YAMAHA

40X
E40X

SERVICE MANUAL

290545

66T-28197-5F-11

NOTICE

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

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

Important information

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

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

⚠ WARNING

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

CAUTION:

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

NOTE:

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

40X, E40X
SERVICE MANUAL

Printed in Japan

Contents

General information

How to use this manual

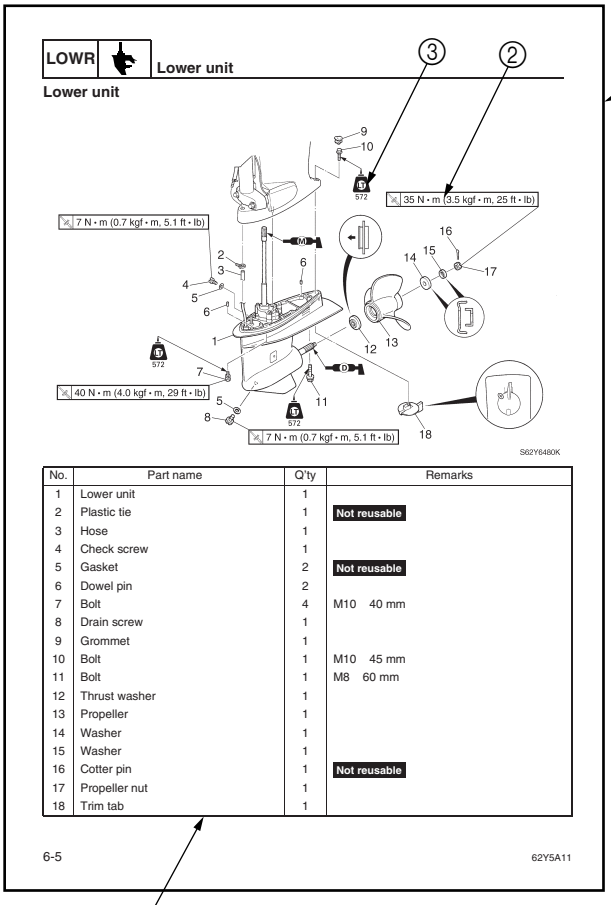
Manual format

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

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

NOTE:

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



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

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④

⑤

LOWR Lower unit

Removing the drive shaft

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

S62Y6850K

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

Disassembling the drive shaft

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

S62Y6735K

CAUTION:

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

Bearing inner race attachment ③: 90890-06639

Disassembling the forward gear

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

S62Y6740K

CAUTION:

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

Bearing separator ①: 90890-06534

2. Remove the needle bearing from the forward gear.

S62Y6750K

CAUTION:

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

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

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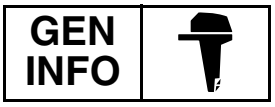
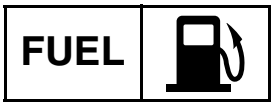
Symbols

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

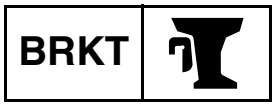
General information



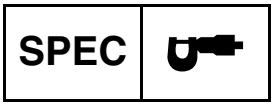
Fuel system



Bracket unit

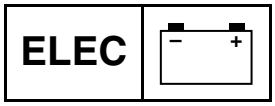


Specifications

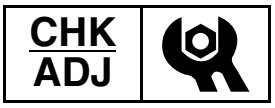


Power unit

Electrical systems

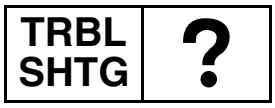


Periodic checks and adjustments

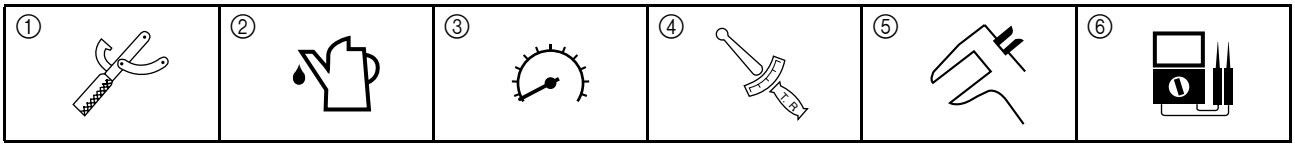


Lower unit

Troubleshooting

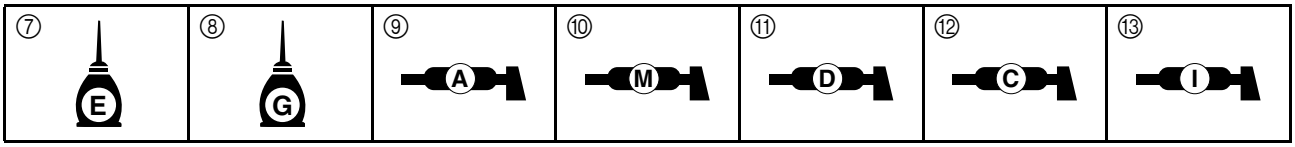


Symbols ① to ⑥ indicate specific data.



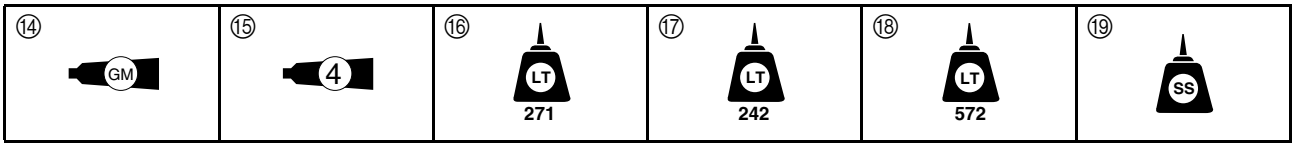
① Special tool
② Specified oil or fluid
③ Specified engine speed
④ Specified tightening torque
⑤ Specified measurement
⑥ Specified electrical value (resistance, voltage, electric current)

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



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

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



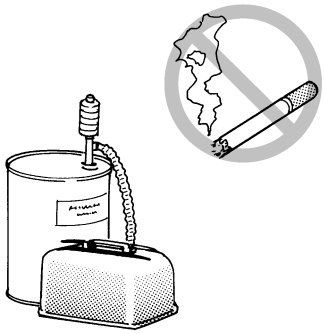
⑭ Apply Gasket Maker
⑮ Apply Yamabond No. 4
⑯ Apply LOCTITE 271 (red)
⑰ Apply LOCTITE 242 (blue)
⑱ Apply LOCTITE 572
⑲ Apply silicon sealant

Safety while working

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

Fire prevention

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



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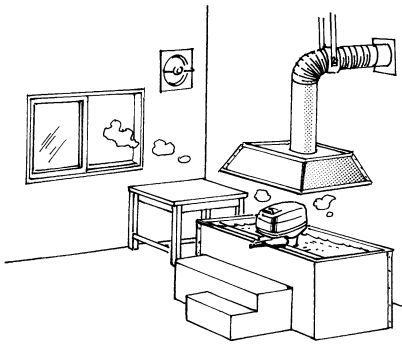
Ventilation

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



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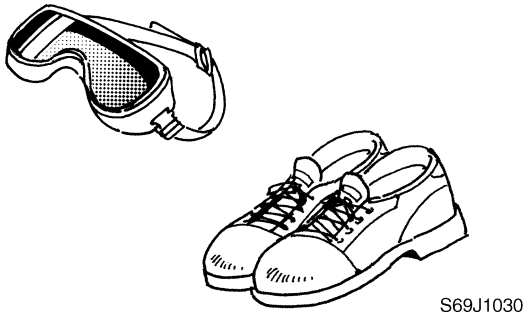
Self-protection

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



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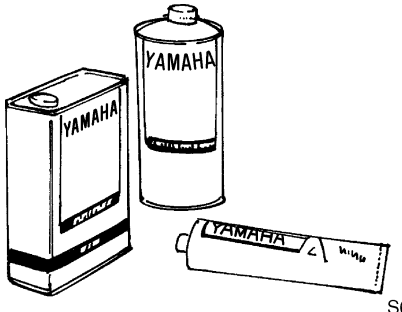
Parts, lubricants, and sealants

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



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

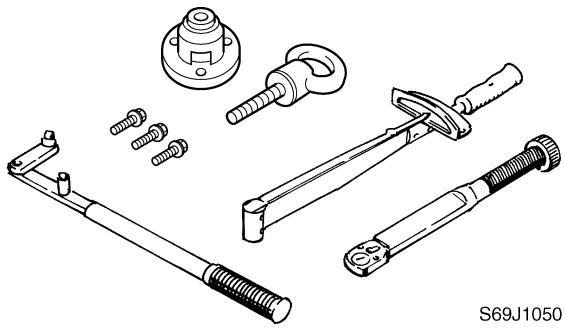
1. Maintain good standards of personal and industrial hygiene.
2. Change and wash clothing as soon as possible if soiled with lubricants.
3. Avoid contact with skin. Do not, for example, place a soiled rag in your pocket.
4. Wash hands and any other part of the body thoroughly with soap and hot water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

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

Good working practices

Special service tools

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



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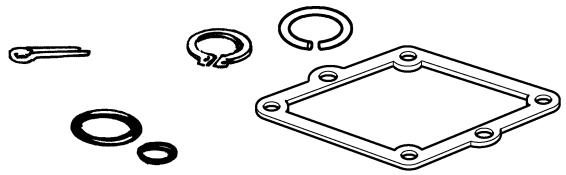
Tightening torques

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

Non-reusable parts

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



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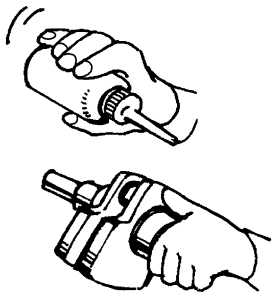
Disassembly and assembly

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

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



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

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

5. Check that moving parts operate normally after assembly.

Identification

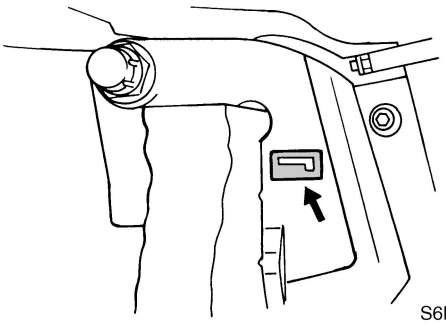
Applicable models

This manual covers the following models.

Applicable models
40XWH, 40XW, E40XMH, E40XW

Serial number

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



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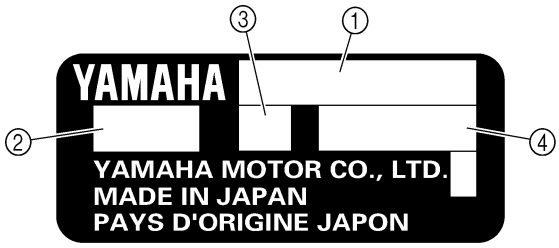


S69J1090N

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

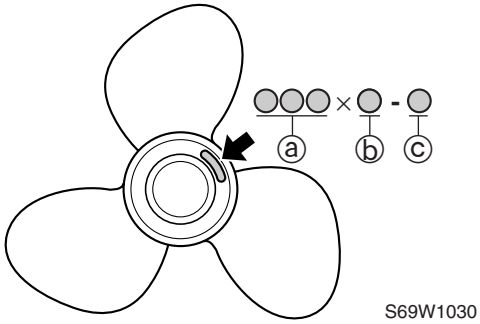
Model name	Approved model code	Starting serial No.
40XWH	66TK	1008141–
40XW		
E40XMH		
E40XW		

Propeller selection

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

Propeller size

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



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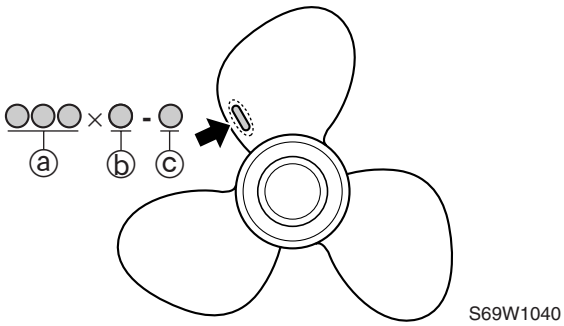

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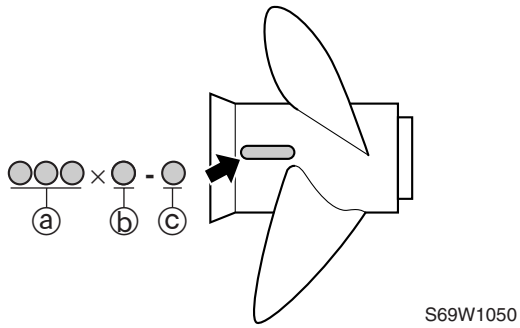


S69W1050

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

Selection

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

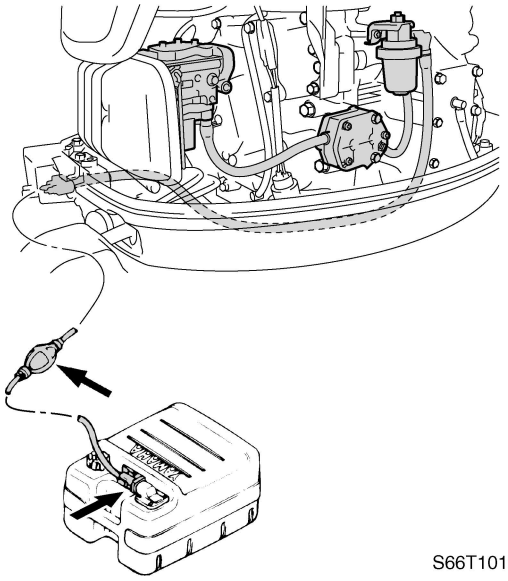
Propeller size (in)	Material
10 1/4 × 14 - G	Aluminum
10 1/4 × 15 - G	
10 1/4 × 16 - G	
10 3/4 × 16 - G	
10 3/4 × 17 - G	
11 × 15 - G	
11 1/8 × 13 - G	
11 1/4 × 14 - G	
11 3/8 × 12 - G	
11 1/2 × 13 - G	
11 5/8 × 11 - G	
11 3/4 × 10 - G	
11 3/4 × 12 - G	
12 × 11 - G	
12 1/4 × 8 - G	
12 1/4 × 9 - G	

Predelivery checks

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

Checking the fuel system

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



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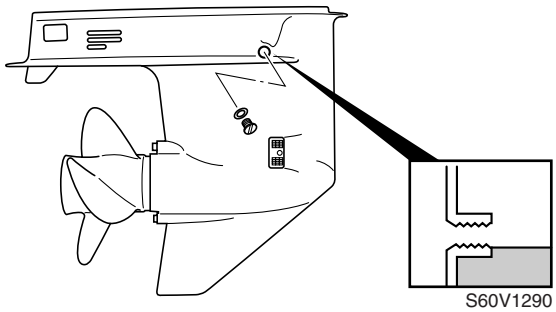
CAUTION:

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

Checking the gear oil level

1. Check the gear oil level.



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Checking the battery (WH, W)

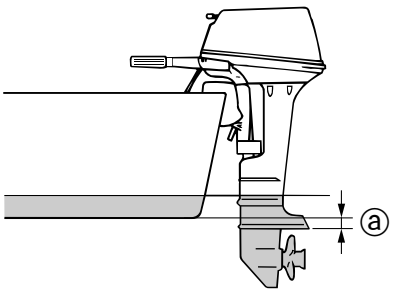
1. Check the capacity, electrolyte level, and specified gravity of the battery.

