engine start switch to the on position.
- (3) Measure the atmospheric pressure sensor output voltage.

**CHECKING THE INTAKE AIR TEMPERATURE SENSOR**

Measure:

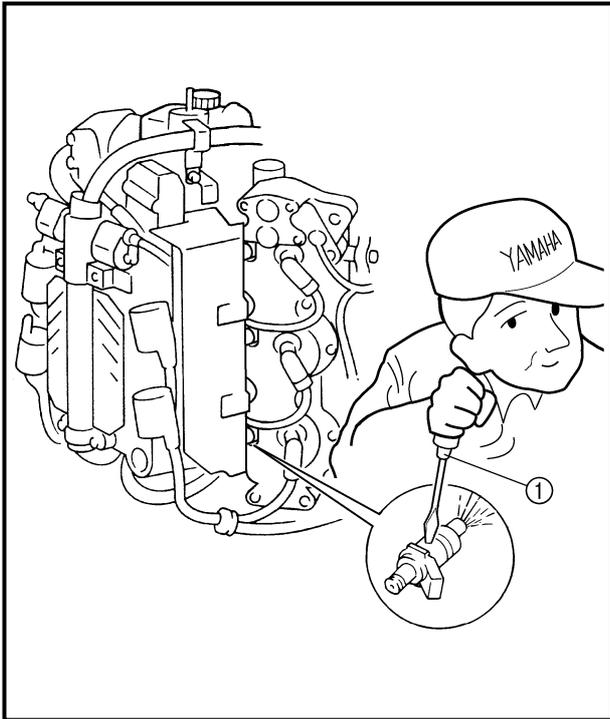
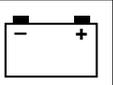
- Intake air temperature sensor resistance

Out of specification → Replace.



**Intake air temperature sensor resistance**

**Black/yellow (B/Y) –**  
**Black/yellow (B/Y)**  
**1.5 - 4.0 k $\Omega$**



## CHECKING THE FUEL INJECTORS

### 1. Check:

- Fuel injector operating sound  
No sound (no fuel is being sprayed) →  
Check the electric fuel pump.

### Checking steps

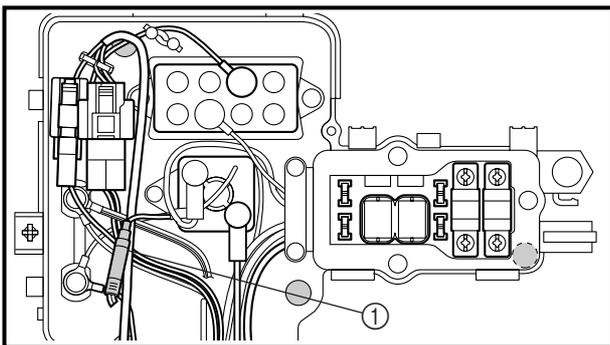
- (1) Start the engine.
- (2) Fully close the throttle valves.
- (3) Attach the screwdriver ① onto the fuel injector body and check if all of the fuel injectors have a solenoid valve operating sound.

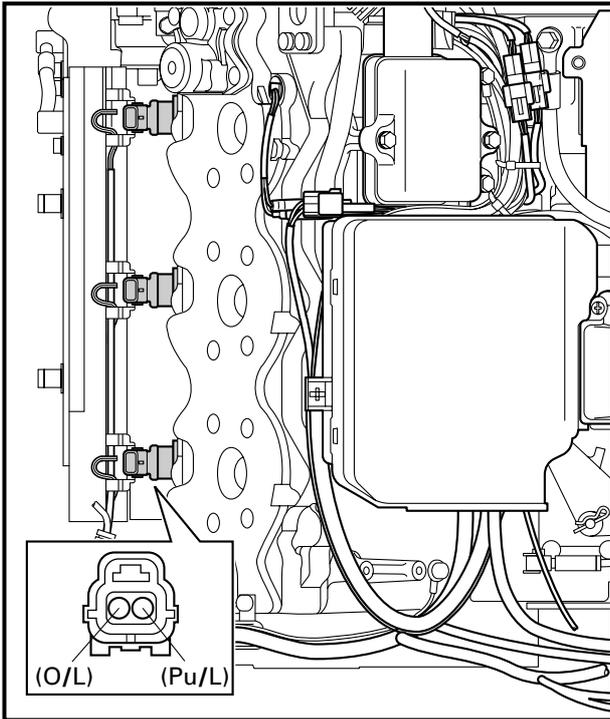
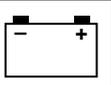
### 2. Check:

- Electric fuel pump operating sound  
Correct → Replace the fuel injector (no sound).  
No sound → Measure the injector driver output peak voltage.

### NOTE:

- The electric fuel pump should sound when the engine start switch is turned on.
- Disconnect the Brown (Br) starter relay terminal ① to prevent the engine from starting.





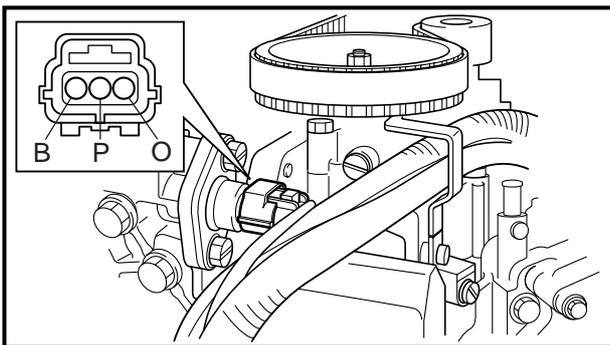
**3. Measure:**

- Injector driver output peak voltage  
Correct → Replace the electric fuel pump.  
Out of specification → Replace the injector driver.

**Injector driver output peak voltage**

Orange/red (O/R) – Purple/red (Pu/R)  
 Orange/black (O/B) – Purple/black (Pu/B)  
 Orange/yellow (O/Y) – Purple/yellow (Pu/Y)  
 Orange/green (O/G) – Purple/green (Pu/G)  
 Orange/blue (O/L) – Purple/blue (Pu/L)  
 Orange/white (O/W) – Purple/white (Pu/W)

r/min	Circuit		Loaded	
	Cranking		1,500	3,500
<b>V</b>	65	60	65	65



**CHECKING THE FUEL PRESSURE SENSOR**

**Measure:**

- Fuel pressure sensor output voltage  
Out of specification → Replace.

**Fuel pressure sensor output voltage**

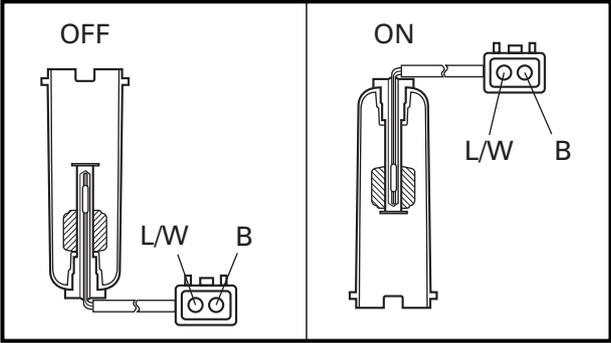
Pink (P) – Black (B)  
 2.8 – 3.2 V

**Measuring steps**

- (1) Connect the test harness (3-pin) as shown.

**Test harness (3-pin)**  
 YB-06769 / 90890-06769

- (2) Start the engine.
- (3) Measure the fuel pressure sensor output voltage.

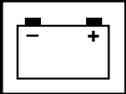


**CHECKING THE WATER DETECTION SWITCH**

- Check:
- Water detection switch continuity
- Out of specification → Replace.

 Float position	Lead color	
	Blue/white (L/W)	Black (B)
<b>ON</b>	○ — ○	○ — ○
<b>OFF</b>		





### CHECKING THE BATTERY

Refer to "CHECKING THE BATTERY" on page 3-19.

### CHECKING THE FUSES

Refer to "CHECKING THE FUSES" on page 8-13.

### CHECKING THE FUSE HOLDER

Refer to "CHECKING THE FUSE HOLDER" on page 8-13.

### CHECKING THE WIRE HARNESS CONTINUITY

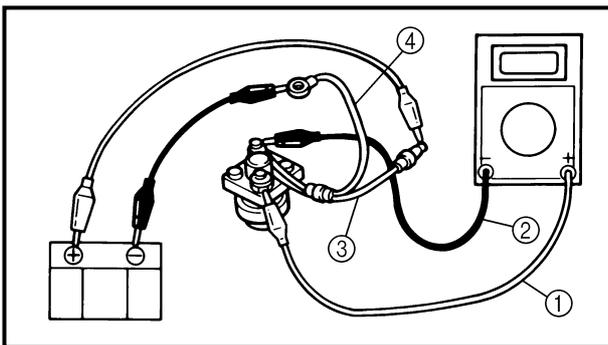
Check:

- Wire harness continuity  
No continuity → Replace.

### CHECKING THE WIRE CONNECTIONS

Check:

- Wire connections  
Poor connection → Properly connect.



### CHECKING THE STARTER RELAY

Check:

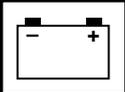
- Starter relay continuity  
No continuity → Replace.

#### Checking steps

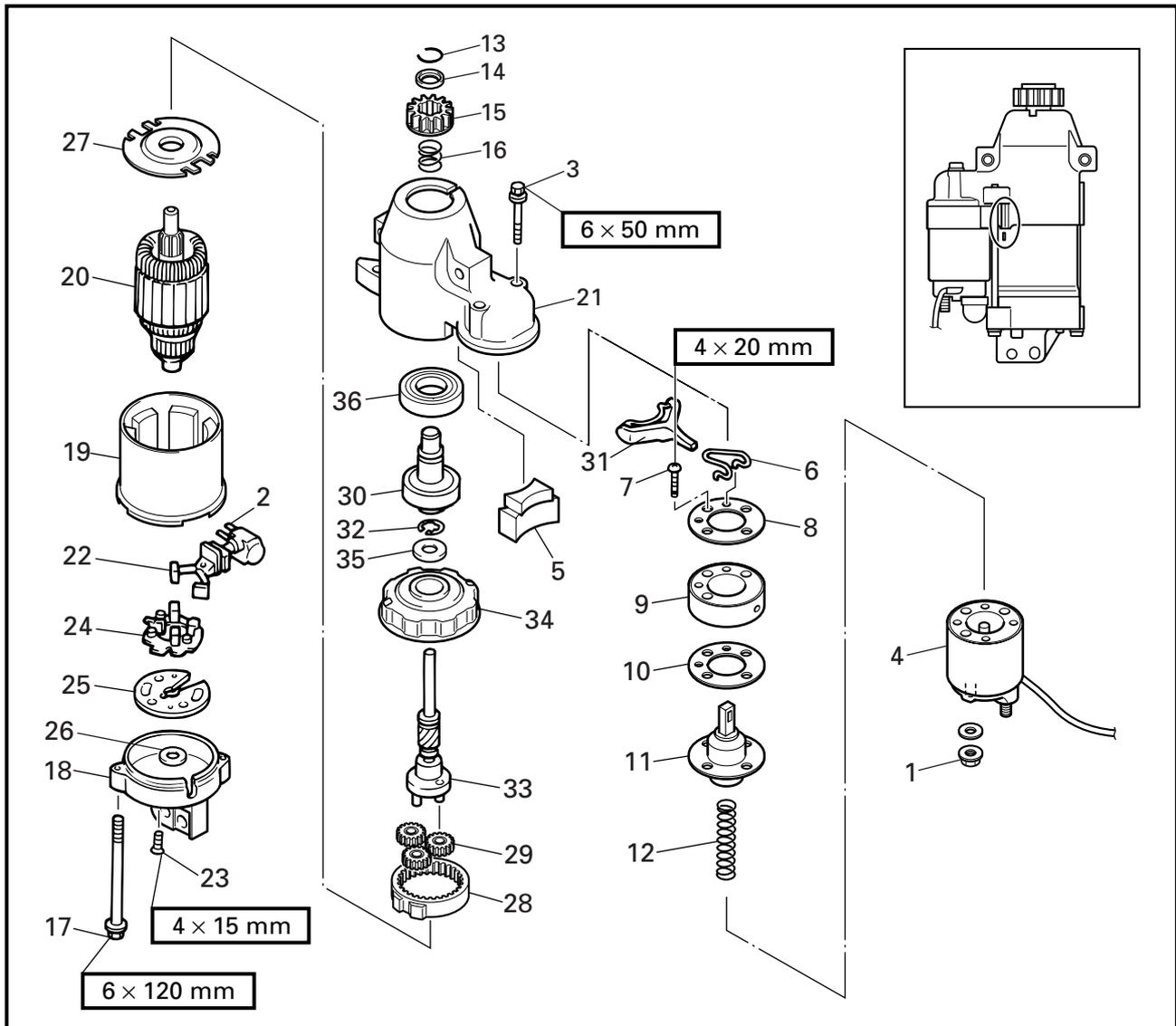
- (1) Connect the tester and battery between the starter relay terminals.

**Positive digital tester probe ① → Starter relay terminal**  
**Negative digital tester probe ② → Starter relay terminal**  
**Positive battery terminal → Brown lead ③**  
**Negative battery terminal → Black lead ④**

- (2) Check that there is continuity between the starter relay terminals.