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

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

Checking the outboard motor mounting height

1. Check that the anti-cavitation plate is between the bottom of the boat and a maximum of 25 mm (1 in) ⓐ below it. If the mounting height is too high, cavitation will occur and propulsion will be reduced. Also, the engine speed will increase abnormally and cause the engine to overheat. If the mounting height is too low, water resistance will increase and reduce engine efficiency.



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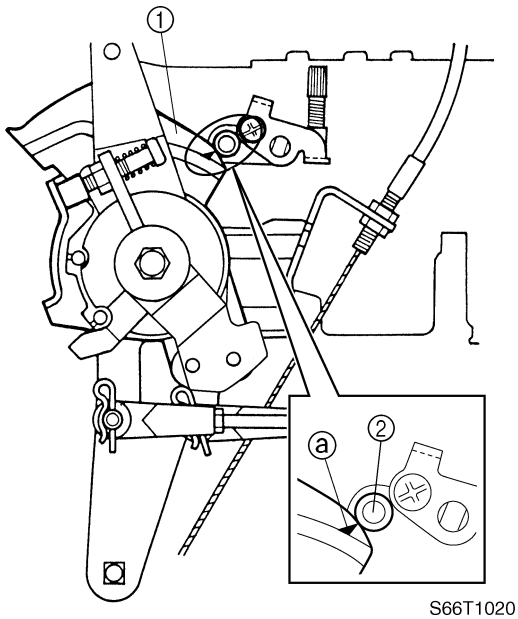
NOTE:
The optimum mounting height is affected by the combination of the boat and the outboard motor. To determine the optimum mounting height, test run the outboard motor at different heights.

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

Checking the remote control cables (remote control model)

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

2. Check that the throttle cam ① is in its fully closed position and align the center of the throttle cam roller ② with the mark ⓐ on the throttle cam.



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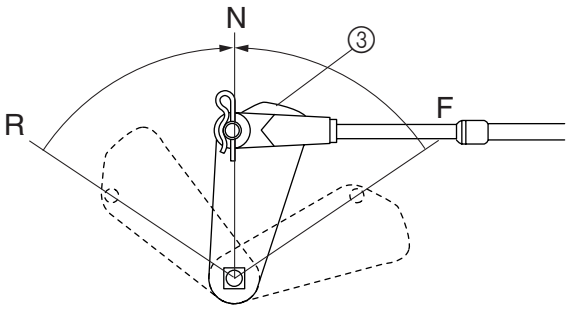
3. Check that the shift link lever ③ is in the neutral position.



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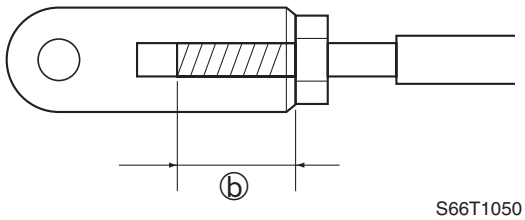
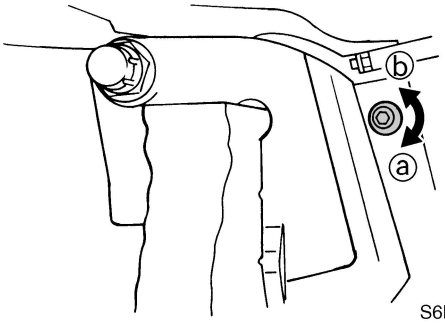


S66T1050

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

Checking the steering system

1. Check the steering friction for proper adjustment.



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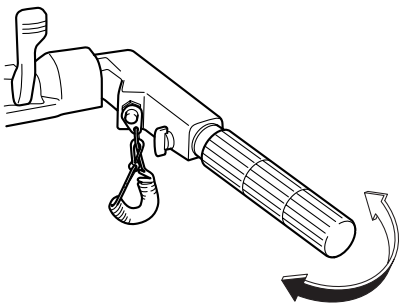
NOTE:
- To increase the friction, turn the friction adjusting bolt in direction ⓐ.
- To decrease the friction, turn the friction adjusting bolt in direction ⓑ.

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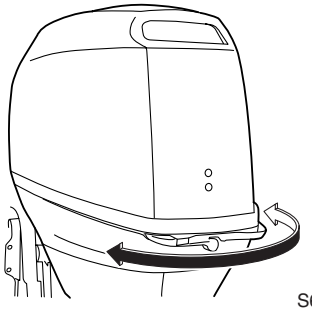
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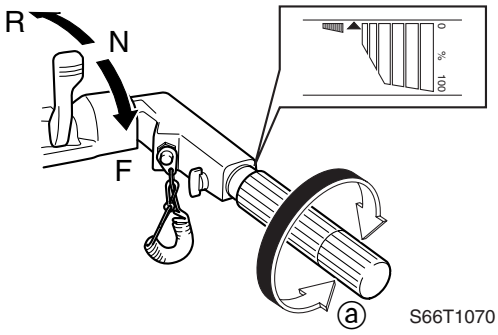
3. Check that there is no interference with wires or hoses when the outboard motor is steered.

Checking the gear shift and throttle operation

1. Check that the gear shift operates smoothly when the remote control lever or shift lever is shifted from neutral to forward or reverse.

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



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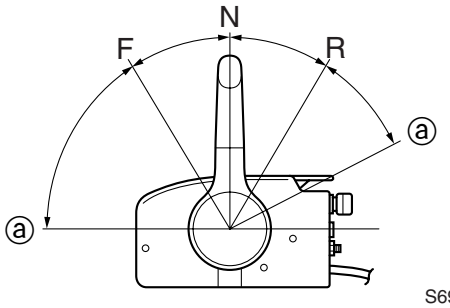
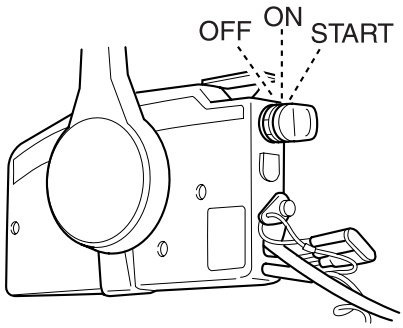


S69J1210

Checking the engine start switch and engine stop lanyard switch

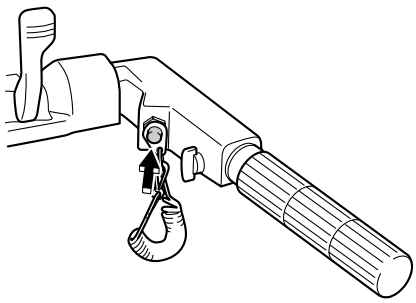
1. Check that the engine starts when the engine start switch is turned to START.

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



S60V1070

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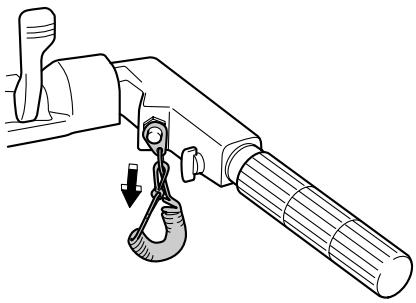
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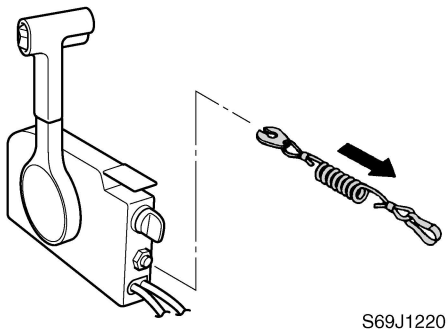
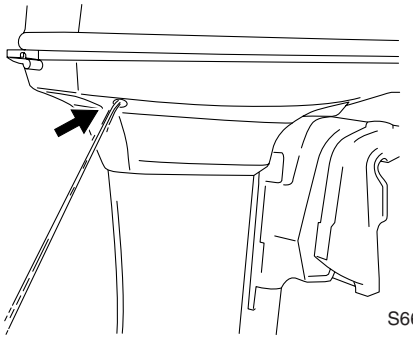

S69J1220

Checking the cooling water pilot hole

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


S66T3050

Test run

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

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

3. Operate at trolling speed.

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

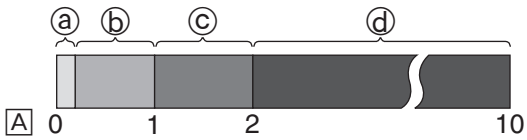
5. Check that the outboard motor does not tilt up when shifting into reverse and that water does not flow in over the transom.

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

Break-in

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

1. First 10 minutes ⓐ of operation at idle
2. Fifty minutes ⓑ at 3,000 r/min or less
3. One hour ⓒ at 4,000 r/min or less
4. Eight hours ⓓ at 5,000 r/min or less with repeated wide-open-throttle operation for 5 minutes or less



S60V1120

A Hour

After test run

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

— MEMO —

Specifications

General specifications

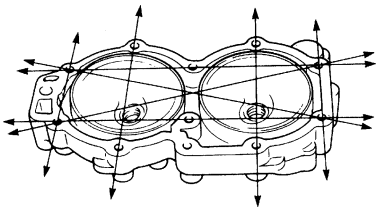
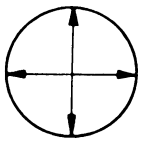
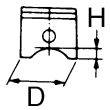
Item	Unit	Model			
		40XWH	40XW	E40XMH	E40XW
Dimension					
Overall length	mm (in)	1,073 (42.2)	675 (26.6)	1,073 (42.2)	675 (26.6)
Overall width	mm (in)	402 (15.8)	362 (14.3)	402 (15.8)	362 (14.3)
Overall height					
(S)	mm (in)	—	1,237 (48.7)		—
(L)	mm (in)	1,364 (53.7)	—	1,364 (53.7)	
(X)	mm (in)	—		1,476 (58.1)	—
Boat transom height					
(S)	mm (in)	—	381 (15.0)		—
(L)	mm (in)	508 (20.0)	—	508 (20.0)	
(X)	mm (in)	—		635 (25.0)	—
Weight					
(with aluminum propeller)					
(S)	kg (lb)	—	74.6 (164.5)	72.0 (158.8)	—
(L)	kg (lb)	78.0 (172.0)	—	73.6 (162.3)	76.2 (168.0)
(X)	kg (lb)	—		76.7 (169.1)	—
Performance					
Maximum output	kW (hp)	29.4 (40) at 5,000 r/min			
Full throttle operating range	r/min	4,500–5,500			
Maximum fuel consumption	L (US gal, Imp gal)/hr	20 (5.3, 4.4) at 5,500 r/min			
Engine idle speed	r/min	950–1,050			
Power unit					
Type		2-stroke			
Cylinder quantity		L2			
Total displacement	cm^3 (cu. in)	703 (42.9)			
Bore × stroke	mm (in)	80.0 × 70.0 (3.15 × 2.76)			
Compression ratio		6.0			
Intake system		Reed valve			
Scavenging system		Loop charge			
Control system		Tiller handle	Remote control	Tiller handle	Remote control
Starting system		Manual and electric		Manual	Manual and electric
Fuel system		Carburetor			
Ignition control system		CDI			
Maximum generator output	V, A	12, 6.0		—	12, 6.0
Starting enrichment		Choke valve			
Spark plug		B7HS (NGK), BR7HS (NGK)			
Cooling system		Water			
Exhaust system		Propeller boss			
Lubrication system		Pre-mixed fuel			

Item	Unit	Model			
		40XWH	40XW	E40XMH	E40XW
Fuel and oil					
Fuel type		Regular gasoline			
Engine oil		2-stroke outboard motor oil			
Engine oil grade	NMMA-certified	TC-W3			
Fuel and oil mixing ratio		50:1			
Gear oil type		Hypoid gear oil			
Gear oil grade(*1)	API	GL-4			
	SAE	90			
Gear oil quantity	cm^3 (US oz, Imp oz)	430 (14.54, 15.17)			
Bracket unit					
Tilt angle (at 12° boat transom)	Degree	8, 12, 16, 20, 24			
Tilt-up angle	Degree	68			
Steering angle	Degree	45 + 45			
Drive unit					
Gear shift positions		F-N-R			
Gear ratio		2.00 (26/13)			
Reduction gear type		Spiral bevel gear			
Clutch type		Dog clutch			
Propeller shaft type		Spline			
Propeller direction (rear view)		Clockwise			
Propeller mark		G			
Electrical					
Battery minimum capacity(*2)					
CCA/EN	A	430		—	430
20HR/IEC	Ah	70		—	70