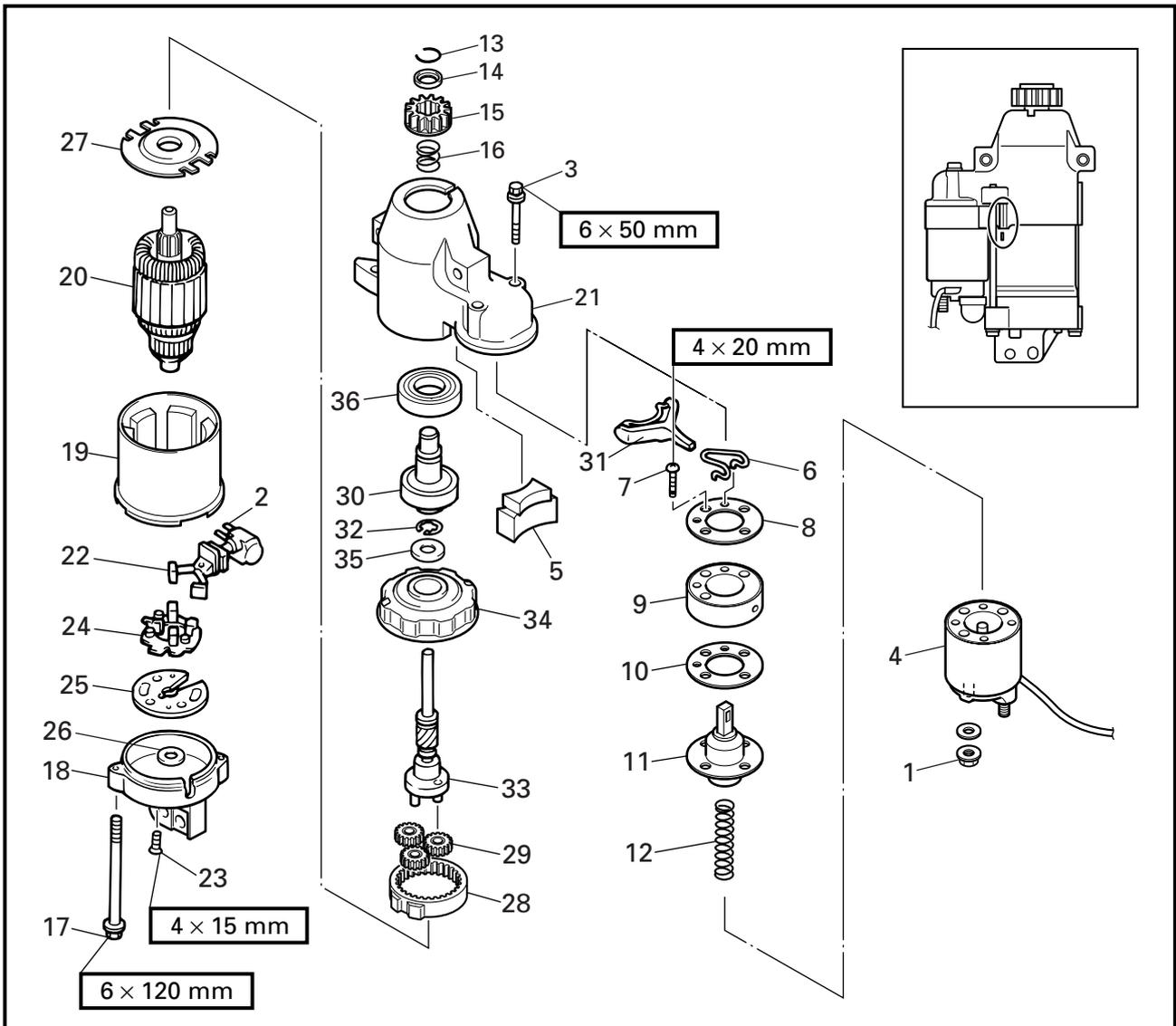
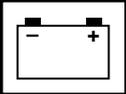


**STARTER MOTOR**  
**DISASSEMBLING/ASSEMBLING THE STARTER MOTOR**



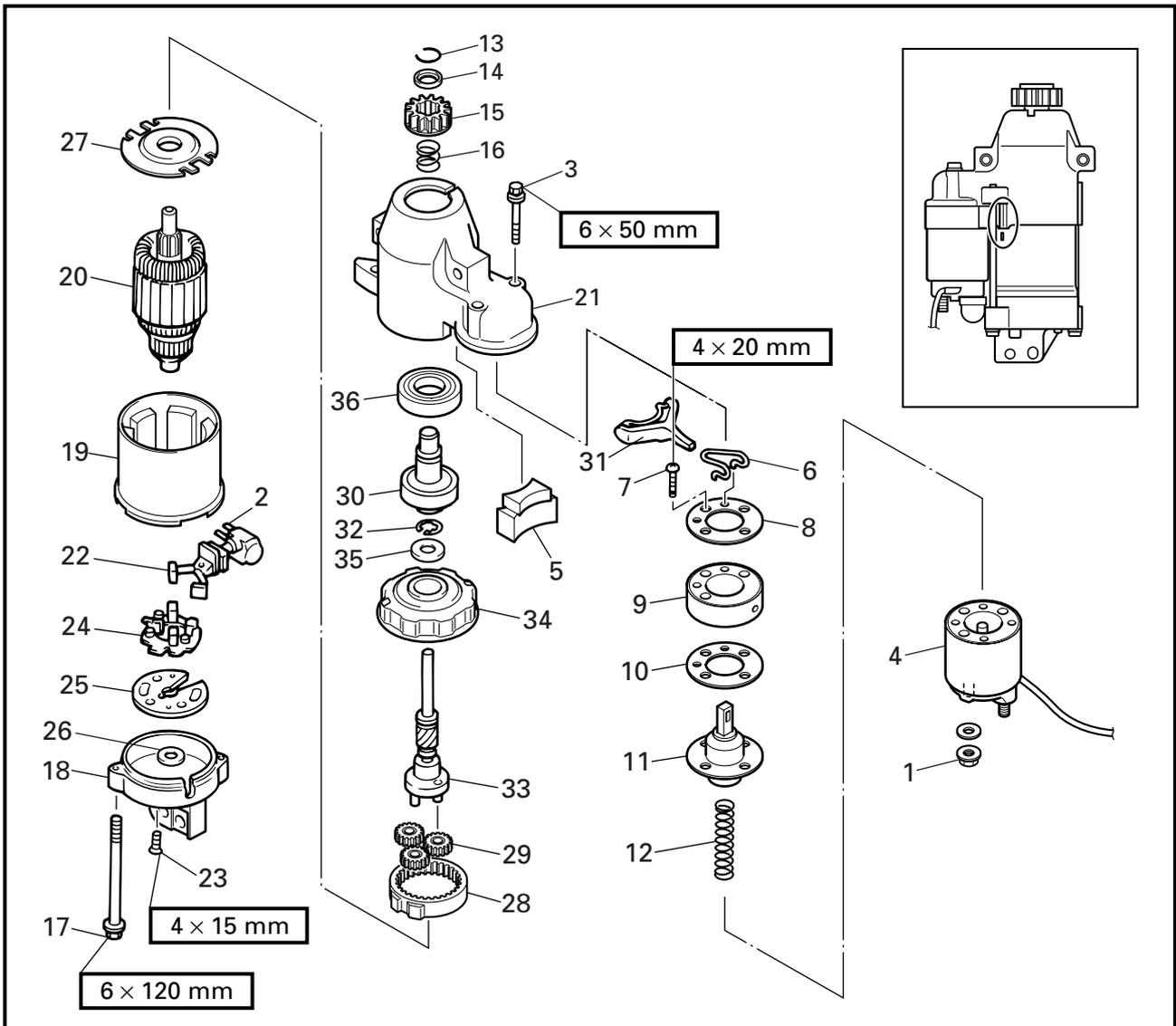
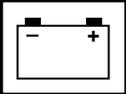
Order	Job/Part	Q'ty	Remarks
	Starter motor		Refer to "STARTER MOTOR" on page 5-28.
1	Nut	1	
2	Brush terminal	1	
3	Bolt	2	
4	Magnetic switch relay	1	
5	Dust cover	1	
6	Spring	1	
7	Screw	1	
8	Dust seal	1	
9	Dust seal cover	1	

Continued on next page.



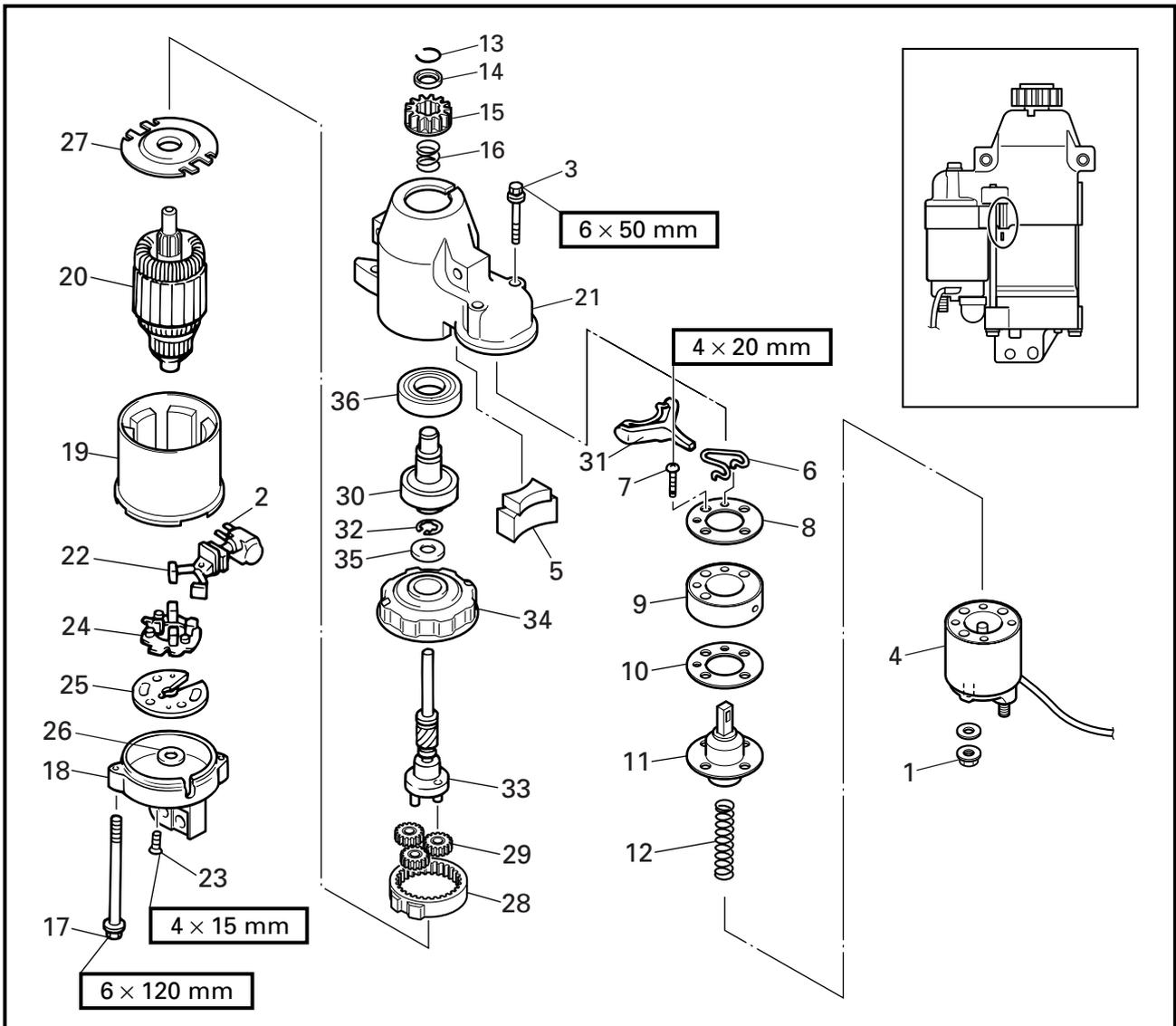
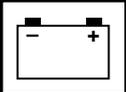
Order	Job/Part	Q'ty	Remarks
10	Dust seal	1	
11	Diaphragm	1	
12	Spring	1	
13	Clip	1	
14	Starter motor pinion stopper	1	
15	Starter motor pinion	1	
16	Spring	1	
17	Bolt	2	
18	Lower bracket	1	

Continued on next page.

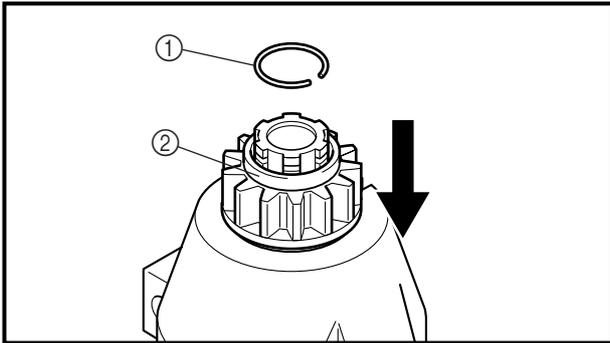
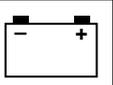


Order	Job/Part	Q'ty	Remarks
19	Stator	1	
20	Armature	1	
21	Starter motor bracket	1	
22	Brush assembly	1	
23	Screw	2	
24	Brush holder assembly	1	
25	Thrust plate	1	
26	Thrust washer	1	
27	Planetary gear seat cover	1	

Continued on next page.



Order	Job/Part	Q'ty	Remarks
28	Outer ring gear	1	
29	Planetary gear	3	
30	Starter motor clutch	1	
31	Shift lever assembly	1	
32	Circlip	1	
33	Starter motor pinion shaft	1	
34	Planetary gear seat	1	
35	Thrust washer	1	
36	Shield bearing	1	
			For assembly, reverse the disassembly procedure.



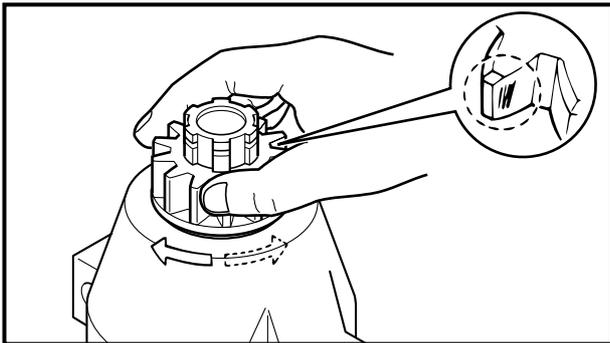
## REMOVING THE STARTER MOTOR PINION

Remove:

- Clip ①

### NOTE:

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



## CHECKING THE STARTER MOTOR PINION

1. Check:

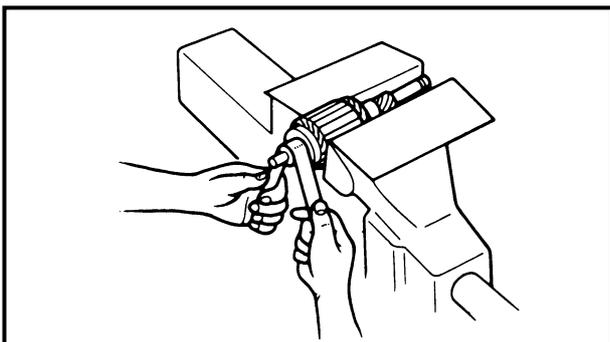
- Starter motor pinion teeth  
Damage/wear → Replace.

2. Check:

- Starter motor pinion movement  
Incorrect → Replace.

### NOTE:

Rotate the starter motor pinion clockwise and make sure it moves smoothly. Also, rotate the starter motor pinion counter-clockwise and make sure it locks.



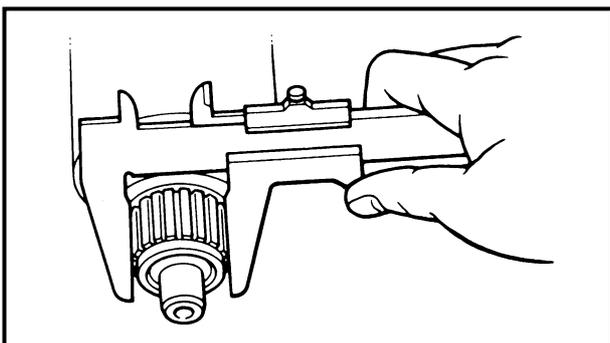
## CHECKING THE ARMATURE

1. Check:

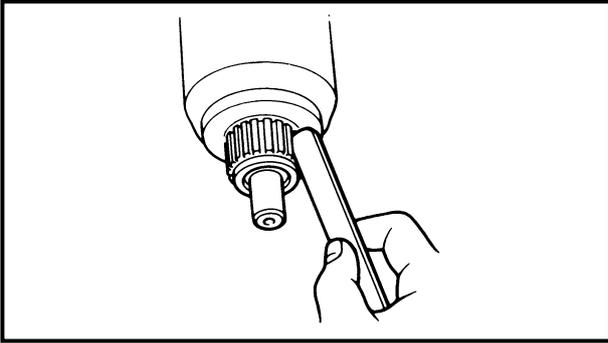
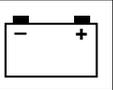
- Commutator  
Foreign matter → Clean.  
(with 600 grit sandpaper)

2. Measure:

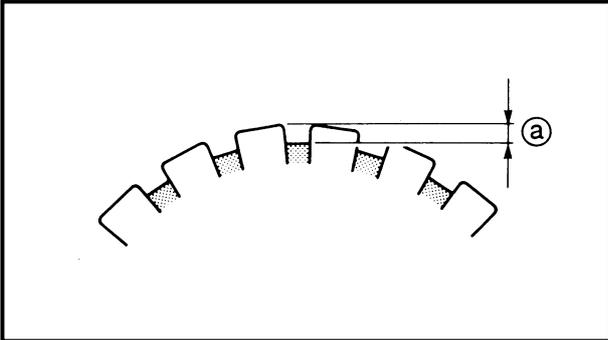
- Commutator diameter  
Out of specification → Replace.



**Commutator diameter limit**  
28.0 mm (1.10 in)

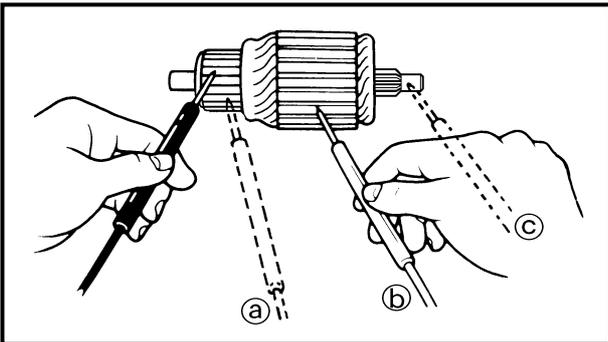


3. Check:
- Commutator undercut  
Dirt/foreign matter → Clean.  
(with compressed air)



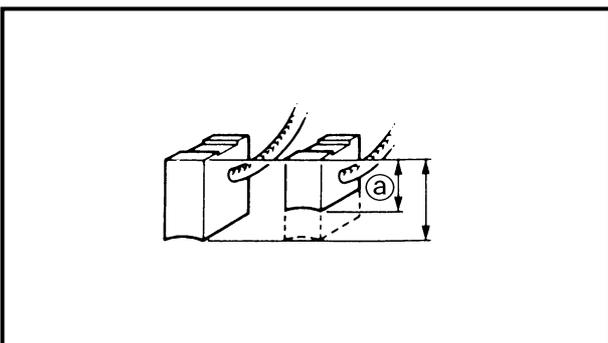
4. Measure:
- Commutator undercut (a)  
Out of specification → Replace the armature.

	<b>Commutator undercut limit</b> 0.2 mm (0.01 in)
--	--



5. Check:
- Armature continuity  
Out of specification → Replace.

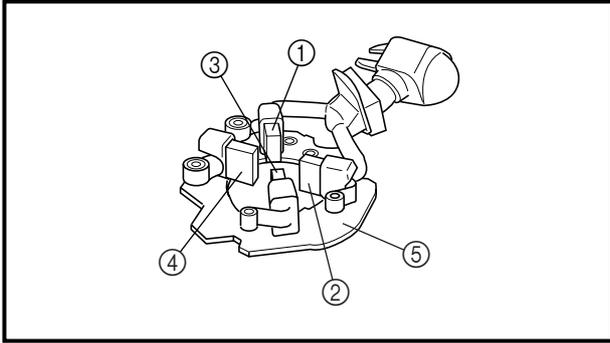
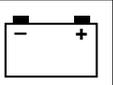
	<b>Armature continuity</b>	
<b>Commutator segments (a)</b>		<b>Continuity</b>
<b>Segment – Armature core (b)</b>		<b>No continuity</b>
<b>Segment – Armature shaft (c)</b>		<b>No continuity</b>



**MEASURING THE BRUSHES**

1. Measure:
- Brush length (a)  
Out of specification → Replace the brush assembly.

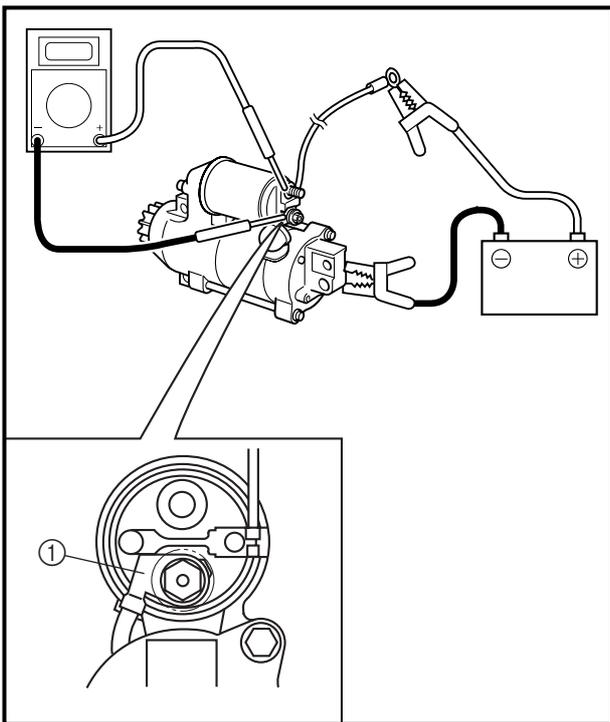
	<b>Brush length limit</b> 9.5 mm (0.37 in)
--	---



**2. Check:**

- Brush assembly continuity  
Out of specification → Replace the brush assembly.

 <b>Brush assembly continuity</b>	
<b>Brush ① – Brush ②</b> <b>Brush ③ – Brush ④</b> <b>Brush (③, ④) –</b> <b>Brush assembly holder ⑤</b>	<b>Continuity</b>
<b>Brush ① – Brush ③</b> <b>Brush ① – Brush ④</b> <b>Brush ② – Brush ③</b> <b>Brush ② – Brush ④</b> <b>Brush (①, ②) –</b> <b>Brush assembly holder ⑤</b>	<b>No continuity</b>



**CHECKING THE MAGNETIC SWITCH RELAY**

**Check:**

- Magnetic switch relay continuity  
Out of specification → Replace.

**Checking steps**

- (1) Remove the terminal ① from the magnetic switch relay.

**NOTE:** \_\_\_\_\_  
Remove the terminal to prevent the pinion gear from turning.

- (2) Connect the tester leads between the magnetic switch relay terminals as shown.
- (3) Connect the Brown/white (Br/W) lead to the positive battery terminal.
- (4) Connect the starter motor body to the negative battery terminal.

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

**Do not connect the battery for more than one second. Otherwise, the magnetic switch relay may be damaged.**



## STARTER MOTOR

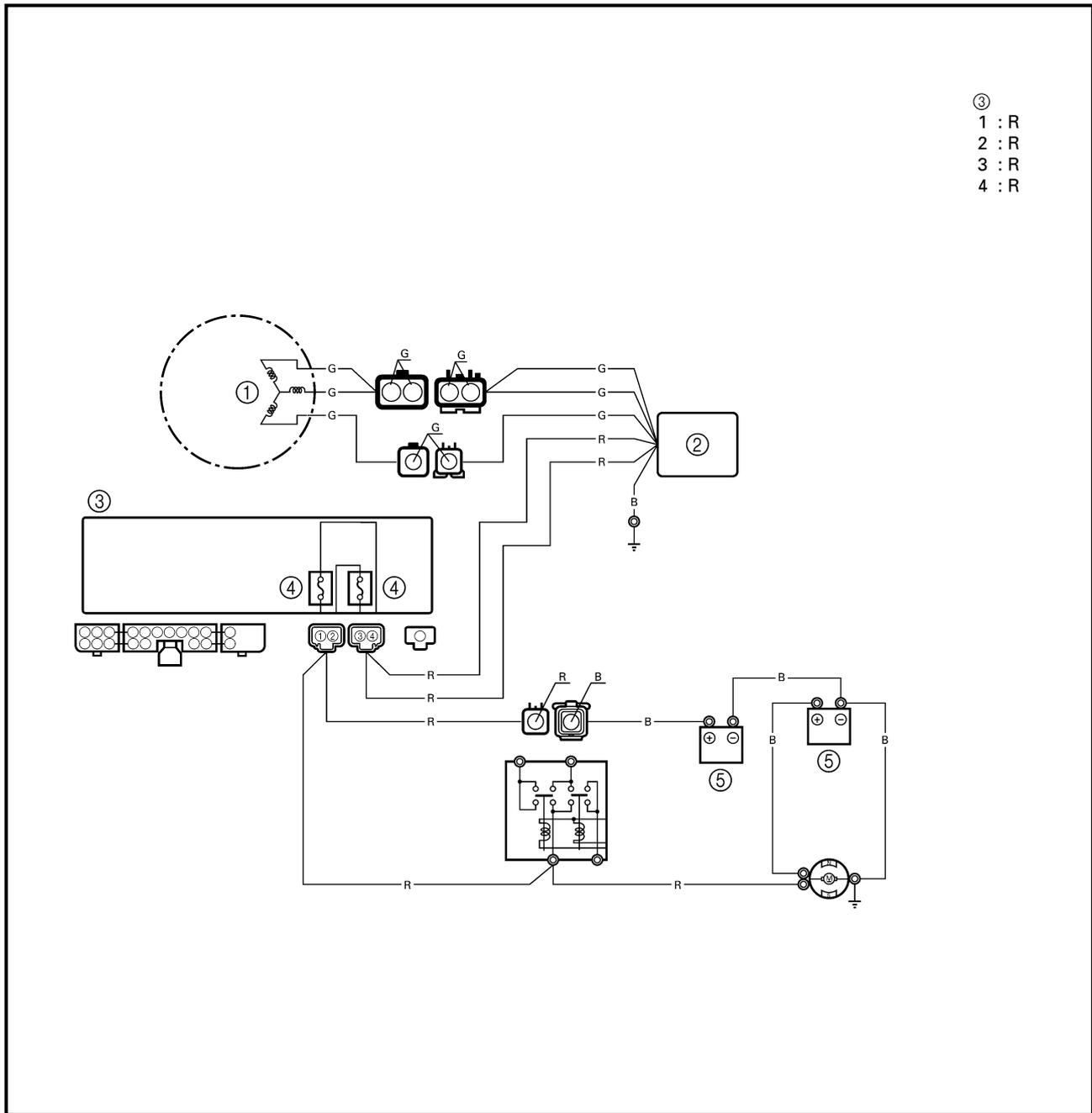
E

- 
- (5) Check that there is continuity between the magnetic switch relay terminals.
  - (6) Check that there is no continuity after the Br/W lead is removed.

**NOTE:** \_\_\_\_\_  
The starter motor pinion should be pushed out while the magnetic switch is on.

- 
- (7) Install the terminal to the magnetic switch relay.