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

Maintenance specification

Power unit

Item	Unit	Model			
		40XWH	40XW	E40XMH	E40XW
Power unit					
Minimum compression pressure(*1)	kPa (kgf/cm², psi)	630 (6.3, 91)			
Cylinder heads					
Warpage limit	mm (in)	0.1 (0.0039)			
 (lines indicate straightedge position)					
Cylinders					
Bore size 	mm (in)	80.000–80.020 (3.1496–3.1504)			
Bore size limit	mm (in)	80.100 (3.1535)			
Taper limit	mm (in)	0.08 (0.0032)			
Out-of-round limit	mm (in)	0.05 (0.0020)			
Pistons					
Piston diameter (D) 	mm (in)	79.910–79.934 (3.1461–3.1470)			
Measuring point (H)	mm (in)	10 (0.39)			
Piston-to-cylinder clearance	mm (in)	0.085–0.090 (0.0033–0.0035)			
(Limit)	mm (in)	0.14 (0.0055)			
Piston pin boss bore	mm (in)	19.904–19.915 (0.7836–0.7841)			
Oversize piston					
1st	mm (in)	0.25 (0.010)			
2nd	mm (in)	0.50 (0.020)			
Oversize piston diameter					
1st	mm (in)	80.160–80.184 (3.1559–3.1568)			
2nd	mm (in)	80.410–80.434 (3.1657–3.1667)			
Piston pins					
Outside diameter	mm (in)	19.895–19.900 (0.7833–0.7835)			

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

Item	Unit	Model			
		40XWH	40XW	E40XMH	E40XW
Piston rings					
Top ring					
Dimension B	mm (in)	1.97–1.99 (0.0776–0.0783)			
Dimension T	mm (in)	2.40–2.60 (0.0945–0.1024)			
End gap	mm (in)	0.30–0.50 (0.0118–0.0197)			
Side clearance	mm (in)	0.04–0.08 (0.0015–0.0031)			
Oversize diameter					
1st	mm (in)	80.250 (3.1594)			
2nd	mm (in)	80.500 (3.1693)			
2nd piston ring					
Dimension B	mm (in)	1.97–1.99 (0.0776–0.0783)			
Dimension T	mm (in)	2.40–2.60 (0.0945–0.1024)			
End gap	mm (in)	0.30–0.50 (0.0118–0.0197)			
Side clearance	mm (in)	0.03–0.07 (0.0012–0.0028)			
Oversize diameter					
1st	mm (in)	80.250 (3.1594)			
2nd	mm (in)	80.500 (3.1693)			
Connecting rods					
Small-end inside diameter	mm (in)	24.900–24.912 (0.9803–0.9808)			
Big-end side clearance	mm (in)	0.200–0.700 (0.0079–0.0276)			
Small-end axial play limit	mm (in)	2.0 (0.08)			
Crankshaft					
Crankshaft width A	mm (in)	63.90–63.95 (2.5157–2.5177)			
Crankshaft width B	mm (in)	40.88–41.10 (1.6094–1.6181)			
Crankpin diameter	mm (in)	26.995–27.000 (1.0628–1.0630)			
Runout limit	mm (in)	0.03 (0.0012)			
Thermostats					
Opening temperature	°C (°F)	48–52 (118–126)			
Fully open temperature	°C (°F)	60 (140)			
Valve open lower limit	mm (in)	3.0 (0.12)			
Reed valves					
Valve stopper height limit	mm (in)	10.2–10.4 (0.40–0.41)			
Valve bending limit	mm (in)	0.2 (0.008)			

Item	Unit	Model			
		40XWH	40XW	E40XMH	E40XW
Carburetor					
ID mark		66T02	66T12	66T02	66T12
Main jet	#	170			
Main air jet	#	160			
Pilot jet	#	70			
Pilot air jet	#	60			
Pilot screw	turns out	1 3/8–1 7/8			
Float height	mm (in)	16.5–18.5 (0.65–0.73)			

Lower unit

Item	Unit	Model			
		40XWH	40XW	E40XMH	E40XW
Gear backlash					
Pinion-to-forward gear	mm (in)	0.19–0.56 (0.0075–0.0220)			
Pinion-to-reverse gear	mm (in)	0.75–1.13 (0.0295–0.0445)			
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	Unit	Model			
		40XWH	40XW	E40XMH	E40XW
Ignition and ignition control system					
Ignition timing (cylinder #1)	Degree Degree	ATDC2 at engine idle speed BTDC23 at 5,000 r/min			
Spark plug gap	mm (in)	0.6–0.7 (0.024–0.028)			
Spark plug cap resistance (with resister type)	kΩ	4.0–6.0			
Ignition coil resistance					
Primary coil (B/W – B)					
at 20 °C (68 °F)	Ω	0.32–0.44			
Secondary coil (B/W – spark plug wire)					
at 20 °C (68 °F)	kΩ	5.4–7.4			
CDI unit output peak voltage (B/O – B, B/W – B)					
at cranking (loaded)	V	180			
at 1,500 r/min (loaded)	V	180			
at 3,500 r/min (loaded)	V	170			

Item	Unit	Model			
		40XWH	40XW	E40XMH	E40XW
Pulser coil output peak voltage (W/R – W/B)					
at cranking (unloaded)	V	7.0			
at cranking (loaded)	V	4.0			
at 1,500 r/min (loaded)	V	10.0			
at 3,500 r/min (loaded)	V	17.0			
Pulser coil resistance(*1) (W/R – W/B)	Ω	311.4–380.6			
Starter motor					
Type		Bendix		—	Bendix
Brushes					
Length limit	mm (in)	6.4 (0.25)		—	6.4 (0.25)
Armature					
Commutator undercut limit	mm (in)	0.8 (0.03)		—	0.8 (0.03)
Charging system					
Fuse	A	10			
Charge coil output peak voltage (Positive side: Br – Negative side: L)					
at cranking (unloaded)	V	330			
at cranking (loaded)	V	190			
at 1,500 r/min (loaded)	V	190			
at 3,500 r/min (loaded)	V	190			
Charge coil resistance (Br – L)	Ω	684–836			
Lighting coil output peak voltage(*1) (G – G)					
at cranking (unloaded)	V	6.0		—	6.0
at 1,500 r/min (unloaded)	V	16.0		—	16.0
at 3,500 r/min (unloaded)	V	33.0		—	33.0
Lighting coil resistance(*1) (G – G)	Ω	0.31–0.37		—	0.31–0.37
Rectifier output peak voltage (R – B)					
at 1,500 r/min (unloaded)	V	14.0		—	14.0
at 3,500 r/min (unloaded)	V	32.0		—	32.0

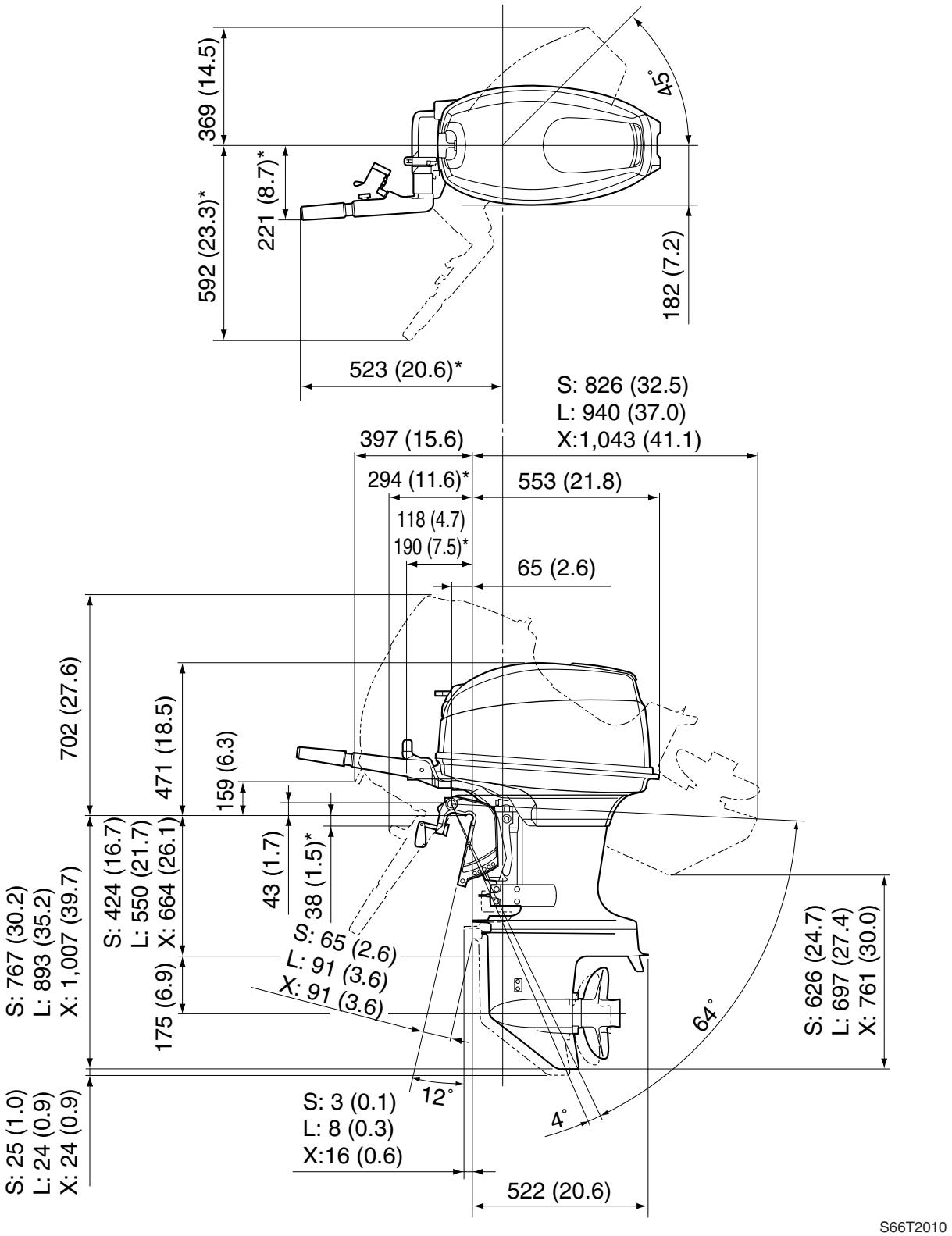
(*1) The figures are for reference only.

Dimensions

Exterior

* Tiller handle model only

mm (in)



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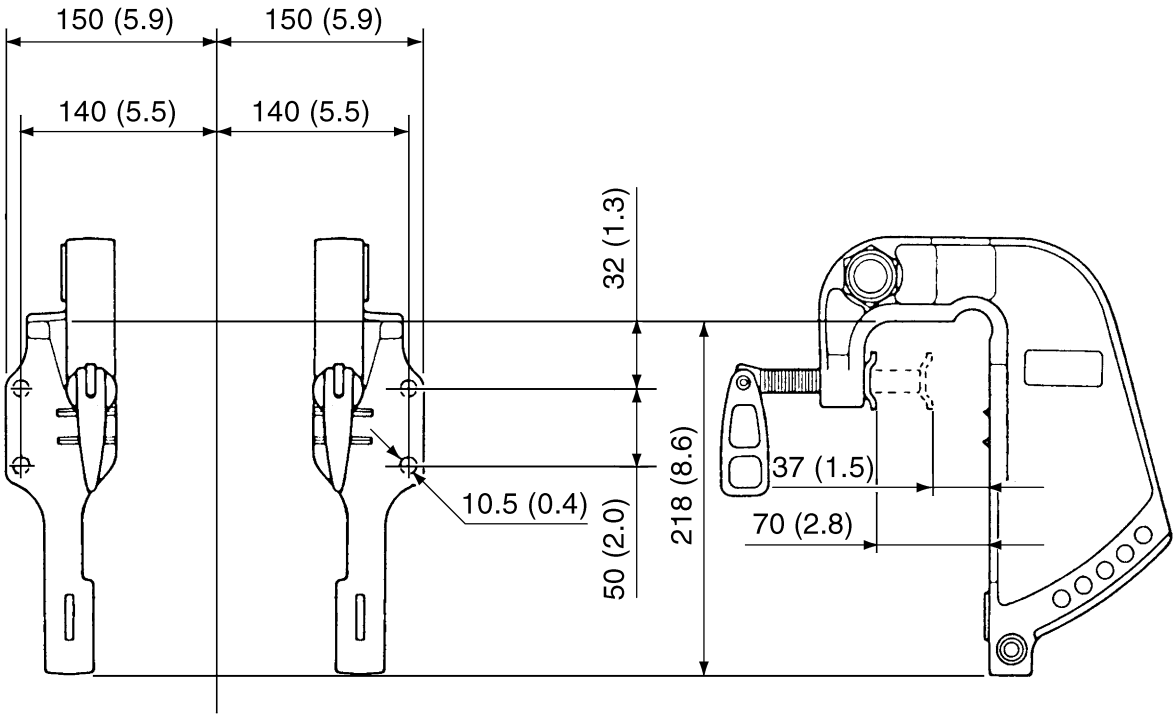
Clamp bracket

mm (in)



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Tightening torques

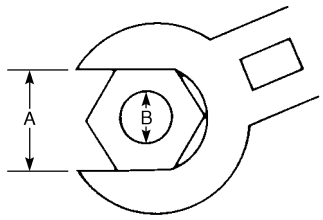
Specified torques

Part to be tightened		Thread size	Tightening torques		
			N·m	kgf·m	ft·lb
Fuel system					
Intake silencer screw		M6	2	0.2	1.5
Power unit					
Power unit mounting bolt		M8	21	2.1	15.5
Engine start button nut		M16	5	0.5	3.7
Starter rope guide bolt		M6	8	0.8	5.9
Manual starter roller bolt		M6	3	0.3	2.2
Sheave drum bolt		M6	5	0.5	3.7
Flywheel magnet nut		M20	157	15.7	115.8
Starter motor bolt		M8	21	2.1	15.5
Starter motor terminal nut		M8	7	0.7	5.2
Starter relay terminal nut		M6	4	0.4	3.0
Ignition coil bolt		M6	8	0.8	5.9
Rectifier screw		M5	3	0.3	2.2
Intake manifold bolt	1st	M6	6	0.6	4.4
	2nd		12	1.2	8.9
Reed valve screw		M5	2	0.2	1.5
Cylinder head bolt	1st	M8	15	1.5	11.1
	2nd		30	3.0	22.1
Cylinder head cover bolt	1st	M6	6	0.6	4.4
	2nd		12	1.2	8.9
Exhaust cover bolt	1st	M6	6	0.6	4.4
	2nd		12	1.2	8.9
Spark plug		—	25	2.5	18.4
Crankcase bolt	1st	M10	20	2.0	14.8
	2nd		40	4.0	29.5
Lower unit					
Gear oil drain screw		—	9	0.9	6.6
Gear oil check screw		—	9	0.9	6.6
Lower case mounting bolt		M10	40	4.0	29.5
Cooling water inlet cover screw		M5	4	0.4	3.0
Propeller nut		M16	40	4.0	29.5
Propeller shaft housing bolt		M8	16	1.6	11.8
Pinion nut		M12	74	7.4	54.6

Part to be tightened	Thread size	Tightening torques		
		N·m	kgf·m	ft·lb
Bracket unit				
Tiller handle bracket nut	M10	10	1.0	7.4
Self-locking nut	M10	41	4.1	30.2
Engine stop lanyard switch nut	—	2	0.2	1.5
Battery lead holder screw	M6	2	0.2	1.5
Throttle grip screw	M5	3	0.3	2.2
Neutral switch nut	—	7	0.7	5.2
Upper mounting nut	M8	24	2.4	17.7
Upper mount bolt	M8	27	2.7	20.0
Mount housing nut	M10	54	5.4	39.8
Steering friction adjusting bolt	M8	4	0.4	3.0
Upper case bolt	M8	21	2.1	15.5
Exhaust manifold bolt	M8	21	2.1	15.5
Self-locking nut	M22	45	4.5	33.2
Tilt stopper plate nut	M8	24	2.4	17.7
Grease nipple	—	3	0.3	2.2
Clamp bracket nut	M8	18	1.8	13.3
Tilt lever screw	M5	4	0.4	3.0

General torques

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



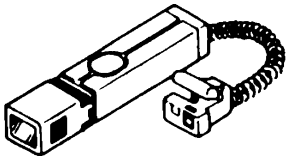
S69J2150

Nut (A)	Bolt (B)	General torque specifications		
		N·m	kgf·m	ft·lb
8 mm	M5	5	0.5	3.6
10 mm	M6	8	0.8	5.8
12 mm	M8	18	1.8	13
14 mm	M10	36	3.6	25
17 mm	M12	43	4.3	31

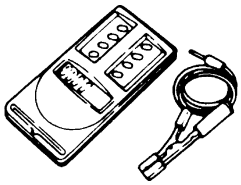
— MEMO —

Periodic checks and adjustments

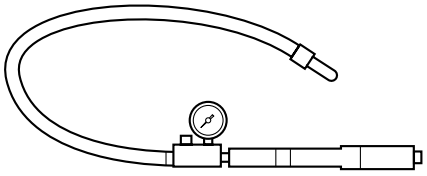
Special service tools



Timing light
90890-03141



Digital tachometer
90890-06760



Leakage tester
90890-06840

Maintenance interval chart

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

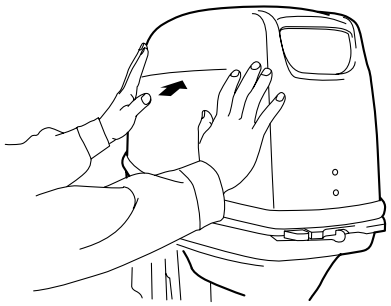
Item	Remarks	Initial		Every		Refer to page
		10 hours (1 month)	50 hours (3 months)	100 hours (6 months)	200 hours (1 year)	
Anodes (external)	Check/replace		○	○		
Anodes (internal)	Check/replace				○	
Battery	Check/charge	○				
Cooling water passages	Clean		○	○		
Top cowling	Check				○	
Fuel filter (can be disassembled)	Check/replace	○	○	○		
Fuel system	Check	○	○	○		
Fuel tank (Yamaha portable tank)	Check/clean				○	
Gear oil	Change	○		○		
Lubrication points	Lubricate			○		
Engine idle speed (carburetor models)	Check/adjust	○		○		
Propeller and cotter pin	Check/replace		○	○		
Shift link/shift cable	Check/adjust				○	
Thermostat	Check				○	
Throttle link/throttle cable/ throttle pick-up timing	Check/adjust				○	
Water pump	Check				○	
Spark plugs	Clean/adjust/ replace	○	○	○		

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

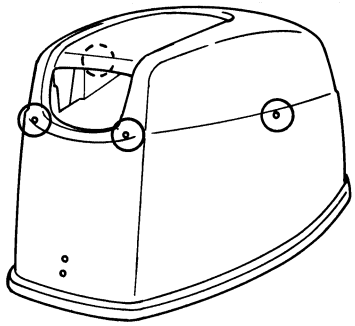
Top cowling

Checking the top cowling

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


S66T3010

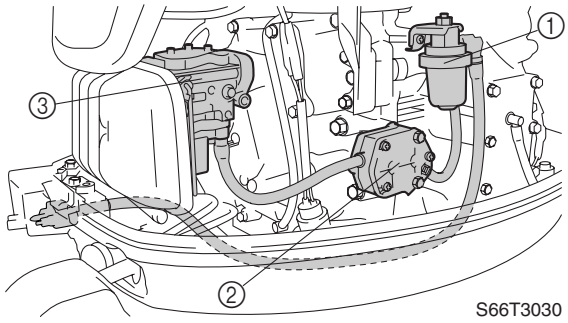
2. Check the water separator drain holes for obstructions. Clean if necessary.


S66T3020

Fuel system

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

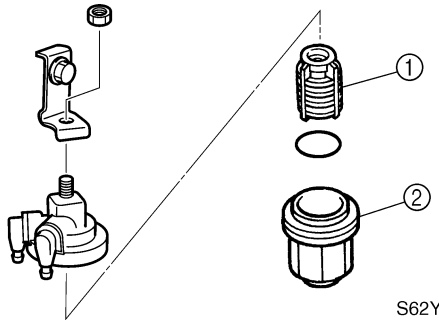
1. Check the fuel hose connections and fuel joints for leaks. Replace if necessary. Also, check the fuel filter ①, fuel pump ②, and carburetor ③ for leaks or deterioration. Replace if necessary.



S66T3030

Checking the fuel filter

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



S62Y3040K

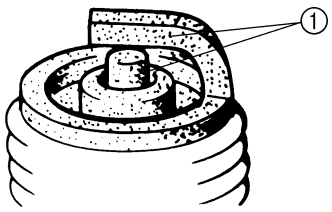
NOTE:
Be sure not to spill any fuel when removing the fuel filter cup.

Power unit

Checking the spark plugs

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

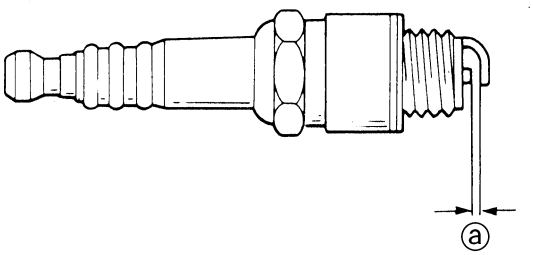
2. Clean the electrodes ① with a spark plug cleaner or wire brush. Replace the spark plug if necessary.



S69J3190

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

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



S66T3320

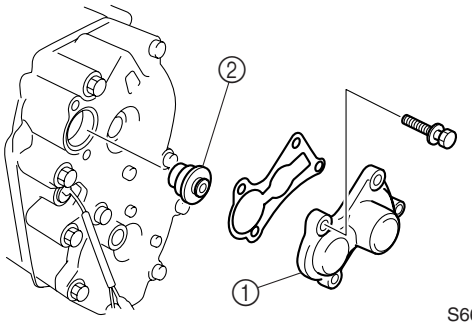
Specified spark plug:
B7HS (NGK), BR7HS (NGK)
Spark plug gap ⓐ:
0.6–0.7 mm (0.024–0.028 in)

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

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

Checking the thermostat

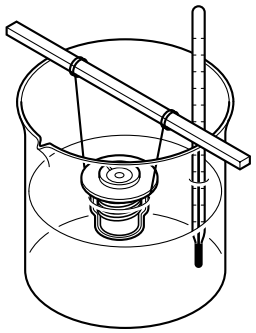
1. Remove the cover ① and thermostat ②.



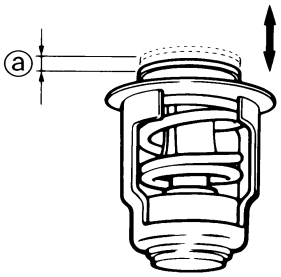
S66T3040

2. Suspend the thermostat in a container of water.

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


S69J5E40

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



S69J5E50

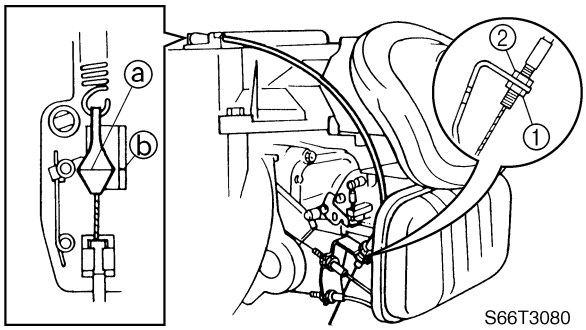
Water temperature	Valve lift ⓐ
48–52 °C (118–126 °F)	0.05 mm (0.0020 in) (valve begins to lift)
above 60 °C (140 °F)	more than 3.0 mm (0.12 in)

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

Adjusting the start-in-gear protection

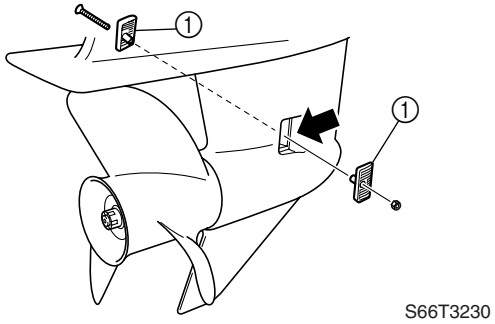
1. Set the gear shift to the neutral position.

2. Loosen the lock nut ①, and then adjust the start-in-gear protection adjusting nut ② until the point ⓐ on the wire connector aligned with the mark ⓑ on the manual starter case.



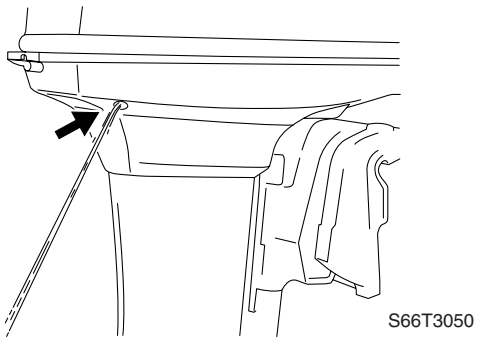
Checking the cooling water passage

1. Check the cooling water inlet cover ① and cooling water inlet for clogs. Clean if necessary.



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

3. Check for water flow at the cooling water pilot hole. If there is no water flow, check the cooling water passage inside the outboard motor.



Control system

Adjusting the ignition timing

1. Make sure that the engine is stopped before adjusting the ignition timing.

2. Loosen the throttle cables or remove the remote control cable.

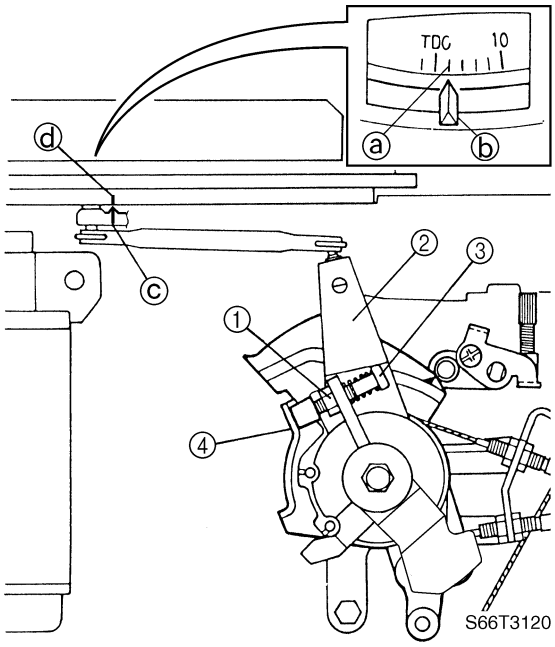
3. Turn the flywheel magnet clockwise so that ATDC 2° line ⓐ aligns with the mark ⓑ on the manual starter case.

4. Loosen the locknut ①.

5. Turn the throttle control lever ② so that the full-retard screw ③ contacts the stopper ④.

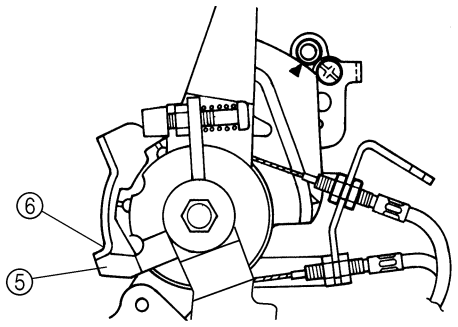
6. Adjust the full-retard screw ③ so that the timing indicator ⓒ aligns with the mark ⓓ on the flywheel magnet.

7. Tighten the locknut ①.



8. Adjust the throttle cables or remote control cable.

9. Shift the remote control lever or shift lever to forward or reverse, and then check that the stopper ⑤ on the throttle control lever contacts the stopper ⑥ on the throttle cable bracket when the throttle is fully open.



S66T3130

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

11. Check the ignition timing with a timing light and, if necessary, repeat steps 1–10.

Ignition timing at engine idle speed:
ATDC 2°

Adjusting the throttle cables (MH, WH)

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

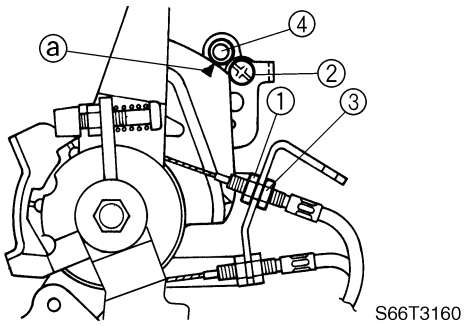
1. Loosen the locknut ①.