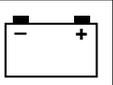
**CHARGING SYSTEM**



③  
1 : R  
2 : R  
3 : R  
4 : R

- ① Lighting coil
- ② Rectifier/regulator
- ③ Fuse holder
- ④ Fuses (80A)
- ⑤ Battery

B : Black  
G : Green  
R : Red



**CHECKING THE BATTERY**

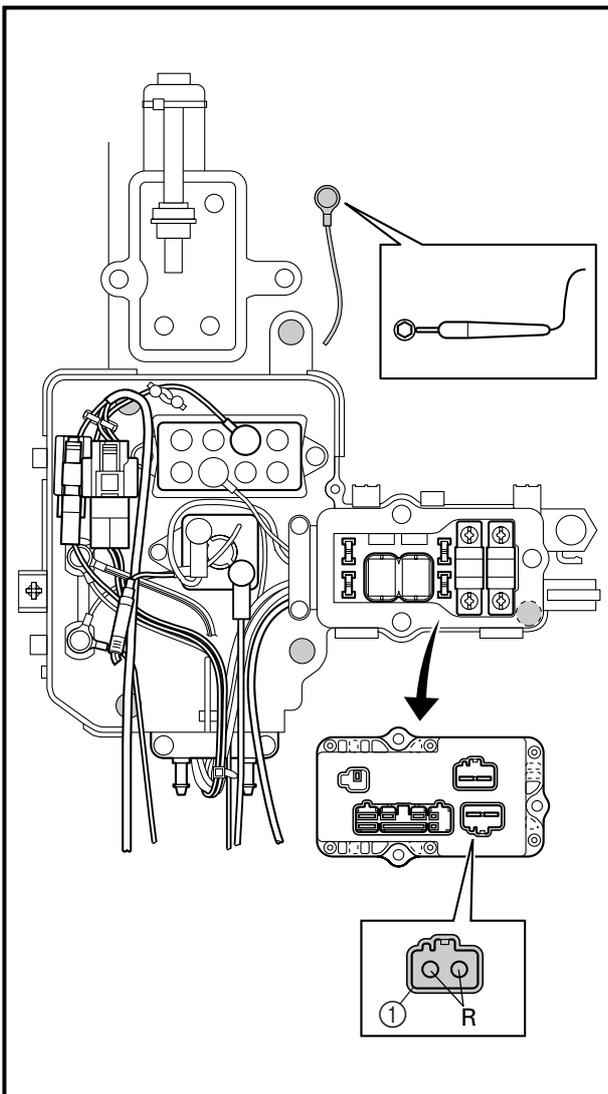
Refer to “CHECKING THE BATTERY” on page 3-19.

**CHECKING THE FUSES**

Refer to “CHECKING THE FUSES” on page 8-13.

**CHECKING THE FUSE HOLDER**

Refer to “CHECKING THE FUSE HOLDER” on page 8-13.



**MEASURING THE RECTIFIER/REGULATOR OUTPUT PEAK VOLTAGE**

Measure:

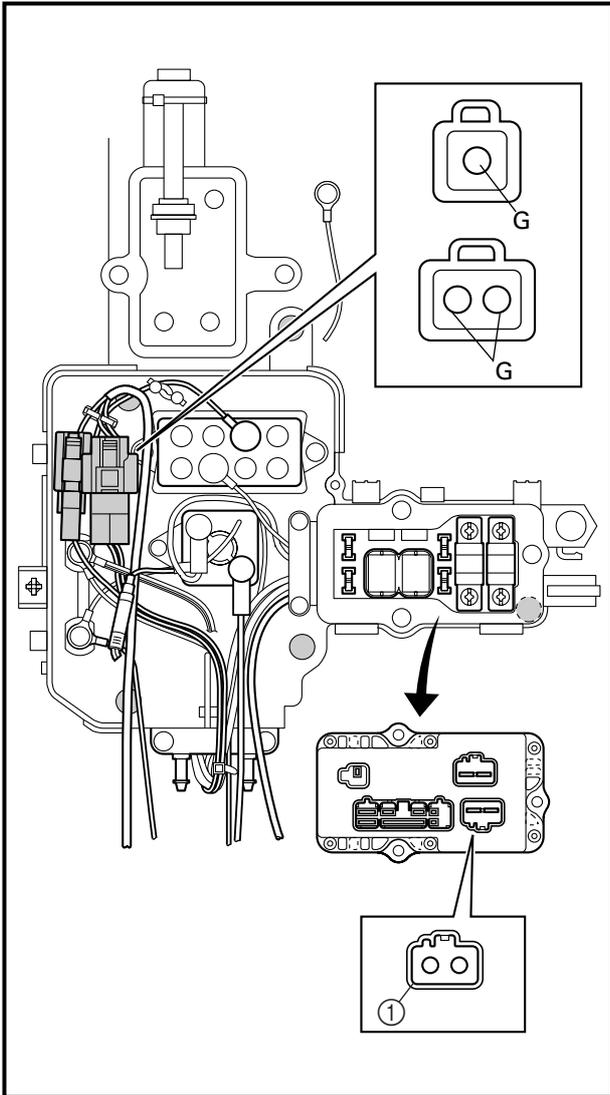
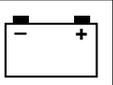
- Rectifier/regulator output peak voltage  
Below specification → Replace the rectifier/regulator.

 <b>Rectifier/regulator output peak voltage</b> Red (R) – Black (B)				
r/min	Circuit	Loaded		
	Cranking	1,500	3,500	
V	—	7.5	12.7	12.7

**NOTE:**

Before measuring the rectifier/regulator output peak voltage;

- Measure the lighting coil output peak voltage.
- Disconnect the rectifier/regulator coupler (blue) ①.



**MEASURING THE LIGHTING COIL OUTPUT PEAK VOLTAGE**

Measure:

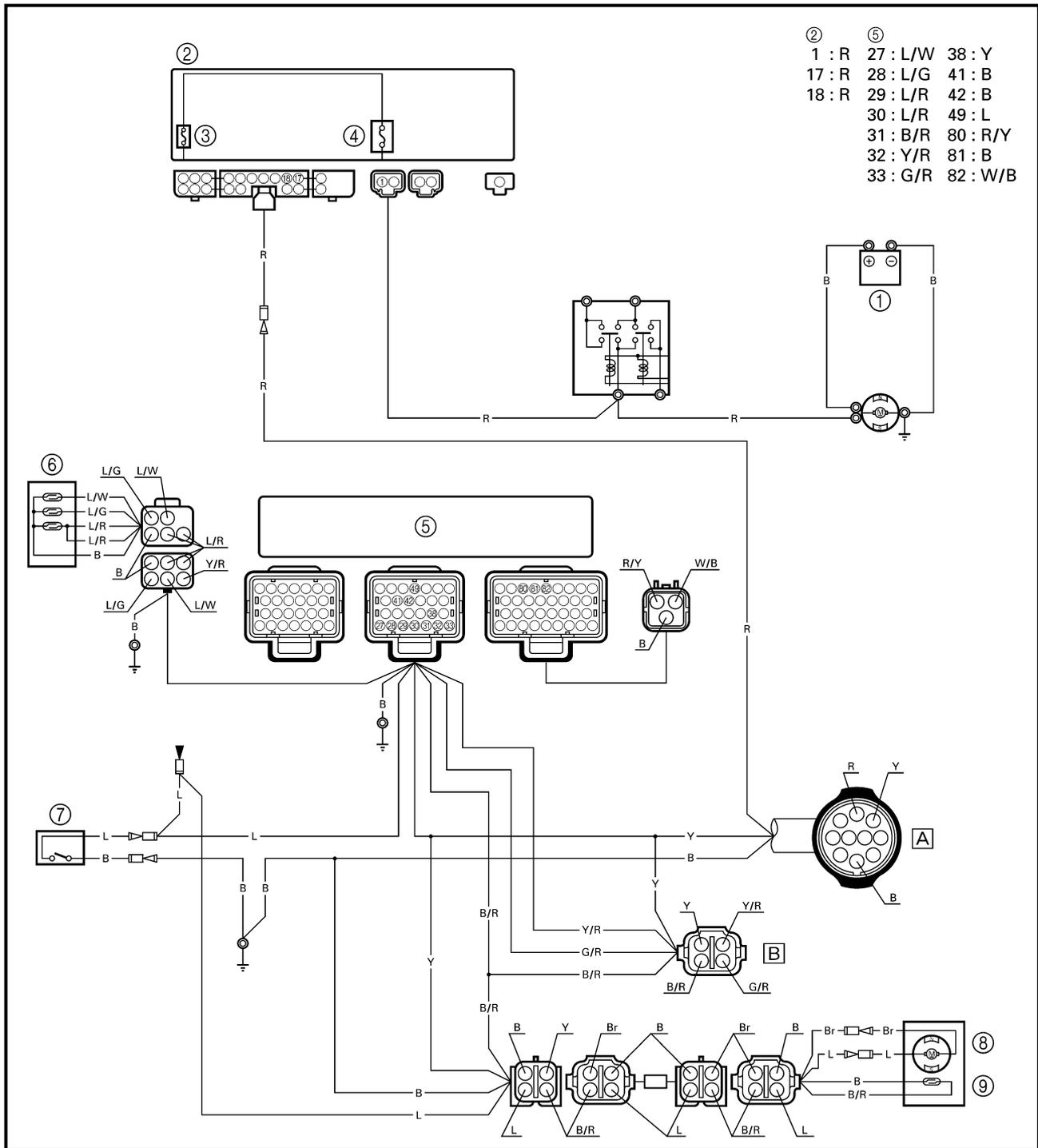
- Lighting coil output peak voltage  
Below specification → Replace the lighting coil.

	<b>Lighting coil output peak voltage Green (G) – Green (G)</b>			
<b>r/min</b>	<b>Circuit</b>	<b>Loaded</b>		
	<b>Cranking</b>	<b>1,500</b>	<b>3,500</b>	
<b>V</b>	<b>7.5</b>	<b>8.0</b>	<b>12</b>	<b>12</b>

	<b>Test harness (1-pin)</b>
	<b>YB-06788 / 90890-06788</b>
	<b>Test harness (2-pin)</b>
	<b>YB-06787 / 90890-06787</b>

**NOTE:** \_\_\_\_\_  
Before measuring the lighting coil output peak voltage, disconnect the rectifier/regulator coupler (blue) ①.  
\_\_\_\_\_

**OIL FEED PUMP CONTROL SYSTEM**



- |        |          |          |
|--------|----------|----------|
| ②      | ⑤        |          |
| 1 : R  | 27 : L/W | 38 : Y   |
| 17 : R | 28 : L/G | 41 : B   |
| 18 : R | 29 : L/R | 42 : B   |
|        | 30 : L/R | 49 : L   |
|        | 31 : B/R | 80 : R/Y |
|        | 32 : Y/R | 81 : B   |
|        | 33 : G/R | 82 : W/B |

- ① Battery
- ② Fuse holder
- ③ Fuse (20A)
- ④ Fuse (80A)
- ⑤ Control unit
- ⑥ Oil level sensor
- ⑦ Emergency switch
- ⑧ Oil pump (sub-oil tank)
- ⑨ Oil level switch (sub-oil tank)

- A** : To remote control
- B** : To oil level meter
- B** : Black
- Br** : Brown
- L** : Blue
- R** : Red
- Y** : Yellow
- B/R** : Black/red

- G/R** : Green/red
- L/G** : Blue/green
- L/R** : Blue/red
- L/W** : Blue/white
- R/Y** : Red/yellow
- W/B** : White/black
- Y/R** : Yellow/red



**CHECKING THE BATTERY**

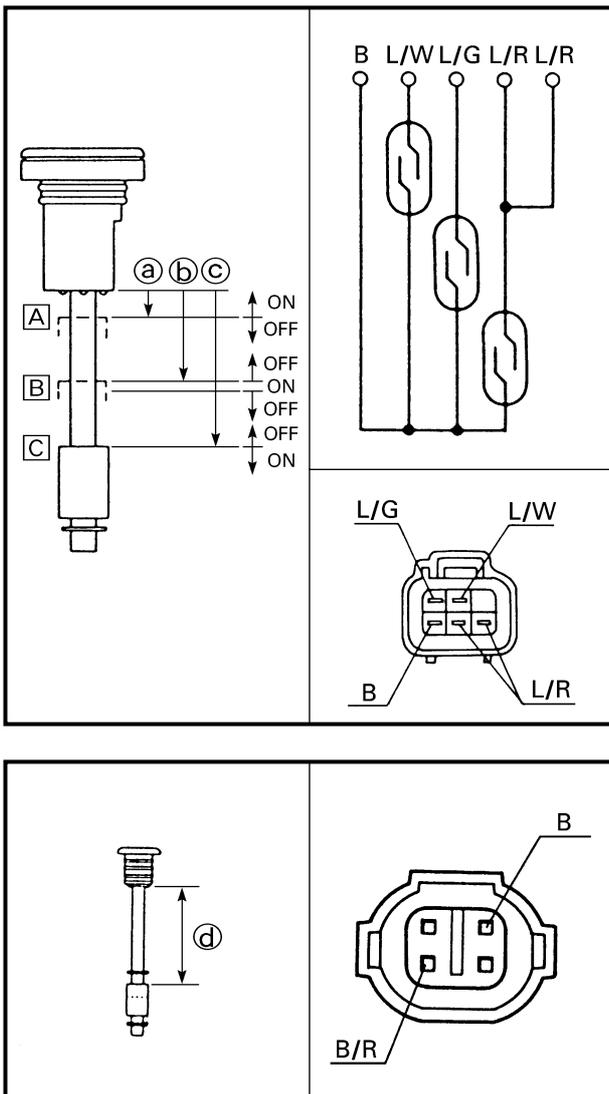
Refer to "CHECKING THE BATTERY" on page 3-19.

**CHECKING THE FUSES**

Refer to "CHECKING THE FUSES" on page 8-13.

**CHECKING THE FUSE HOLDER**

Refer to "CHECKING THE FUSE HOLDER" on page 8-13.