2. Loosen the throttle-cam-roller adjusting screw (left-hand threads) ②.

3. Turn the throttle grip to the fully open position.

4. Adjust the throttle cable adjusting nut ③ until the center of the throttle cam roller ④ aligns with the mark ⓐ on the throttle cam.

5. Tighten the locknut.



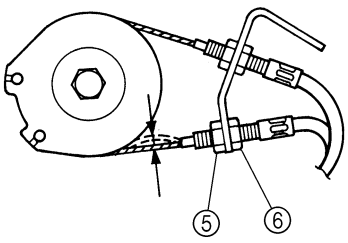
S66T3160

6. Turn the throttle grip to the fully closed position.

7. Loosen the locknut ⑤.

8. Contact the full-retard screw ⑦ to the stopper ⑧, and then turn the adjusting nut ⑥ in or out until the specified throttle cable free play is obtained.

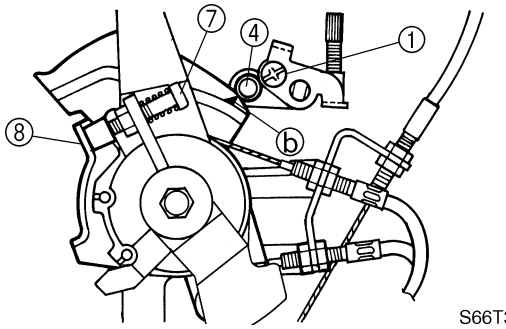
9. Tighten the locknut ⑤.



S66T3240

Throttle cable free play:
1 mm (0.04 in)

10. Align the center of the throttle cam roller ④ with the mark ⓑ on the throttle cam, and then tighten the throttle-cam-roller adjusting screw ①.



S66T3170

11. Check that the center of the throttle cam roller ④ aligns with the mark ⓐ on the throttle cam when the throttle grip is turned to the fully open position.

12. Check that the full-retard screw ⑦ contacts the stopper ⑧ and that the center of the throttle cam roller ④ is aligned with the mark ⓑ on the throttle cam when the throttle grip is turned to the fully closed position.

13. If necessary, repeat steps 1–12.

Adjusting the throttle cable (W)

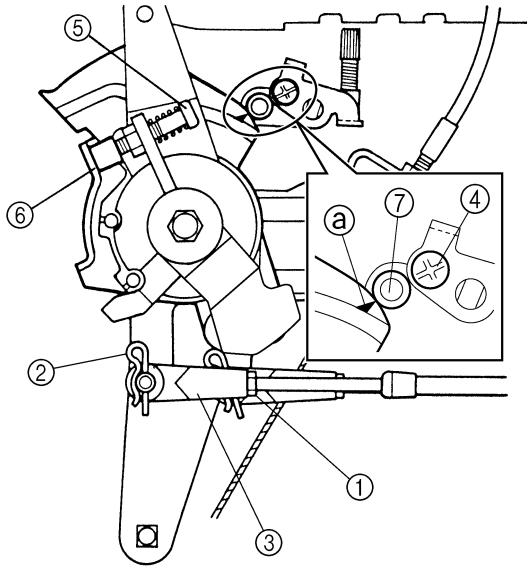
NOTE:
Before adjusting the throttle cable, the throttle stop screw should be properly adjusted.

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

2. Set the remote control lever to the neutral position.

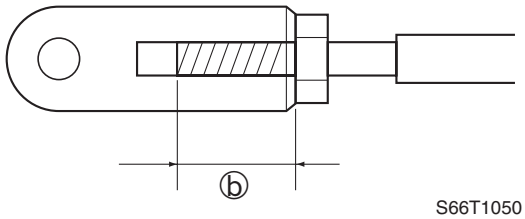
3. Loosen the throttle-cam-roller adjusting screw (left-hand threads) ④.

4. Check that the full-retard screw ⑤ contacts the stopper ⑥ and that the center of the throttle cam roller ⑦ is aligned with the mark ⓐ on the throttle cam.



S66T3140

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



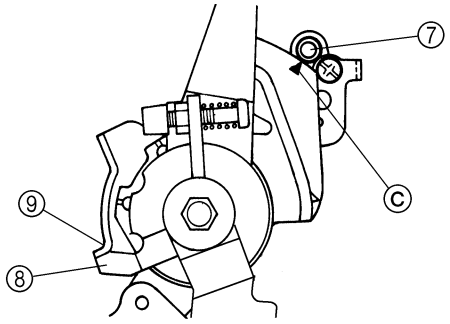
S66T1050

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

6. Connect the cable joint, install the clip, and then tighten the locknut.

7. Align the center of the throttle cam roller ⑦ with the mark ⓐ on the throttle cam, and then tighten the throttle-cam-roller adjusting screw ④.

8. Check that the stopper ⑧ on the throttle control lever contacts the stopper ⑨ on the throttle cable bracket and that the center of the throttle cam roller ⑦ is aligned with the mark ⓒ on the throttle cam when the remote control lever is fully open position.



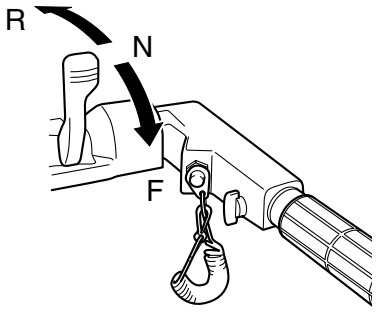
S66T3150

9. Check that the full-retard screw ⑤ contacts the stopper ⑥ and that the center of the throttle cam roller ⑦ is aligned with the mark ⓐ on the throttle cam when the remote control lever is fully closed position.

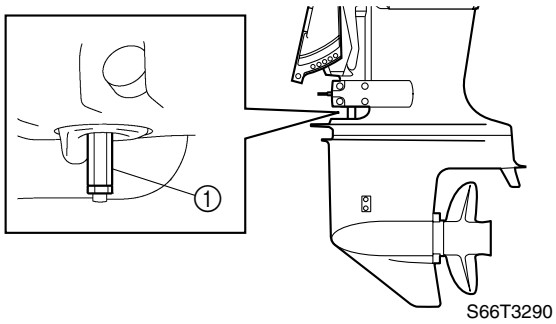
10. If necessary, repeat steps 1–9.

Checking the gear shift operation (MH, WH)

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



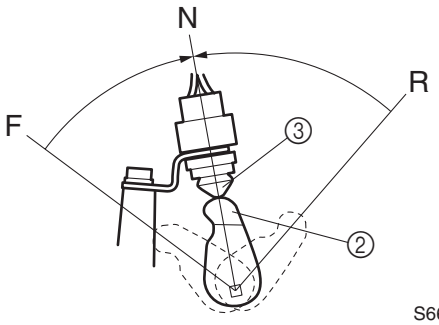
S66T3250



S66T3290

2. Set the gear shift to the neutral position.

3. Check that the neutral switch lever ② on the shift lever assembly is pushing the neutral switch ③. (WH)



S66T3260

Checking the gear shift operation (W)

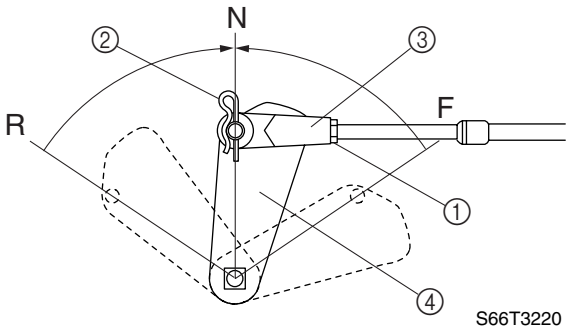
1. Check that the gear shift operates smoothly when shifting it from neutral to forward or reverse. Adjust the shift cable length if necessary.

2. Set the gear shift to the neutral position.

3

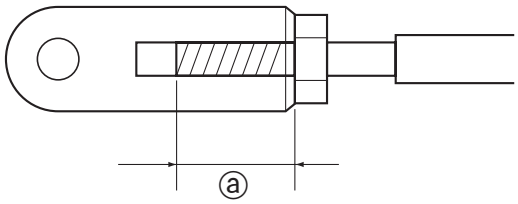
3. Loosen the locknut ①, remove the clip ②, and then disconnect the shift cable joint ③.

4. Set the shift lever ④ to the neutral position.



S66T3220

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



S6D53190

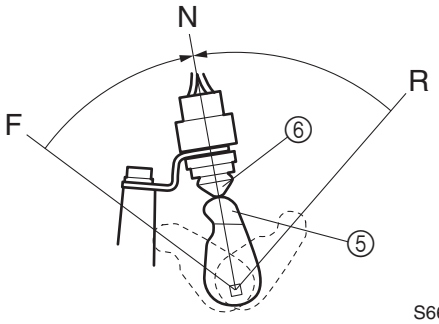
⚠ WARNING

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

6. Connect the cable joint, install the clip, and then tighten the locknut.

7. Check the gear shift for smooth operation and, if necessary, repeat steps 2–6.

8. Check that the neutral switch lever on the shift lever assembly ⑤ is pushing the neutral switch ⑥. (if equipped)

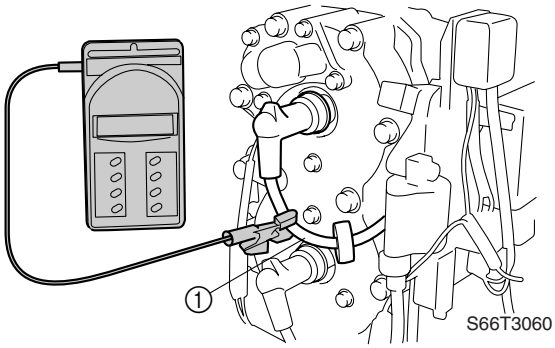


S66T3270

Checking the engine idle speed

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

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

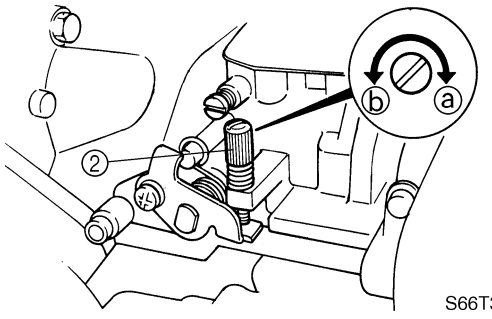


S66T3060

Digital tachometer: 90890-06760

Engine idle speed: 950–1,050 r/min

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



S66T3070

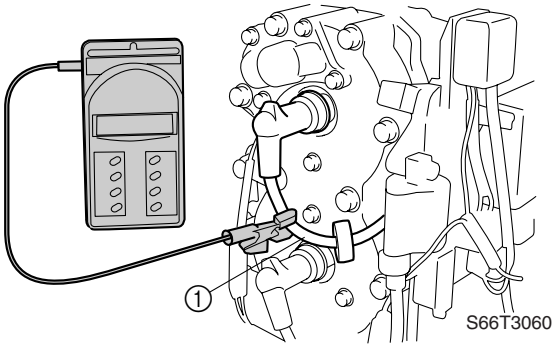
NOTE:
- To increase the idle speed, turn the throttle stop screw in direction ⓐ.
- To decrease the idle speed, turn the throttle stop screw in direction ⓑ.

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

Checking the ignition timing

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

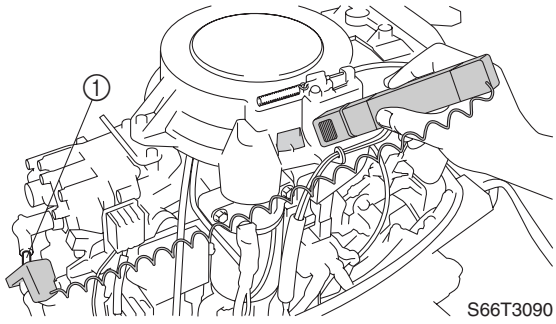
2. Attach the special service tool to spark plug wire #1 ①, and then check the engine idle speed.



Digital tachometer: 90890-06760

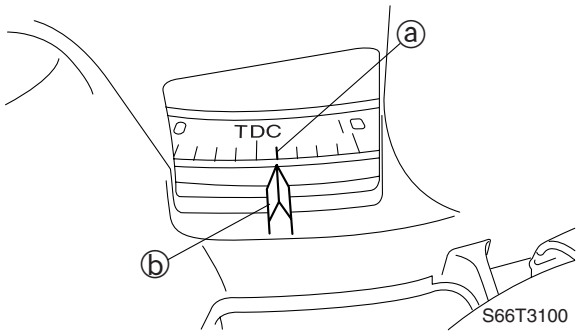
Engine idle speed: 950–1,050 r/min

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



Timing light: 90890-03141

4. Check that the ATDC 2° line ⓐ on the flywheel magnet is aligned with the mark ⓑ on the manual starter case. Adjust if out of specification.

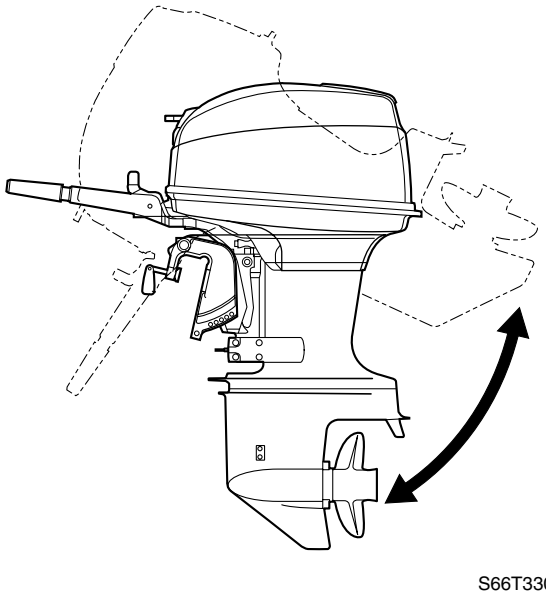


Ignition timing at engine idle speed:
ATDC 2°

Bracket

Checking the tilt operation

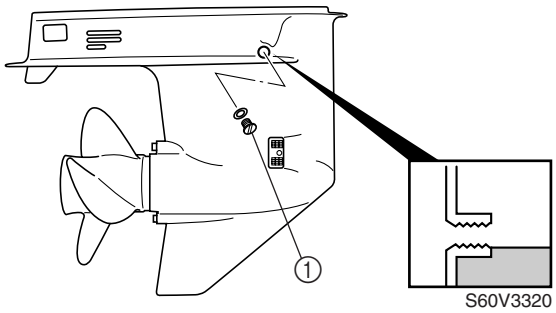
1. Fully tilt the outboard motor up and down a few times and check the entire tilt range for smooth operation.