**CHECKING THE OIL LEVEL SENSOR/ SWITCH CONTINUITY**

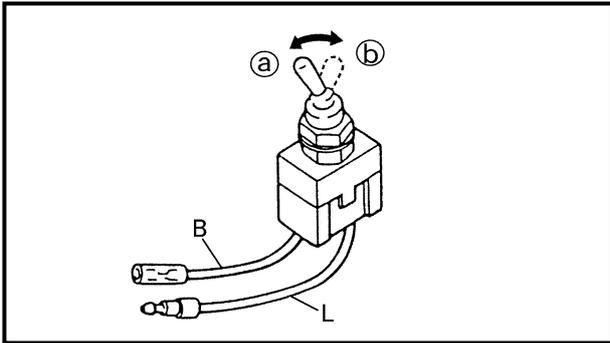
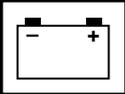
Check:

- Oil level sensor/switch continuity  
Out of specification → Replace.

<b>Float position</b>	<b>Lead color</b>			
	<b>Black (B)</b>	<b>Blue/white (L/W)</b>	<b>Blue/green (L/G)</b>	<b>Blue/red (L/R)</b>
<b>A ON</b>	○	○		
<b>A OFF</b>				
<b>B ON</b>	○	—	○	
<b>B OFF</b>				
<b>C ON</b>	○			○
<b>C OFF</b>				

<b>Float distance</b>
<b>a): 3 - 6 mm (0.12 - 0.24 in)</b>
<b>b): 33 - 36 mm (1.30 - 1.42 in)</b>
<b>c): 53 - 56 mm (2.09 - 2.20 in)</b>
<b>d): 150 - 153 mm (5.91 - 6.02 in)</b>

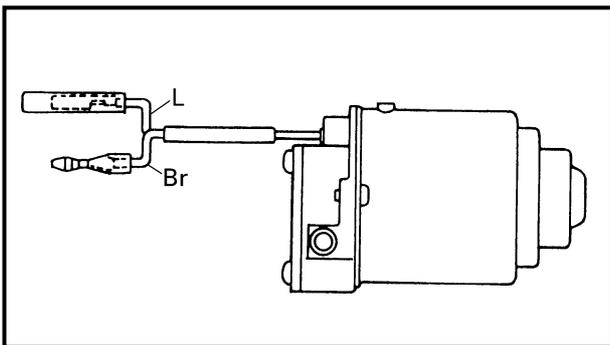


**CHECKING THE EMERGENCY SWITCH**

1. Check:
- Emergency switch continuity  
Out of specification → Replace.

	Switch position	Lead color
	<b>Home (a)</b>	<b>No continuity</b>
	<b>On (b)</b>	<b>Continuity</b>

2. Check:
- Emergency switch  
Does not automatically return to the home position → Replace.

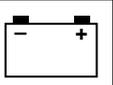


**CHECKING THE OIL PUMP (SUB-OIL TANK)**

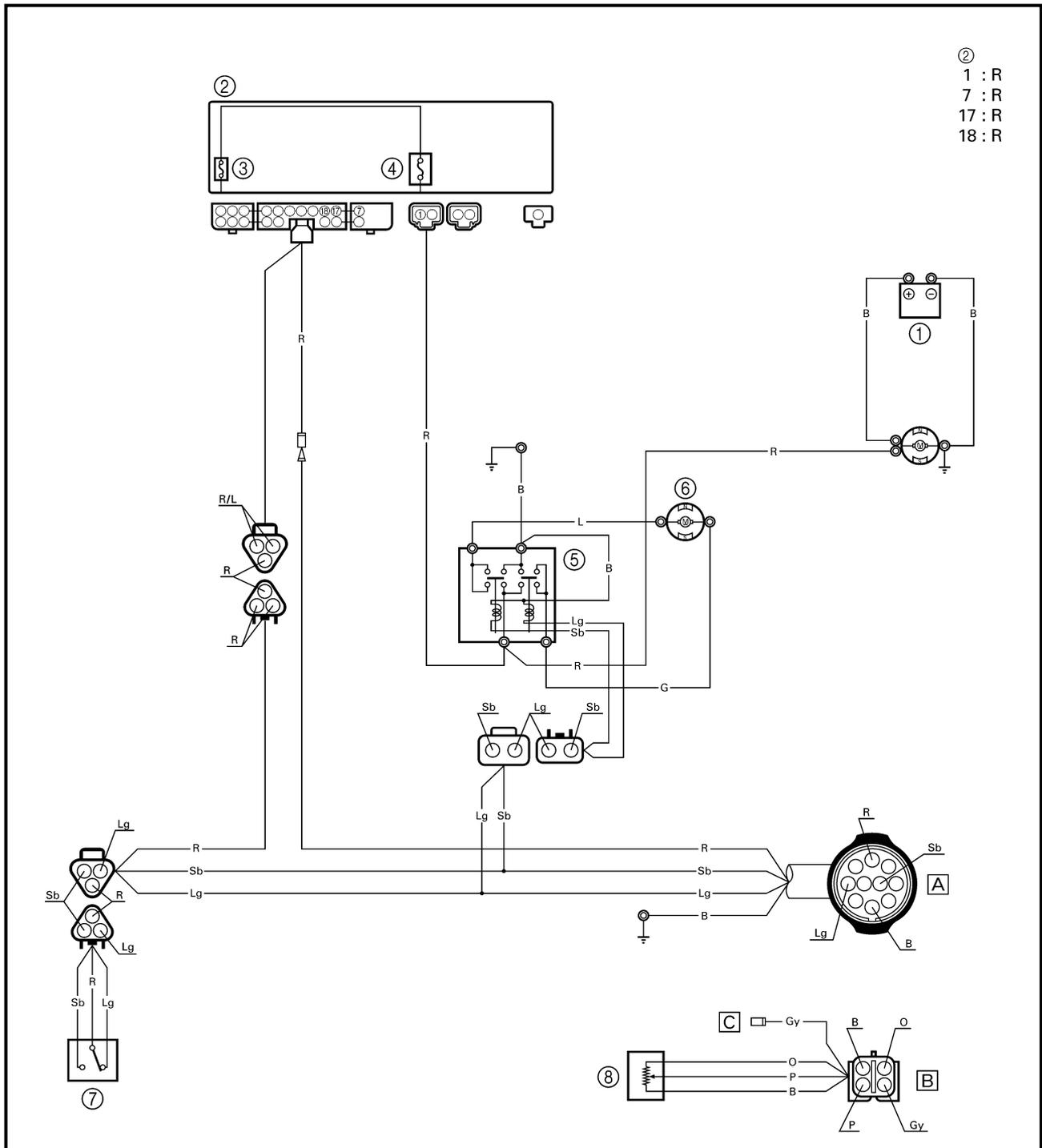
- Check:
- Oil pump (sub-oil tank)  
Incorrect operation → Replace.

**NOTE:** \_\_\_\_\_  
Connect the oil pump leads to a 12-V battery and make sure the oil pump operates properly.

<b>Blue (L) lead → Positive battery terminal</b>
<b>Brown (Br) lead → Negative battery terminal</b>



POWER TRIM AND TILT SYSTEM

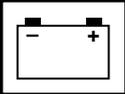


②  
1 : R  
7 : R  
17 : R  
18 : R

- ① Battery
- ② Fuse holder
- ③ Fuse (20A)
- ④ Fuse (80A)
- ⑤ Power trim and tilt relay
- ⑥ Power trim and tilt motor
- ⑦ Trailer switch
- ⑧ Trim sensor

- [A] To remote control
- [B] To trim meter
- [C] To control unit
- B : Black
- G : Green
- Gy : Gray
- L : Blue
- Lg : Light green

- O : Orange
- P : Pink
- R : Red
- Sb : Sky blue
- R/L : Red/blue



**CHECKING THE BATTERY**

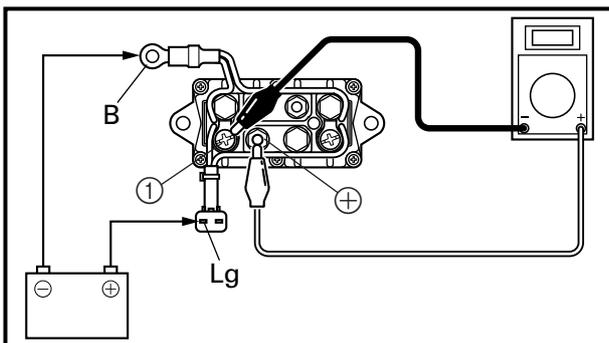
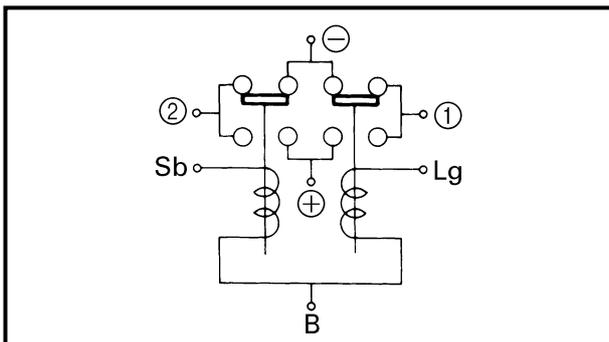
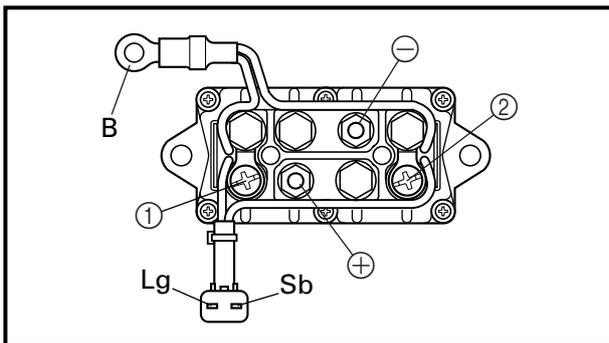
Refer to "CHECKING THE BATTERY" on page 3-19.

**CHECKING THE FUSES**

Refer to "CHECKING THE FUSES" on page 8-13.

**CHECKING THE FUSE HOLDER**

Refer to "CHECKING THE FUSE HOLDER" on page 8-13.



**CHECKING THE POWER TRIM AND TILT RELAY**

1. Check:
  - Power trim and tilt relay continuity  
Out of specification → Replace.

	<b>Power trim and tilt relay continuity</b>
<b>Sky blue (Sb) – Black (B)</b>	<b>Continuity</b>
<b>Light green (Lg) – Black (B)</b>	<b>Continuity</b>
<b>Terminal ① – Terminal ⊖</b>	<b>Continuity</b>
<b>Terminal ② – Terminal ⊖</b>	<b>Continuity</b>
<b>Terminal ① – Terminal ⊕</b>	<b>No continuity</b>
<b>Terminal ② – Terminal ⊕</b>	<b>No continuity</b>

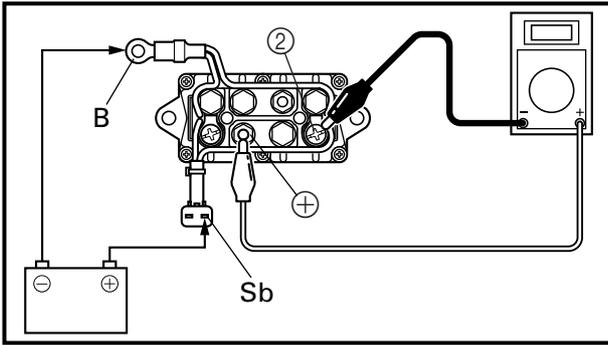
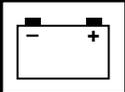
2. Check:
  - Power trim and tilt relay operation  
No continuity → Replace.

**Checking steps**

- (1) Connect the digital tester between power trim and tilt relay terminals ① and ⊕.
- (2) Connect a 12-V battery as shown.

**Light green (Lg) lead → Positive terminal**  
**Black (B) lead → Negative terminal**

- (3) Check that there is continuity between the power trim and tilt relay terminals.

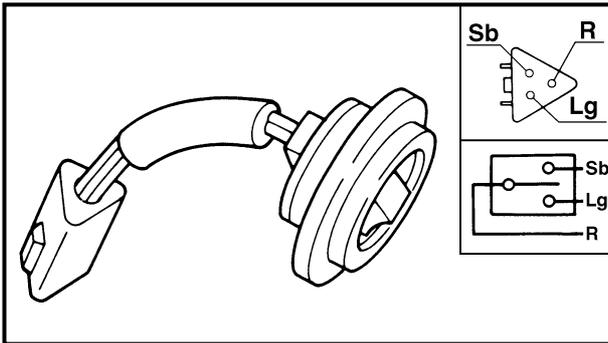


(4) Connect the digital tester between power trim and tilt relay terminals ⊕ and ②.

(5) Connect a 12-V battery as shown.

**Sky blue (Sb) lead → Positive terminal**  
**Black (B) lead → Negative terminal**

(6) Check that there is continuity between the power trim and tilt relay terminals.

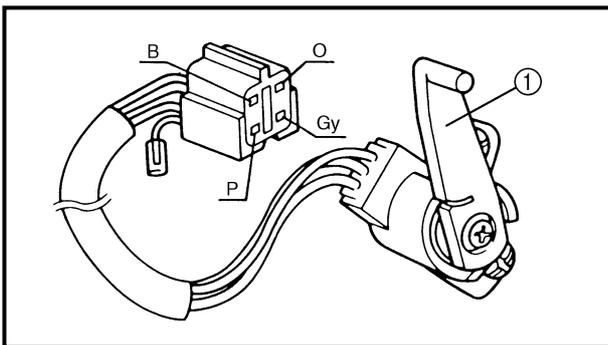


**CHECKING THE TRAILER SWITCH CONTINUITY**

Check:

- Trailer switch continuity
- Out of specification → Replace.

Switch position	Lead color		
	Skyblue (Sb)	Red (R)	Light green (Lg)
Up	○ — ○		
Free			
Down		○ — ○	



**MEASURING THE TRIM SENSOR RESISTANCE**

Measure:

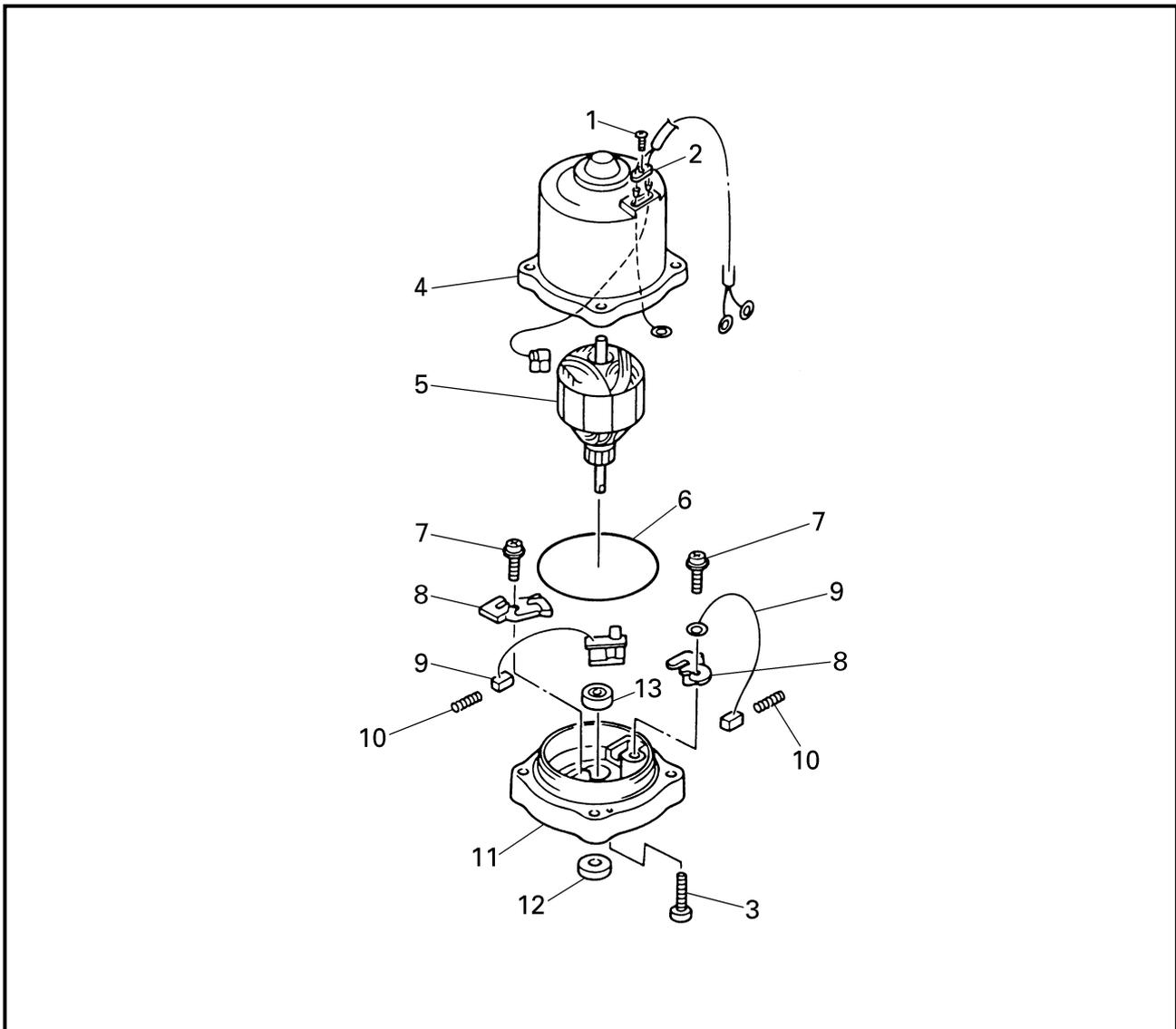
- Trim sensor resistance
- Out of specification → Replace.

**Trim sensor resistance**  
**Pink (P) – Black (B)**  
 582 - 873 Ω at 20 °C (68 °F)  
**Orange (O) – Black (B)**  
 800 - 1,200 Ω at 20 °C (68 °F)

**NOTE:** Turn the lever ① and measure the resistance as it gradually changes.

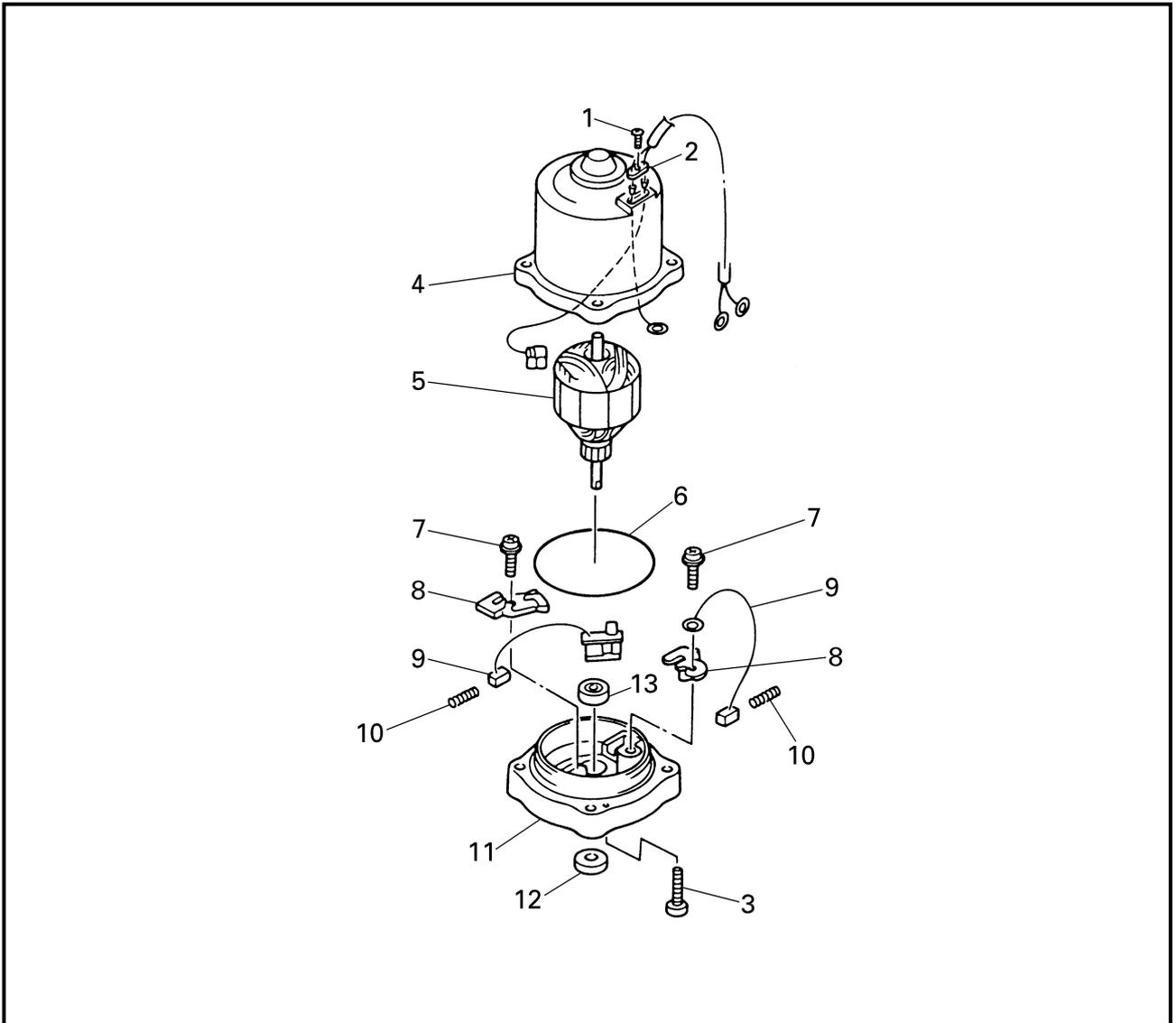
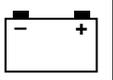
**POWER TRIM AND TILT MOTOR**

**DISASSEMBLING/ASSEMBLING THE POWER TRIM AND TILT MOTOR**

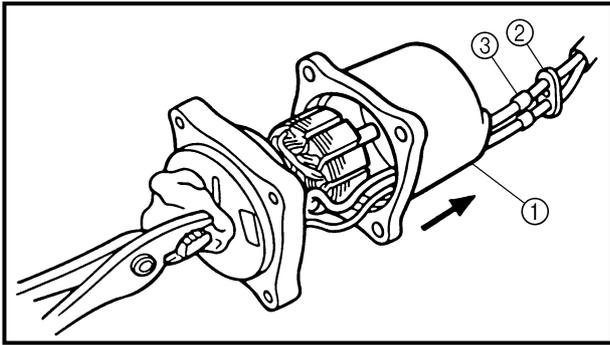
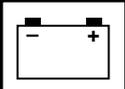


Order	Job/Part	Q'ty	Remarks
	Power trim and tilt motor		Refer to "RESERVOIR AND POWER TRIM AND TILT MOTOR" on page 7-22.
1	Screw	1	
2	Lead holder	1	
3	Screw	2	
4	Stator	1	
5	Armature	1	
6	O-ring	1	
7	Screw	2	

Continued on next page.



Order	Job/Part	Q'ty	Remarks
8	Brush holder	2	For assembly, reverse the disassembly procedure.
9	Brush	2	
10	Spring	2	
11	Lower cover	1	
12	Oil seal	1	
13	Bearing	1	



## REMOVING THE STATOR

Remove:

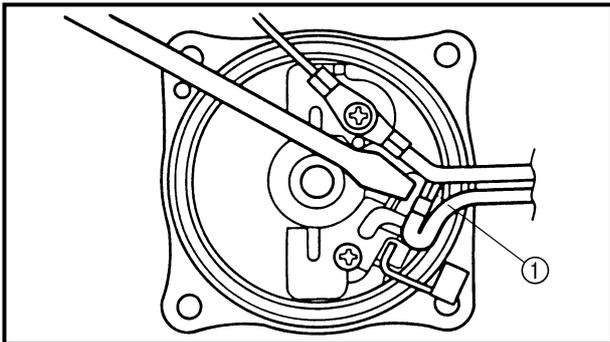
- Stator ①

### CAUTION:

- Keep the power trim and tilt motor leads inside the stator.
- Do not allow grease or oil to contact the commutator.

### NOTE:

- Remove the lead holder ② and rubber spacer ③ from the stator and slide them towards the leads.
- Hold the end of the armature shaft with a clean cloth and pull off the stator.



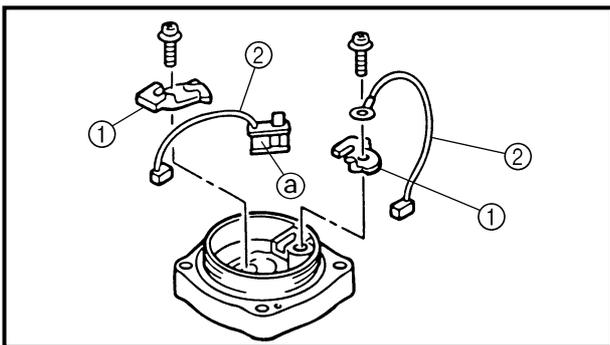
## REMOVING THE BRUSH

1. Remove:

- Sky blue power trim and tilt motor lead ①

### NOTE:

Hold the brush with a screwdriver as shown. Then, disconnect the sky blue lead.

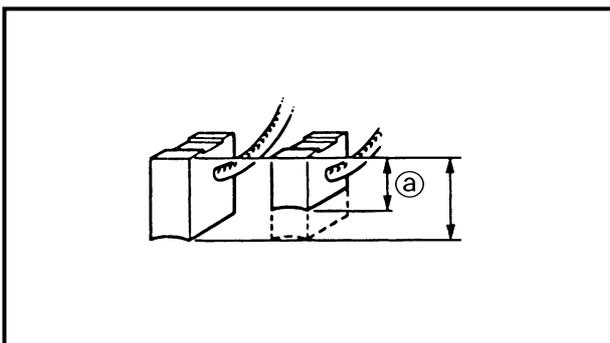


2. Remove:

- Brush holders ①
- Brushes ②

### CAUTION:

Do not touch the bimetal ③; touching it may affect the operation of the breaker.



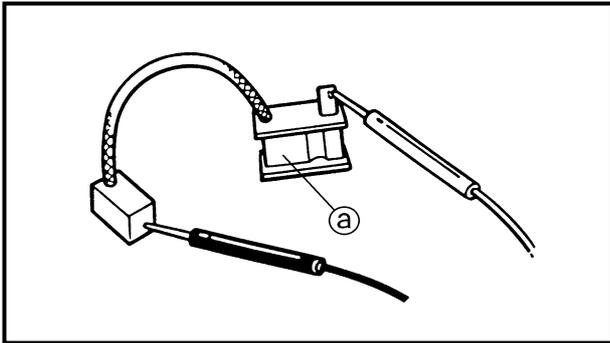
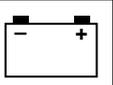
## CHECKING THE BRUSH

1. Measure:

- Brush length ③
- Out of specification → Replace.