Lower unit

Checking the gear oil level

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



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

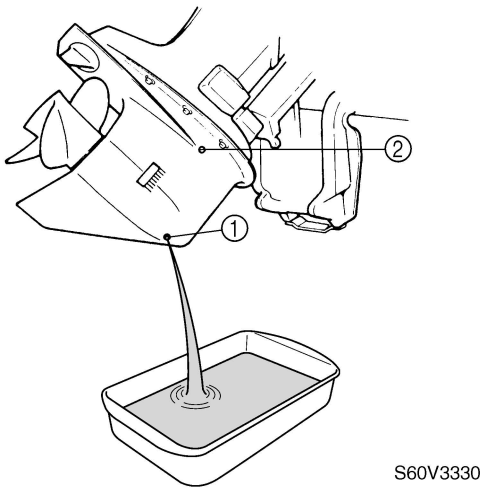
3. If necessary, add sufficient gear oil of the recommended type until it overflows out of the check hole.

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

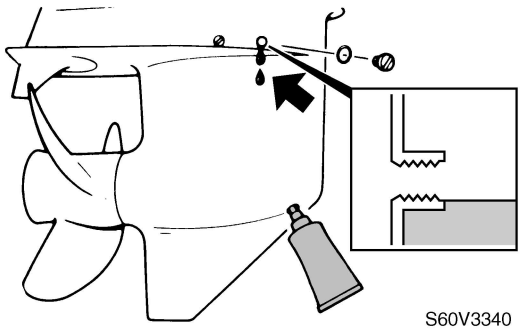
4. Install the check screw.

Changing the gear oil

1. Tilt the outboard motor up slightly.
2. Place a drain pan under the drain screw ①, remove the drain screw, then the check screw ② and let the oil drain completely.



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

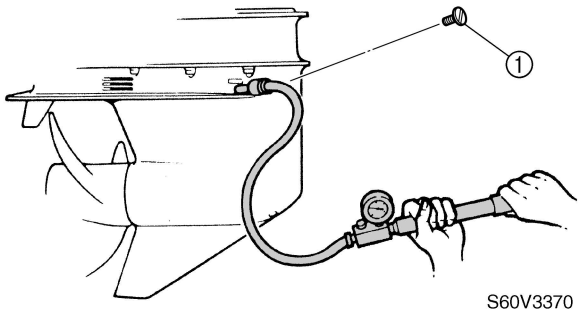


Recommended gear oil:
Hypoid gear oil
API: GL-4
SAE: 90
Oil quantity:
430 cm^3
(14.54 US oz, 15.17 Imp oz)

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

Checking the lower unit for air leakage

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



S60V3370

Leakage tester: 90890-06840

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

CAUTION:

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

NOTE:

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

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

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

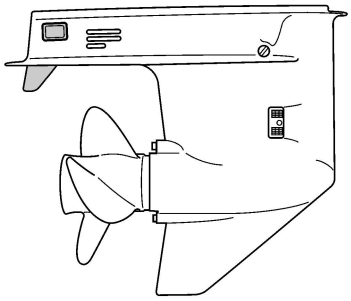
Checking the propeller

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

General

Checking the anodes

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


S66T3190

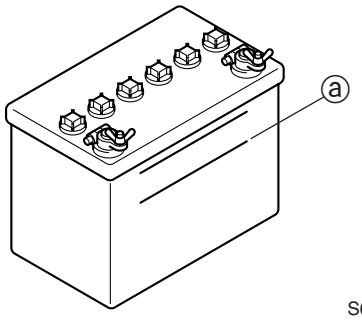
CAUTION:

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

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

Checking the battery

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



S69J3620

3

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

⚠ WARNING

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

Always follow these preventive measures:

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

Antidote (EXTERNAL):

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

Antidote (INTERNAL):

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

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

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

KEEP BATTERIES AND ELECTROLYTE OUT OF REACH OF CHILDREN.

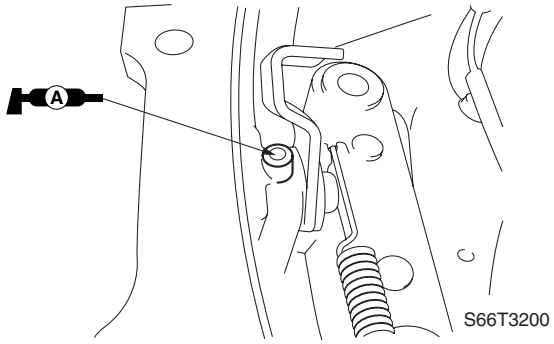
NOTE:

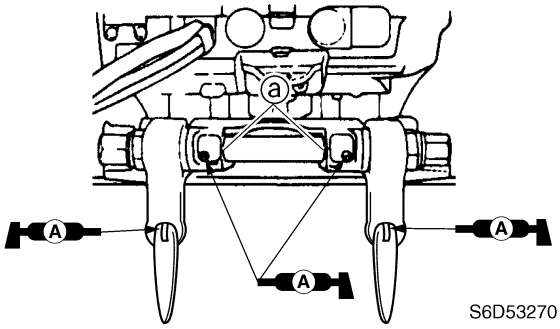
- Batteries vary per manufacturer. The procedures mentioned in this manual may not always apply, therefore, consult the instruction manual of the battery.
- Disconnect the negative battery lead first, then the positive battery lead.

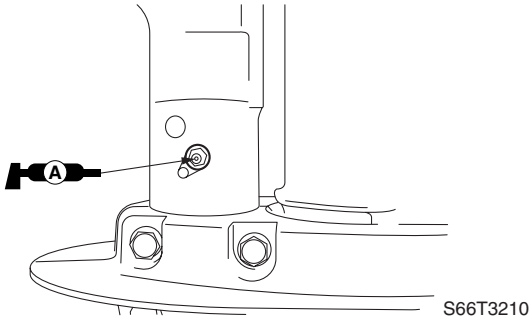
Electrolyte specific gravity:
1.280 at 20 °C (68 °F)

Lubricating the outboard motor

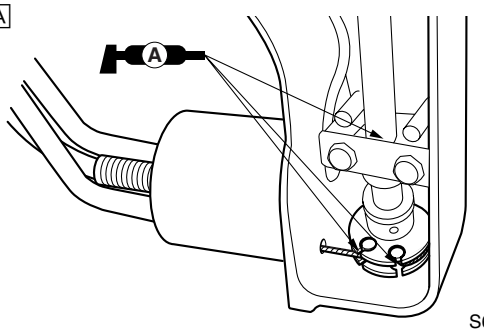
1. Apply water resistant grease to the areas shown.



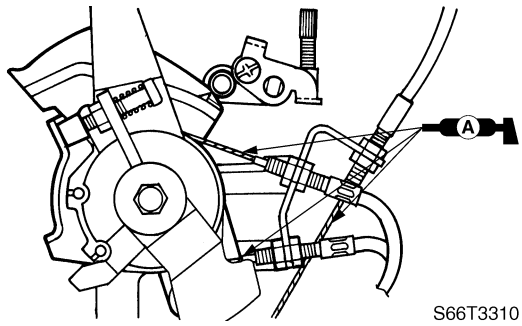




A



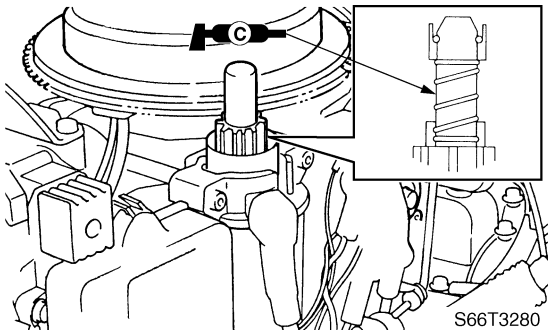
[A]



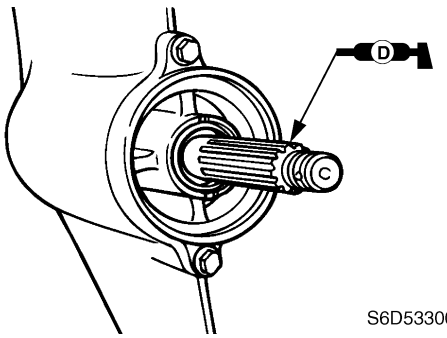
[A] Tiller handle model

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

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



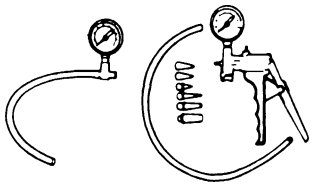
3. Apply corrosion resistant grease to the area shown.