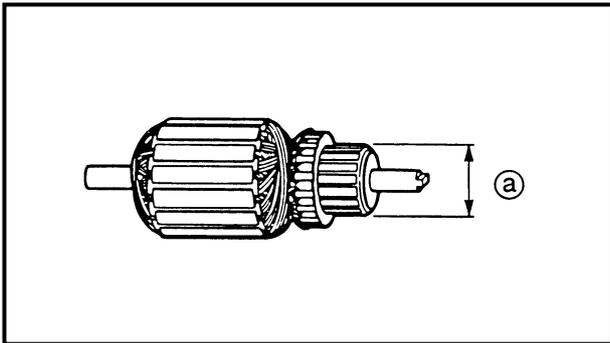
**Brush length**  
4.8 mm (0.19 in)



2. Check
  - Brush continuity
  - No continuity → Replace.

**CAUTION:**

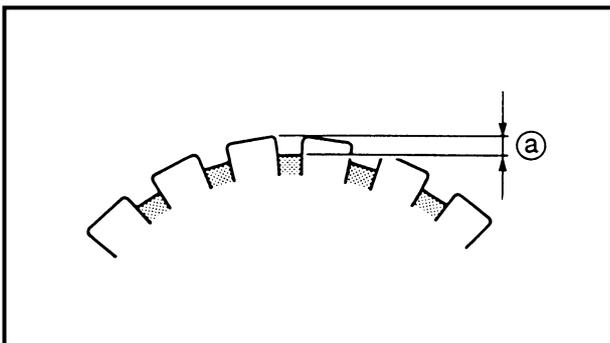
Do not touch the bimetal (a); touching it may affect the operation of the breaker.



**CHECKING THE ARMATURE**

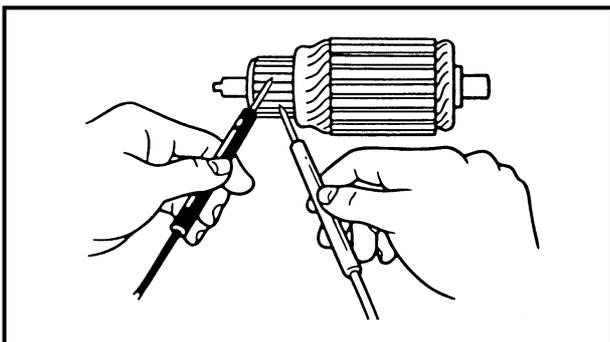
1. Measure:
  - Commutator diameter (a)
  - Out of specification → Replace.

	<b>Commutator diameter limit</b> 21.0 mm (0.83 in)
--	---



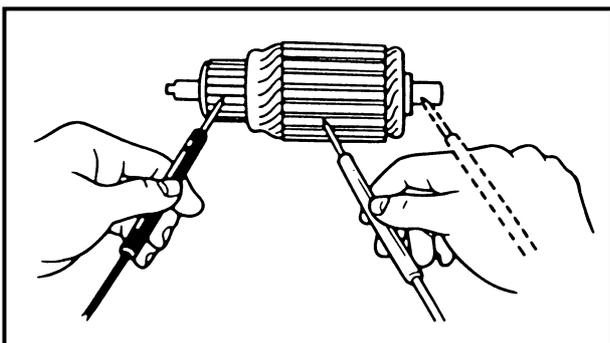
2. Measure:
  - Commutator undercut (a)
  - Out of specification → Replace the armature.

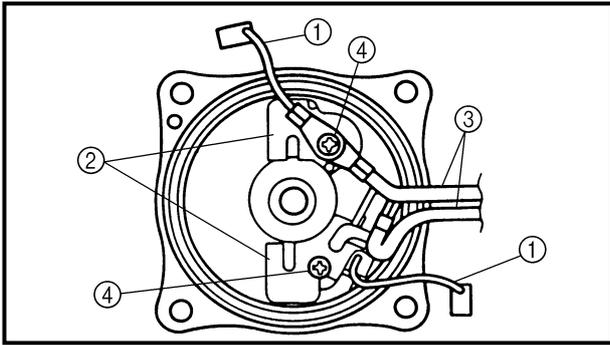
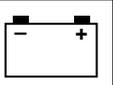
	<b>Commutator undercut limit</b> 0.85 mm (0.03 in)
--	---



3. Check:
  - Armature continuity
  - Out of specification → Replace.

	<b>Armature continuity</b>	
<b>Commutator segments</b>	<b>Continuity</b>	
<b>Segment-laminations</b>	<b>No continuity</b>	
<b>Segment-shaft</b>	<b>No continuity</b>	





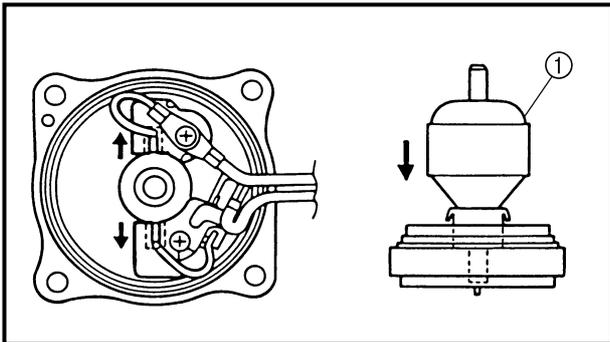
### INSTALLING THE BRUSH

Install:

- Brushes ①
- Brush holders ②
- Power trim and tilt motor leads ③
- Screw ④

#### CAUTION:

Do not touch the bimetal; touching it may affect the operation of the breaker.



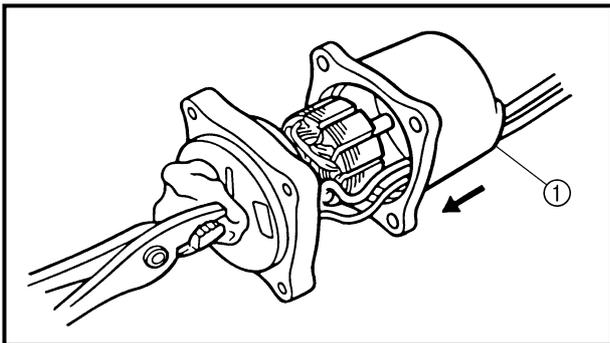
### INSTALLING THE ARMATURE

Install:

- Armature ①

#### NOTE:

Push the brushes into the holder and then install the armature.



### INSTALLING THE STATOR

Install:

- Stator ①

#### NOTE:

Place a clean cloth over the end of the armature shaft and carefully push the armature into the stator with a pair of pliers as shown.



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## CHAPTER 9 TROUBLE ANALYSIS

<b>TROUBLE ANALYSIS</b> .....	9-1
TROUBLE ANALYSIS CHART .....	9-1
<b>SELF-DIAGNOSIS</b> .....	9-5
DIAGNOSIS CODE INDICATION .....	9-5
DIAGNOSIS THE ELECTRONIC CONTROL SYSTEM .....	9-5
<b>TROUBLE SHOOTING FOR HIGH-PRESSURE DIRECT INJECTION</b> .....	9-7

**TROUBLE ANALYSIS**

**NOTE:**

The following items should be checked before the "TROUBLE ANALYSIS CHART" is consulted.

1. The battery is properly charged and its specified gravity is within specification.
2. There are no incorrect wiring connections.
3. Wiring connections are properly secured and are not rusty.
4. The lockplate is attached to the engine stop lanyard switch.
5. The shift position is in neutral.
6. Fuel is reaching the carburetor(s)/vapor separator.
7. The PTT fluid, high-pressure pump oil and gear oil are at the specified levels.
8. The rigging and engine settings are correct.
9. The engine is free from any "Hull problem".

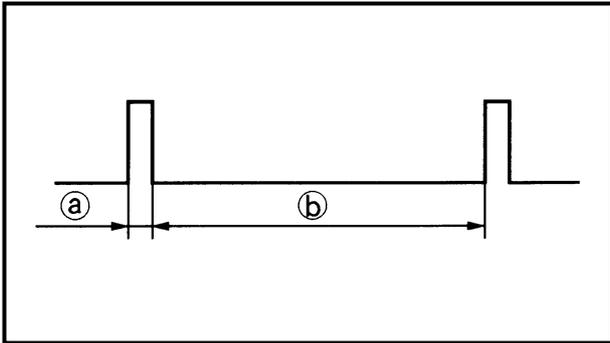
**TROUBLE ANALYSIS CHART**

Trouble mode														Check elements			
ENGINE WILL NOT START	HARD STARTING	ROUGH IDLING	HIGH IDLING	ENGINE STALLS	POOR ACCELERATION	ENGINE WILL NOT STOP	POOR PERFORMANCE	LIMITED ENGINE SPEED	OVERHEATING	LOOSE STEERING	LOOSE TILT HOLDING	TILT MOTOR WILL NOT RUN	HARD SHIFTING	IRREGULAR WARNING INDICATION	POOR BATTERY CHARGING	Relative part	Reference chapter
														<b>FUEL SYSTEM</b>			
														<b>Low-pressure fuel line</b>			
<input type="radio"/>				<input type="radio"/>			<input type="radio"/>									• Fuel line	3
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					<input type="radio"/>									• Fuel filter	3
<input type="radio"/>							<input type="radio"/>									• Fuel pumps	4
														<b>Medium/high-pressure fuel line</b>			
<input type="radio"/>	<input type="radio"/>				<input type="radio"/>		<input type="radio"/>	<input type="radio"/>								• Vapor separator	4
<input type="radio"/>	<input type="radio"/>															• Electric fuel pump	4
<input type="radio"/>	<input type="radio"/>						<input type="radio"/>									• Medium/high-pressure fuel line	3
<input type="radio"/>					<input type="radio"/>		<input type="radio"/>	<input type="radio"/>								• Mechanical fuel pump	4
<input type="radio"/>					<input type="radio"/>		<input type="radio"/>	<input type="radio"/>								• Fuel injectors	4
		<input type="radio"/>	<input type="radio"/>				<input type="radio"/>									Link adjustment	3
														<b>POWER UNIT</b>			
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					<input type="radio"/>									Compression	3
<input type="radio"/>					<input type="radio"/>		<input type="radio"/>	<input type="radio"/>								Drive belt	4
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>												Reed valves	5

Trouble mode													Check elements				
ENGINE WILL NOT START	HARD STARTING	ROUGH IDLING	HIGH IDLING	ENGINE STALLS	POOR ACCELERATION	ENGINE WILL NOT STOP	POOR PERFORMANCE	LIMITED ENGINE SPEED	OVERHEATING	LOOSE STEERING	LOOSE TILT HOLDING	TILT MOTOR WILL NOT RUN	HARD SHIFTING	IRREGULAR WARNING INDICATION	POOR BATTERY CHARGING	Relative part	Reference chapter
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					<input type="radio"/>		<input type="radio"/>							Cylinder head gaskets	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			<input type="radio"/>		<input type="radio"/>		<input type="radio"/>							Seal	5
<input type="radio"/>							<input type="radio"/>									Cylinder block	5
<input type="radio"/>							<input type="radio"/>									Crankcase	5
<input type="radio"/>							<input type="radio"/>									Piston rings	5
<input type="radio"/>							<input type="radio"/>									Pistons	5
							<input type="radio"/>									Bearings	5
									<input type="radio"/>							Thermostats	5
									<input type="radio"/>							Water passages	5
<b>LOWER UNIT</b>																	
<input type="radio"/>				<input type="radio"/>									<input type="radio"/>			Neutral position	6
<input type="radio"/>													<input type="radio"/>			Dog clutch	6
<input type="radio"/>				<input type="radio"/>									<input type="radio"/>			Gears	6
									<input type="radio"/>							Water inlets	6
									<input type="radio"/>							Water pump	6
							<input type="radio"/>									Propeller shaft(s)	6
													<input type="radio"/>			Shift rod joint	6
													<input type="radio"/>			Shift cam	6
													<input type="radio"/>			Shift shaft	6
							<input type="radio"/>						<input type="radio"/>			Lower case	6
<b>BRACKET UNIT</b>																	
									<input type="radio"/>							Bracket	7
									<input type="radio"/>							Rubber mounts	7
													<input type="radio"/>			Shift rod	7
<b>POWER TRIM AND TILT UNIT</b>																	
											<input type="radio"/>					Fluid level	3
											<input type="radio"/>					Relief valve	7
											<input type="radio"/>					Fluid passages	—
												<input type="radio"/>				Power trim and tilt motor	7

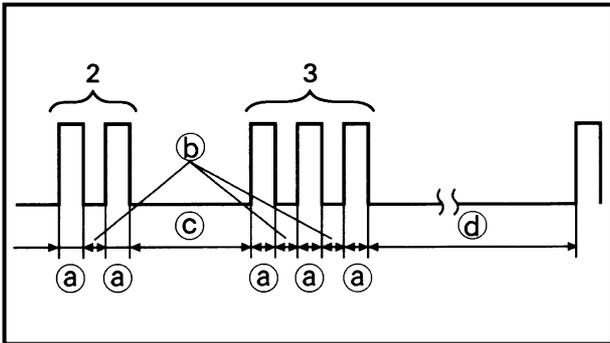
Trouble mode														Check elements			
ENGINE WILL NOT START	HARD STARTING	ROUGH IDLING	HIGH IDLING	ENGINE STALLS	POOR ACCELERATION	ENGINE WILL NOT STOP	POOR PERFORMANCE	LIMITED ENGINE SPEED	OVERHEATING	LOOSE STEERING	LOOSE TILT HOLDING	TILT MOTOR WILL NOT RUN	HARD SHIFTING	IRREGULAR WARNING INDICATION	POOR BATTERY CHARGING	Relative part	Reference chapter
<b>ELECTRICAL</b>																	
<b>Ignition system</b>																	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Pulser coils	8
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Control unit	8
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Ignition coils	8
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Spark plugs	3
<b>Ignition/fuel control system</b>																	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Lanyard switch	—
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Main relay	8
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Driver relay	8
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Crank position sensor	8
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Atmospheric pressure sensor	8
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Intake air temperature sensor	8
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Oxygen density sensor	8
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Engine cooling water temperature sensor	8
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Throttle position sensor	8
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Thermo switches	8
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Shift position switch	8
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Injector driver	8
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Fuel pressure sensor	8
<b>Starting system</b>																	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Engine start switch	—
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Starter relay	8
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Starter motor	8
<b>Charging system</b>																	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Lighting coils	8
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Rectifier/regulator	8
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Fuses	8
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Battery leads	—
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	• Batteries	—