— MEMO —

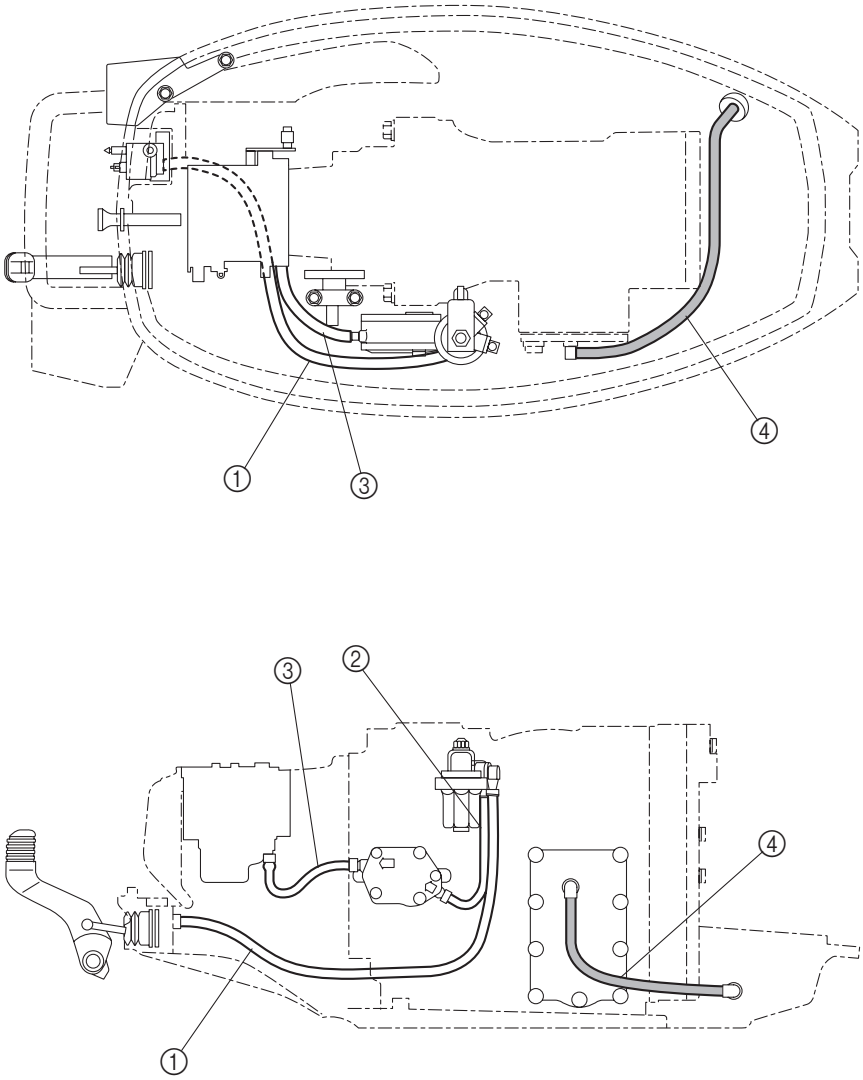
Fuel system

Special service tools



Vacuum/pressure pump gauge set
90890-06756

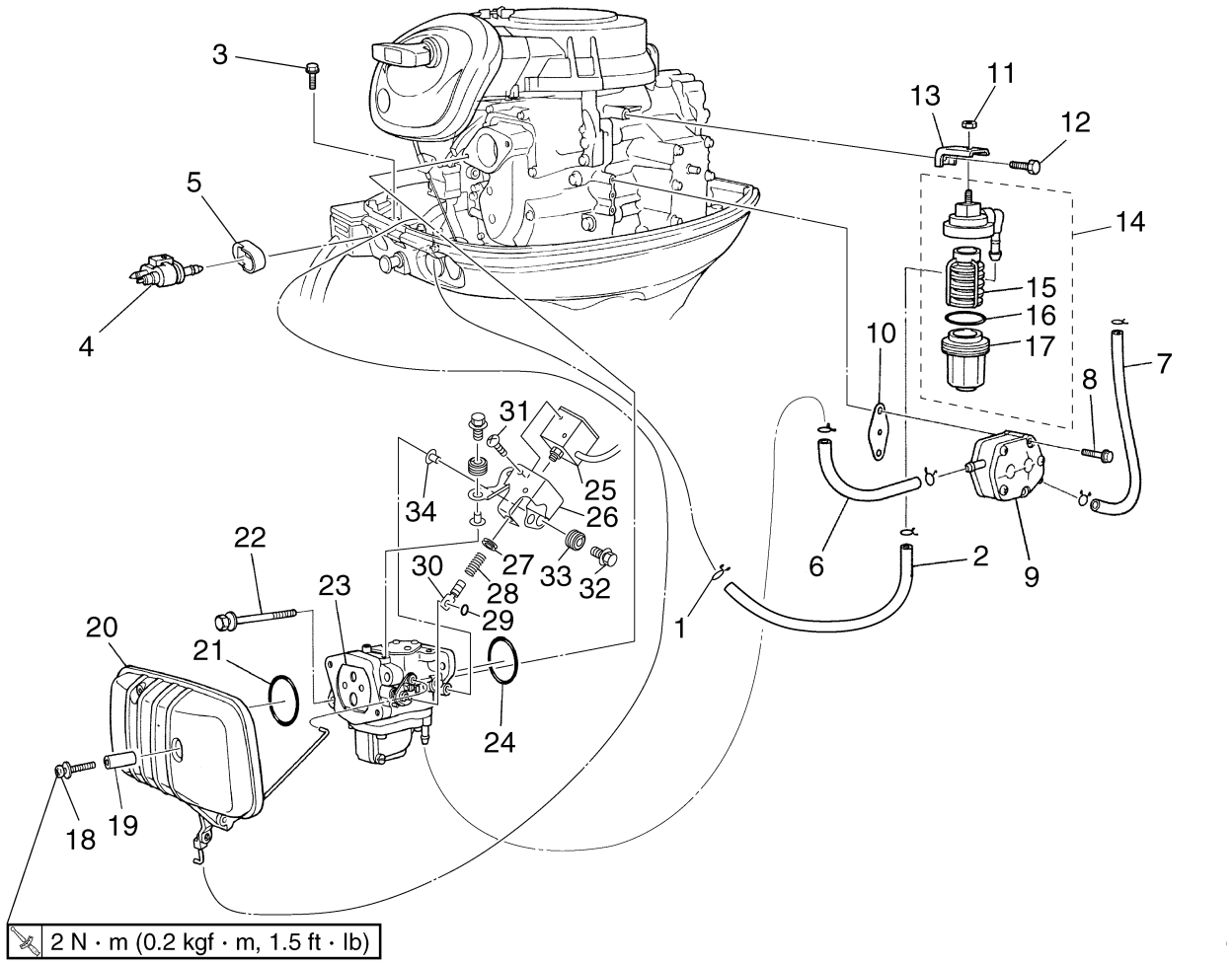
Hose routing



S66T4010

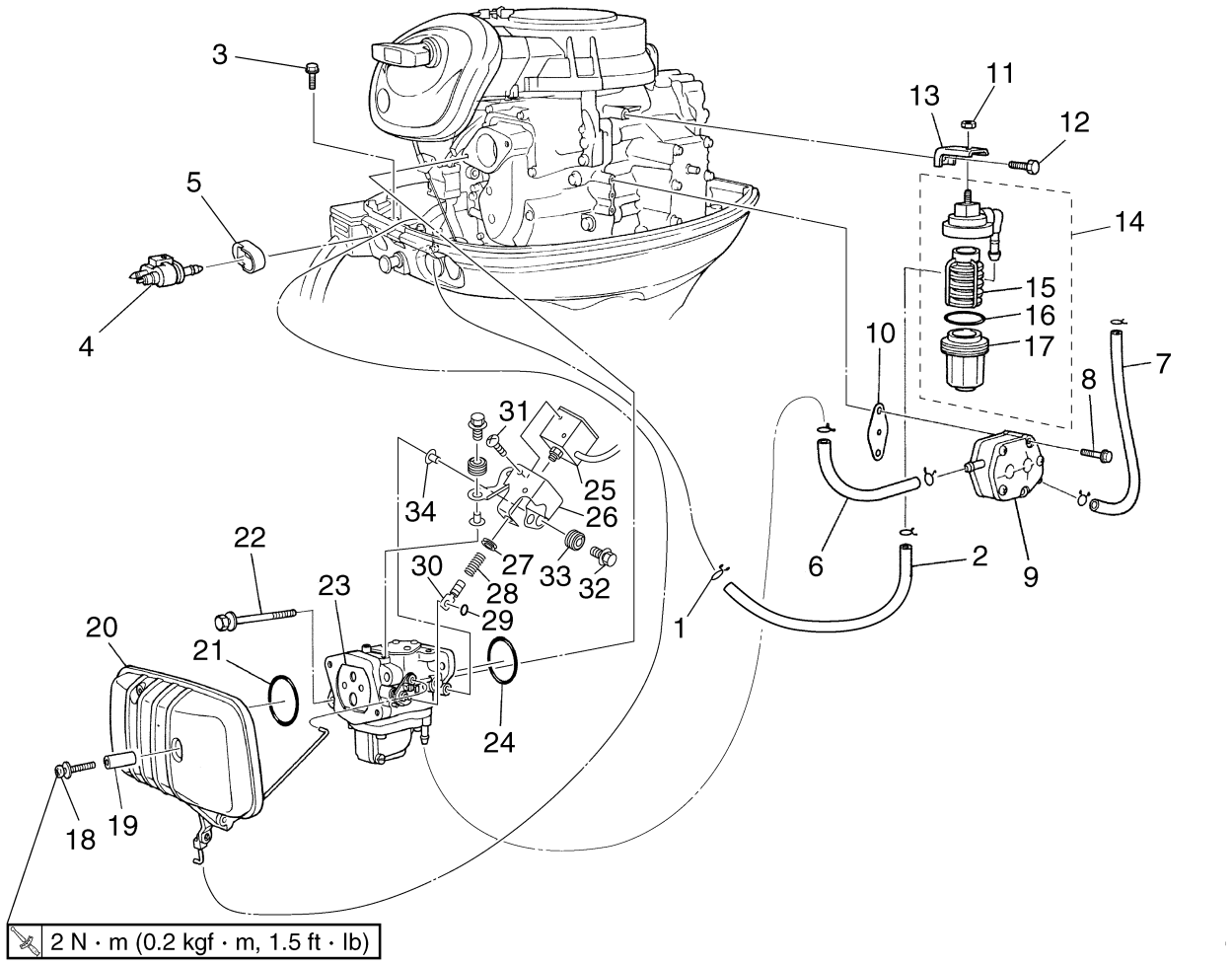
① Fuel hose (fuel joint-to-fuel filter)
② Fuel hose (fuel filter-to-fuel pump)
③ Fuel hose (fuel pump-to-carburetor)
④ Pilot water hose

Fuel line



S66T4020

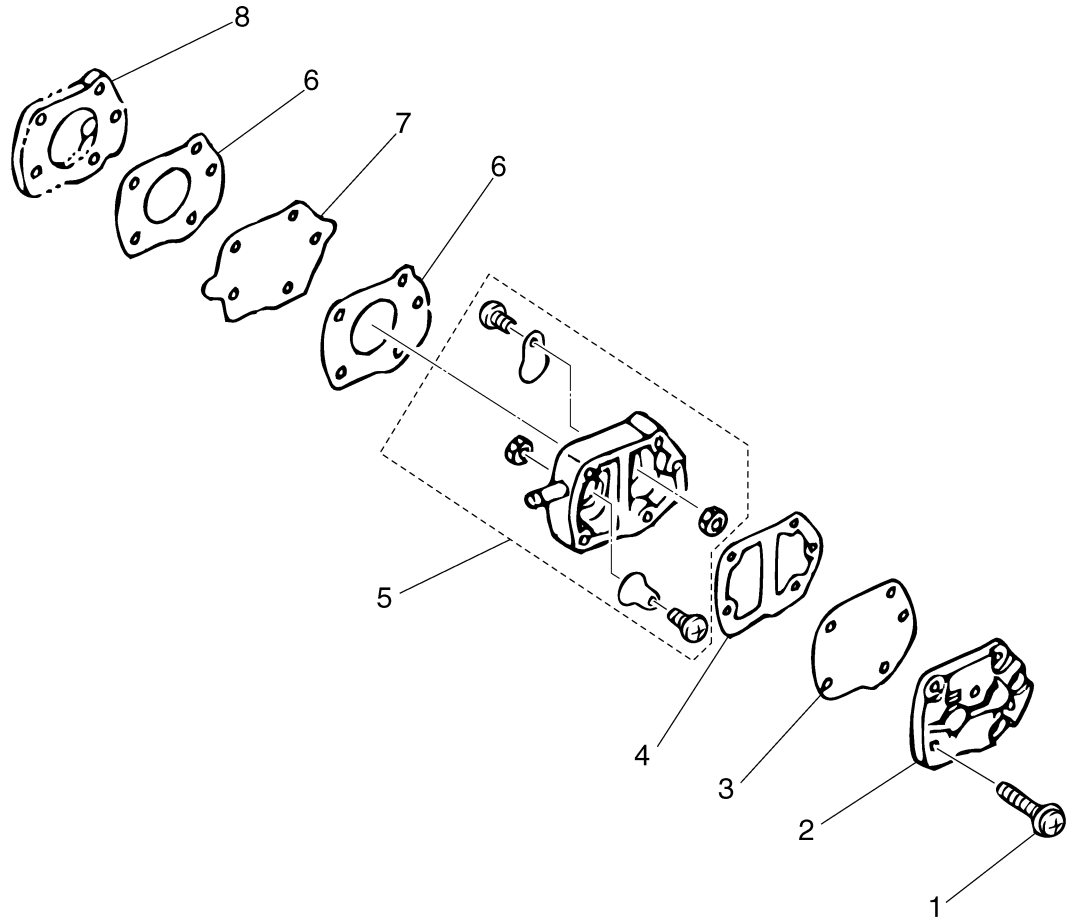
No.	Part name	Q'ty	Remarks
1	Clamp	6	
2	Fuel hose	1	
3	Bolt	1	M6 × 30 mm
4	Fuel joint	1	
5	Grommet	1	
6	Fuel hose	1	
7	Fuel hose	1	
8	Bolt	2	M6 × 40 mm
9	Fuel pump	1	
10	Gasket	1	**Not reusable**
11	Nut	1	
12	Bolt	1	M6 × 14 mm
13	Bracket	1	
14	Fuel filter assembly	1	
15	Fuel filter element	1	
16	O-ring	1	**Not reusable**
17	Cup	1	



S66T4020

No.	Part name	Q'ty	Remarks
18	Screw	2	ø6 × 40 mm
19	Collar	2	
20	Intake silencer	1	
21	O-ring	1	**Not reusable**
22	Bolt	2	M8 × 100 mm
23	Carburetor	1	
24	O-ring	1	**Not reusable**
25	Solenoid coil	1	W model
26	Bracket	1	W model
27	Grommet	1	W model
28	Spring	1	W model
29	O-ring	1	**Not reusable** W model
30	Hook	1	W model
31	Screw	4	W model
32	Bolt	3	M6 × 25 mm / W model
33	Grommet	3	W model
34	Collar	3	W model

Fuel pump



S66T4030

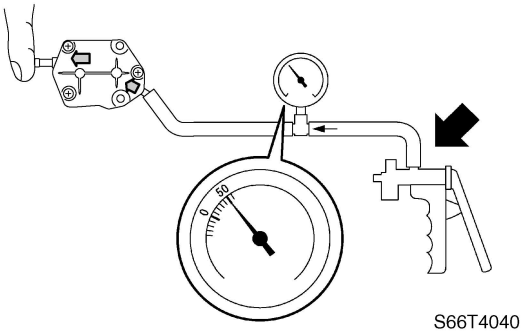
No.	Part name	Q'ty	Remarks
1	Screw	3	ø5 × 30 mm
2	Cover	1	
3	Diaphragm	1	
4	Gasket	1	**Not reusable**
5	Fuel pump body assembly	1	
6	Gasket	2	**Not reusable**
7	Diaphragm	1	
8	Cover	1	

Checking the fuel pump

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

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

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

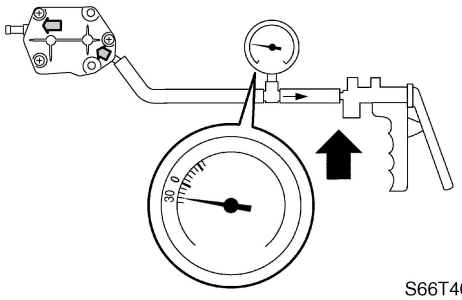


S66T4040

Vacuum/pressure pump gauge set:
90890-06756

Specified pressure:
50 kPa (0.5 kgf/cm^2, 7.3 psi)

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

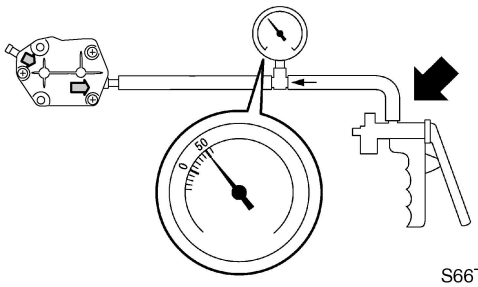


S66T4050

Specified pressure:
30 kPa (0.3 kgf/cm^2, 4.4 psi)

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

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



S66T4060

NOTE:
Assemble the fuel pump valves to the fuel pump body, and moisten the inside of the fuel pump with gasoline to ensure a good seal.

Specified pressure:
50 kPa (0.5 kgf/cm^2, 7.3 psi)

Disassembling the fuel pump

1. Disassemble the fuel pump.

2. Check the diaphragms for tears or damage. Replace if necessary.

3. Check the valves for bends or damage. Replace if necessary. Also, check the fuel pump body for damage. Replace if necessary.

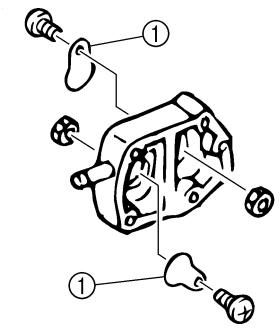
4. Clean the fuel pump body.

4

Assembling the fuel pump

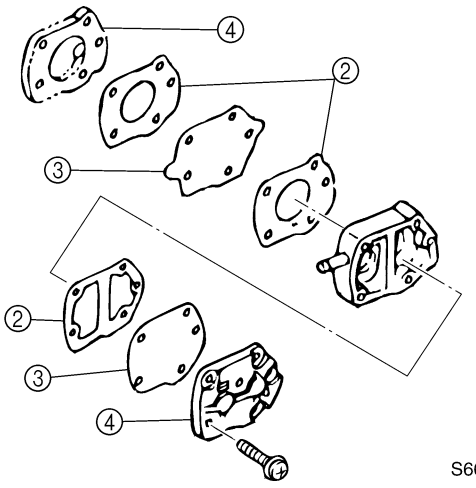
NOTE:
Clean the parts and soak the valves and the diaphragms in gasoline before assembly to obtain prompt operation of the fuel pump when starting the engine.