Trouble mode														Check elements			
ENGINE WILL NOT START	HARD STARTING	ROUGH IDLING	HIGH IDLING	ENGINE STALLS	POOR ACCELERATION	ENGINE WILL NOT STOP	POOR PERFORMANCE	LIMITED ENGINE SPEED	OVERHEATING	LOOSE STEERING	LOOSE TILT HOLDING	TILT MOTOR WILL NOT RUN	HARD SHIFTING	IRREGULAR WARNING INDICATION	POOR BATTERY CHARGING	Relative part	Reference chapter
																<b>Oil feed pump control system</b>	
								○							○	• Oil level sensor (engine oil tank)	8
								○								• Oil level switch (sub-oil tank)	8
																<b>Power trim and tilt system</b>	
												○				• Trailer switch	8
												○				• Power trim and tilt relay	8
															○	• Trim sensor	8

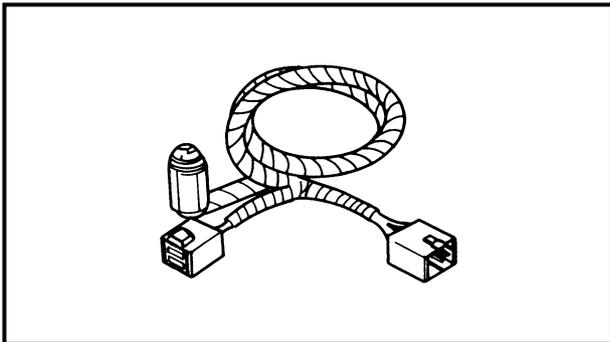


**SELF-DIAGNOSIS  
DIAGNOSIS CODE INDICATION**

1. Normal condition  
(no defective part or irregular processing is found)  
Single flash is given every 5 seconds.  
 (a) : Light on, 0.3 second  
 (b) : Light off, 5 seconds



2. Trouble code indication  
Example: The illustration indicates code number 23.  
 (a) : Light on, 0.3 second  
 (b) : Light off, 0.3 second  
 (c) : Light off, 1.7 seconds  
 (d) : Light off, 5 seconds

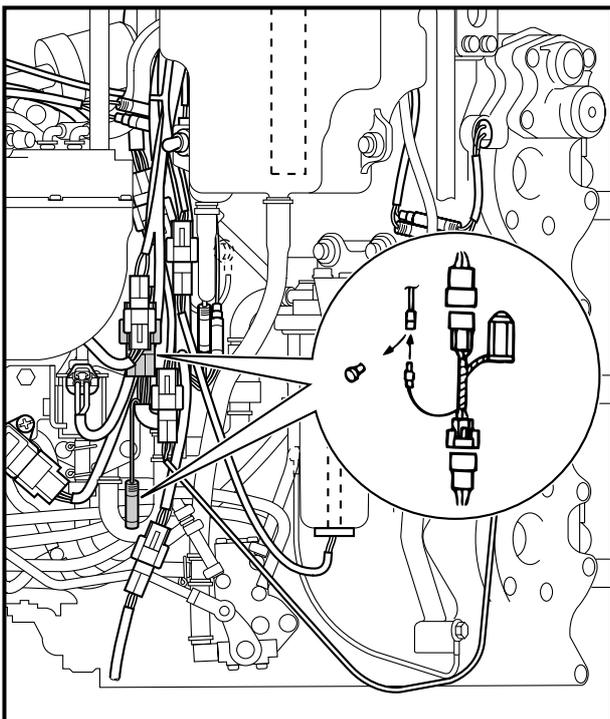


**DIAGNOSIS THE ELECTRONIC  
CONTROL SYSTEM**

1. Install:
  - Diagnostic indicator

	<b>Diagnostic indicator</b> YB-06765 / 90890-06765
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**NOTE:** \_\_\_\_\_  
When performing this diagnosis, all of the electrical wires must be properly connected.



2. Check:
  - Diagnostic code  
Code 1 is indicated → Normal.  
Code 13 - 28 indicated → Check the applicable parts.  
Code 33 - 44 indicated → Microcomputer processing information.

**Checking steps**

- (1) Start the engine and let it idle.
- (2) Check the diagnostic indicator's flash pattern to determine if there are any malfunctions.

**NOTE:**

When more than one problem is detected, the diagnostic indicator's light flashes in the pattern of the lowest numbered problem. After that problem is corrected, the light flashes in the pattern of the next lowest numbered problem. This continues until all of the problems are detected and corrected.

**Diagnosis code chart**

Code	Symptoms
13	Incorrect pulser coil input signal
14	No crank position sensor input signal
15	Incorrect engine cooling water temperature sensor input signal
18	Incorrect throttle position sensor input signal
19	Low battery input voltage
22	Incorrect atmospheric pressure sensor input signal (out of normal operating range)
23	Incorrect intake air temperature sensor input signal
25	Incorrect fuel pressure sensor input signal
26	No injector operation signals
27	Water detection switch ON
28	Incorrect shift position switch input signal
33 ~ 44	Microcomputer processing information
33	Ignition timing is being slightly corrected (when starting a cold engine)
44	Engine stop switch control operating

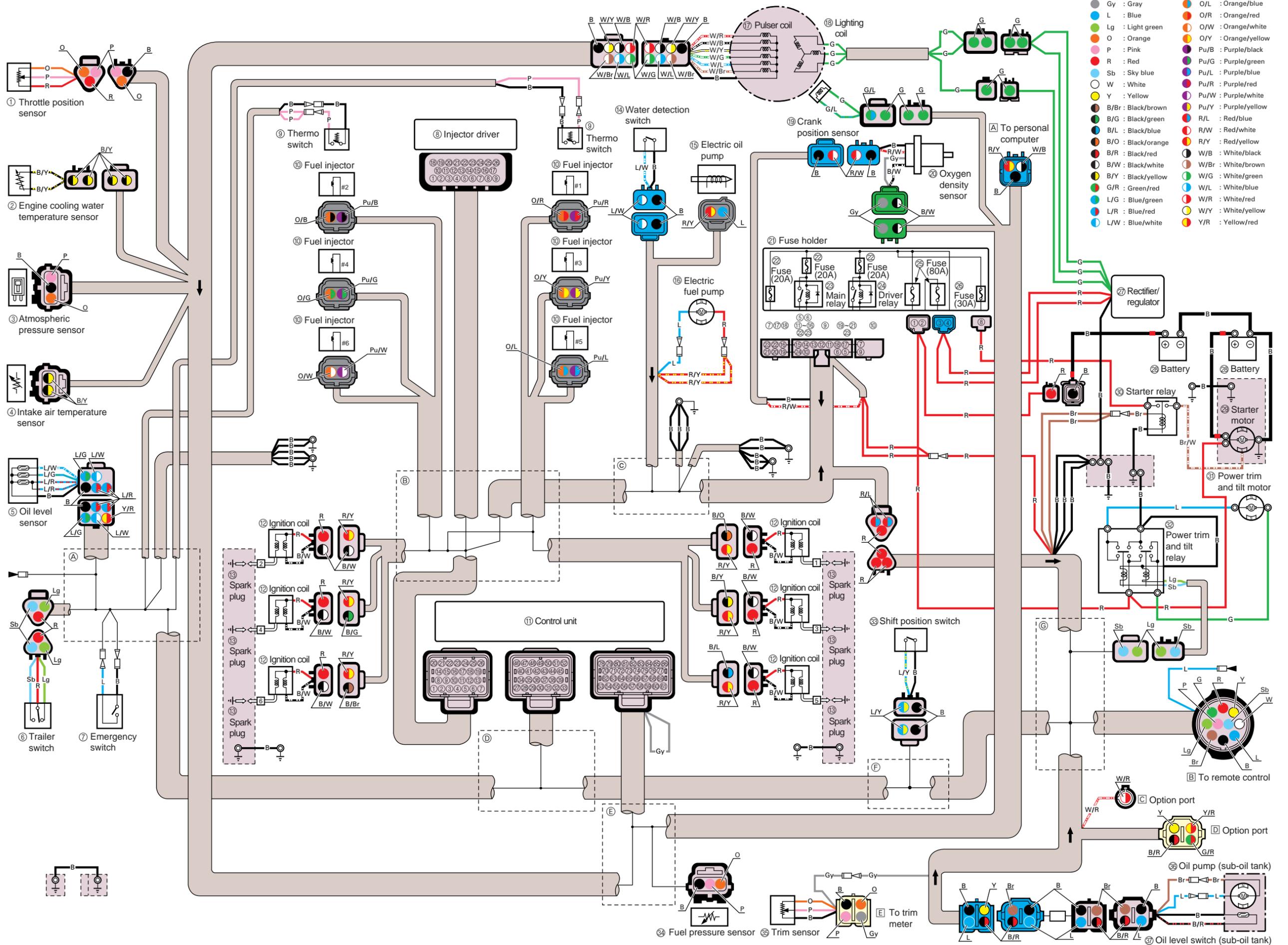
**TROUBLE SHOOTING FOR HIGH-PRESSURE DIRECT INJECTION**

Items	Symptoms
<p>1. Poor starting/ Engine will not start</p>	<p>1. No firing. The starter motor cranks the engine, but no firing is generated in the cylinder. 2. The firing is generated in the cylinder, but the engine soon stops. 3. Start-up time is too long. The engine will not start-up easily.</p>
	<p>1. Check the medium/high-pressure fuel lines.</p> <p>1) Check for fuel line leaks ↓ 2) Check the fuel pressure (vapor separator and mechanical fuel pump) → Fuel pressure is out of specification ↓ 3) Check the operation of the fuel injector ↓ 4) Check the injector driver ↓ 5) Check the diagnosis cord</p> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> <p>① Check the fuses</p> <p>② Check the electric fuel pump operation</p> <p>③ Check the main relay</p> <p>④ Check the driver relay</p> <p>⑤ Check the pressure regulator</p> <p>⑥ Check the mechanical fuel pump</p> </div> </div> <p>2. Check the ignition system.</p> <p>1) Check the wire harness ↓ 2) Check the ignition spark ↓ 3) Check the ignition coil ↓ 4) Check the CDI unit output peak voltage ↓ 5) Check the pulser coil output peak voltage ↓ 6) Check the rectifier/regulator output peak voltage ↓ 7) Check the lighting coil output peak voltage</p>

Items	Symptoms
<p>2. Erratic idling speed</p>	<p>1. The engine speed is not constant when idling.                  2. The engine stalls when the throttle lever is pulled back.                  3. The engine stalls when the throttle lever is opened or during outboard operation.</p> <p>1. Check the medium/high-pressure fuel lines.</p> <p>1) Check for fuel line leaks                  ↓                  2) Check the fuel pressure (vapor separator and mechanical fuel pump) → Fuel pressure is out of specification</p> <p>↓</p> <p>3) Check the operation of the fuel injector                  ↓                  4) Check the injector driver                  ↓                  5) Check the diagnosis cord                  ↓                  6) Check the oxygen density sensor</p> <p>① Check the fuses                  ② Check the electric fuel pump operation                  ③ Check the main relay                  ④ Check the driver relay                  ⑤ Check the pressure regulator                  ⑥ Check the mechanical fuel pump</p> <p>2. Check the ignition system.</p> <p>1) Check the wire harness                  ↓                  2) Check the ignition spark                  ↓                  3) Check the ignition coil                  ↓                  4) Check the CDI unit output peak voltage</p> <p>5) Check the pulser coil output peak voltage                  ↓                  6) Check the rectifier/regulator output peak voltage                  ↓                  7) Check the lighting coil output peak voltage</p> <p>3. Check the ignition timing.</p> <p>1) Check the diagnosis cords</p> <p>① Check the pulser coil diagnosis cord                  ② Check the crank position sensor diagnosis cord                  ③ Check the engine cooling water temperature sensor diagnosis cord                  ④ Check the fuel pressure sensor diagnosis cord                  ⑤ Check the shift position switch diagnosis cord</p>

Items	Symptoms
3. Erratic engine speed	1. The engine is started, but will not run smoothly. The engine speed drops during acceleration.
	<p>1. Check the medium/high-pressure fuel lines.</p> <p>1) Check for fuel line leaks</p> <p style="text-align: center;">↓</p> <p>2) Check the fuel pressure (vapor separator and mechanical fuel pump) → Fuel pressure is out of specification</p> <p style="text-align: center;">↓</p> <p>3) Check the operation of the fuel injector</p> <p style="text-align: center;">↓</p> <p>4) Check the injector driver</p> <p style="text-align: center;">↓</p> <p>5) Check the diagnosis cord</p> <p style="text-align: center;">↓</p> <p>6) Check the oxygen density sensor</p> <div style="float: right; margin-left: 20px;"> <p>① Check the fuses</p> <p>② Check the electric fuel pump operation</p> <p>③ Check the main relay</p> <p>④ Check the driver relay</p> <p>⑤ Check the pressure regulator</p> <p>⑥ Check the mechanical fuel pump</p> </div>
	<p>2. Check the ignition system.</p> <p>1) Check the wire harness</p> <p style="text-align: center;">↓</p> <p>2) Check the ignition spark</p> <p style="text-align: center;">↓</p> <p>3) Check the ignition coil</p> <p style="text-align: center;">↓</p> <p>4) Check the CDI unit output peak voltage</p> <p style="text-align: center;">↓</p> <p>5) Check the pulser coil output peak voltage</p> <p style="text-align: center;">↓</p> <p>6) Check the rectifier/regulator output peak voltage</p> <p style="text-align: center;">↓</p> <p>7) Check the lighting coil output peak voltage</p>
	<p>3. Check the ignition timing.</p> <p>1) Check the diagnosis cords</p> <div style="float: right; margin-left: 20px;"> <p>① Check the pulser coil diagnosis cord</p> <p>② Check the crank position sensor diagnosis cord</p> <p>③ Check the engine cooling water temperature sensor diagnosis cord</p> <p>④ Check the fuel pressure sensor diagnosis cord</p> <p>⑤ Check the shift position switch diagnosis cord</p> </div>

# WIRING DIAGRAM Z200NETO, LZ200NETO/ Z200TR, LZ200TR









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(Z200NETO, LZ200NETO)

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