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



S66T4080

2. Install new gaskets ②, the diaphragms ③, and covers ④.

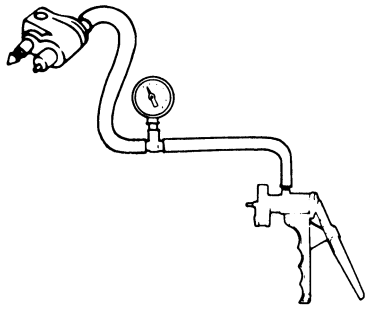


S66T4090

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

Checking the fuel joint

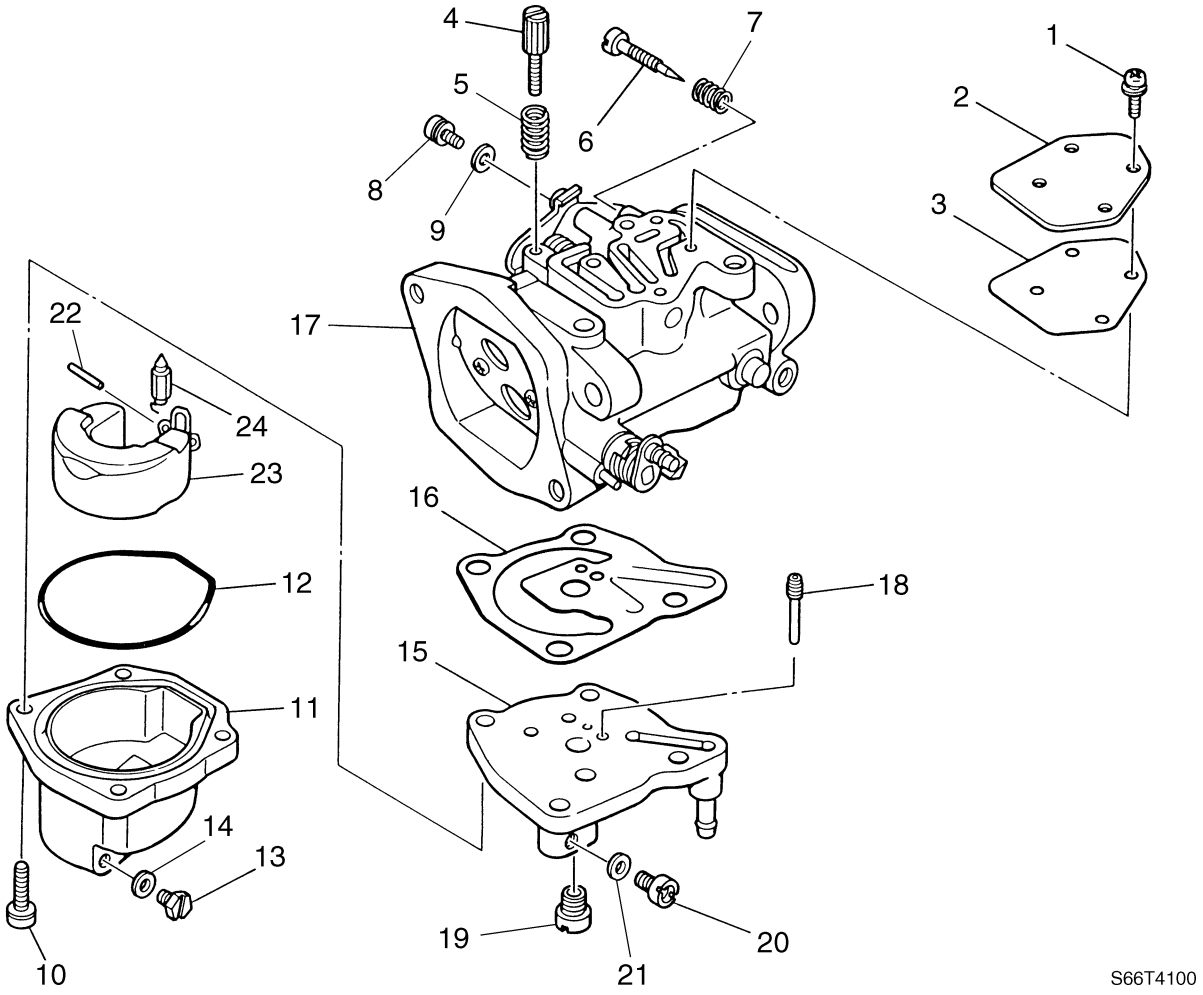
1. Visually check the fuel joint for cracks or damage.
2. Connect the special service tool at the outlet of fuel joint.
3. Apply the specified pressure to check that the pressure is maintained for 10 seconds. Replace the fuel joint if necessary.


S6D54190

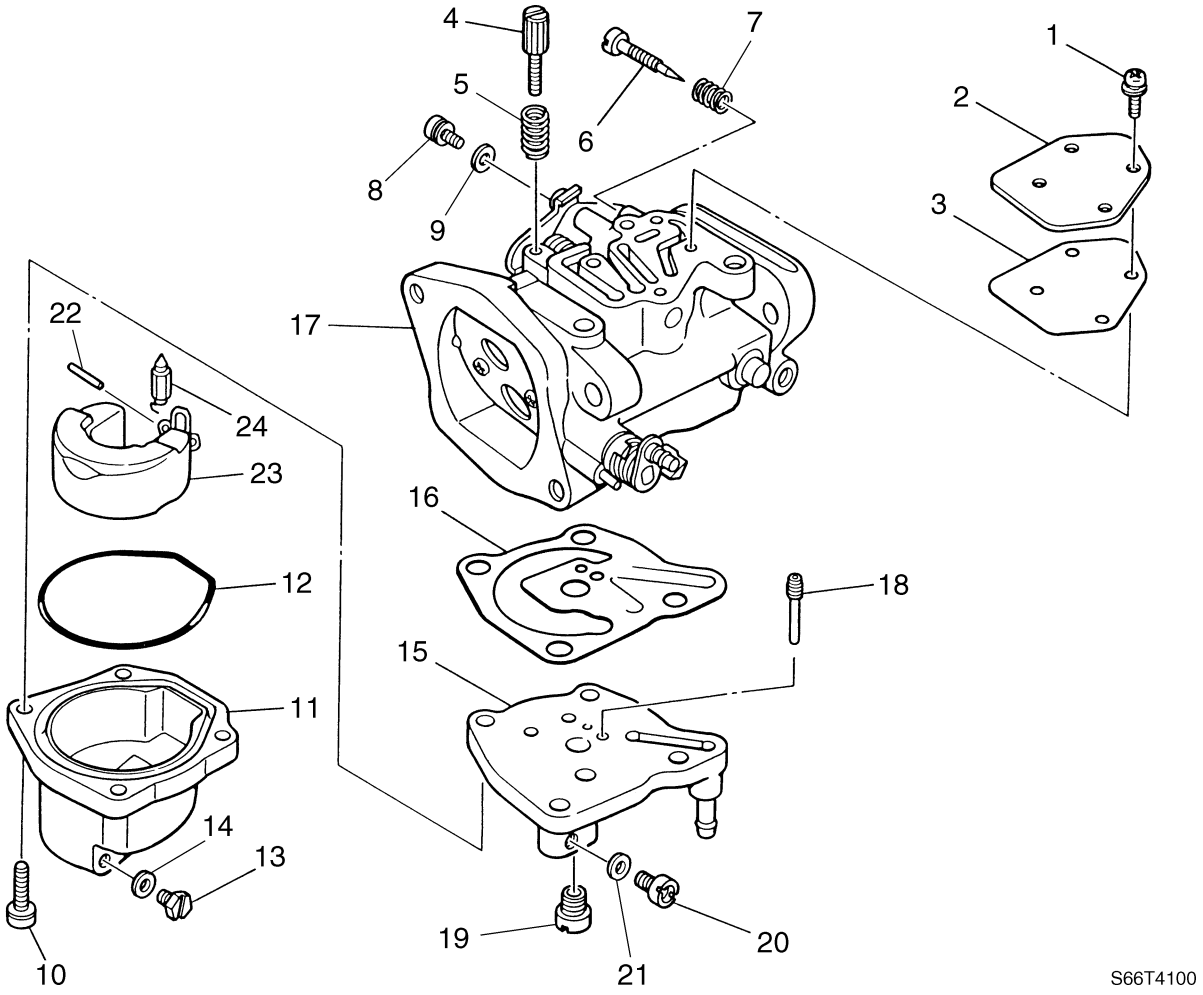
Vacuum/pressure pump gauge set:
90890-06756

Fuel joint holding pressure:
50 kPa (0.5 kgf/cm^2, 7.3 psi)

Carburetor



No.	Part name	Q'ty	Remarks
1	Screw	4	ø4 × 10 mm
2	Cover	1	
3	Gasket	1	**Not reusable**
4	Throttle stop screw	1	
5	Spring	1	
6	Pilot screw	1	
7	Spring	1	
8	Screw	1	ø5 × 10 mm
9	Washer	1	
10	Screw	4	ø5 × 25 mm
11	Float chamber	1	
12	O-ring	1	**Not reusable**
13	Drain screw	1	
14	Gasket	1	
15	Carburetor body	1	
16	Gasket	1	**Not reusable**
17	Carburetor body	1	



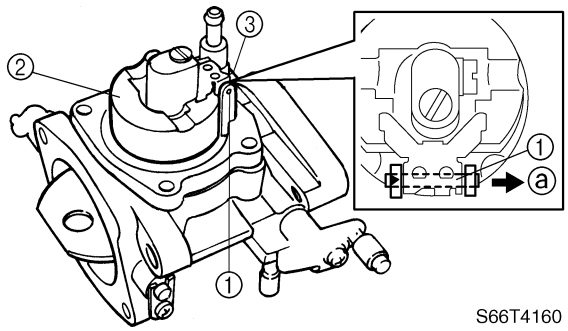
No.	Part name	Q'ty	Remarks
18	Pilot jet	1	
19	Plug	1	
20	Main jet	1	
21	Washer	1	
22	Float pin	1	
23	Float	1	
24	Needle valve	1	

Disassembling the carburetor

1. Remove the pilot screw.

NOTE:
Before disassembling the carburetor, make sure to note the number of times the pilot screw is turned out from the seated position to its set position.

2. Remove the float chamber, float pin ①, float ②, and needle valve ③.



S66T4160

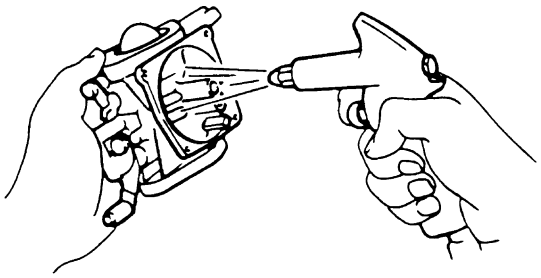
NOTE:
Remove the float pin ① in the direction of the arrow ⓐ shown.

3. Remove the jets and other components.

Checking the carburetor

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

2. Blow compressed air into all passages and jets.



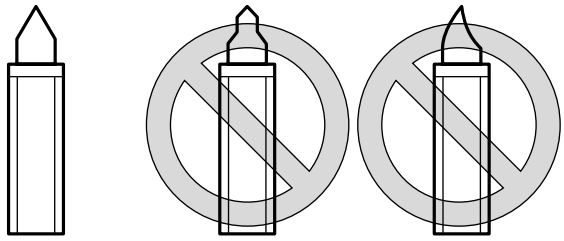
S62Y4220

CAUTION:

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

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

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

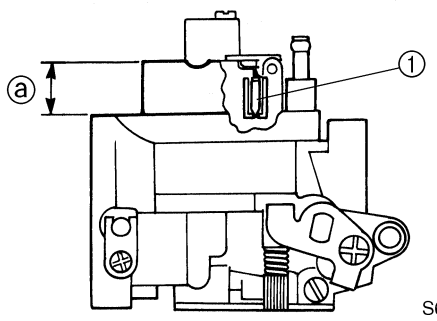


S6D54200

5. Check the float for deterioration. Replace if necessary.

4

6. Measure the float height ⓐ. Replace the float and needle valve as a set, if out of specification.



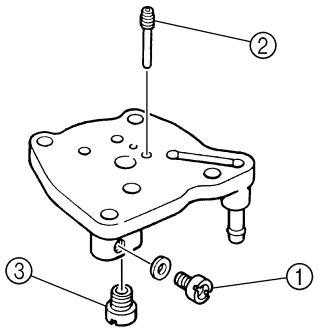
S66T4110

NOTE:
- The float should be resting on the needle valve ①, but not compressing it.
- Take measurements at the float position shown opposite its pivoted side.

Float height ⓐ:
16.5–18.5 mm (0.65–0.73 in)

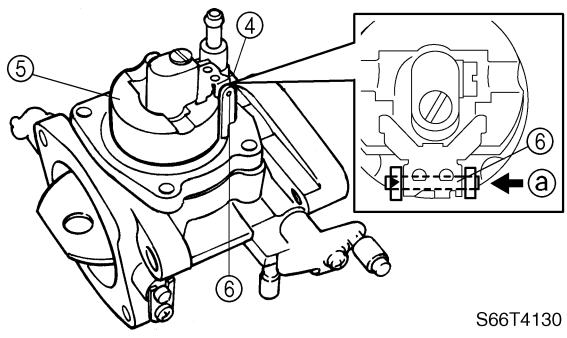
Assembling the carburetor

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



S66T4120

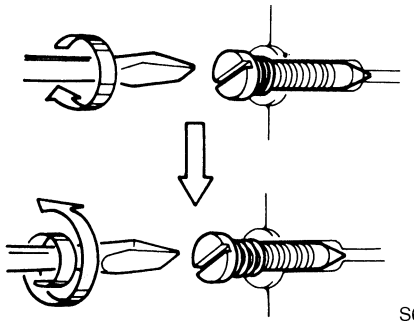
2. Install the needle valve ④, float ⑤, and float pin ⑥, as shown, and then the check the float for smooth operation.



S66T4130

NOTE:
- Install the float pin ⑥ in the direction of the arrow ⓐ shown.
- Place the needle valve in the valve seat when installing the float to the carburetor body.

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


S66T4140

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

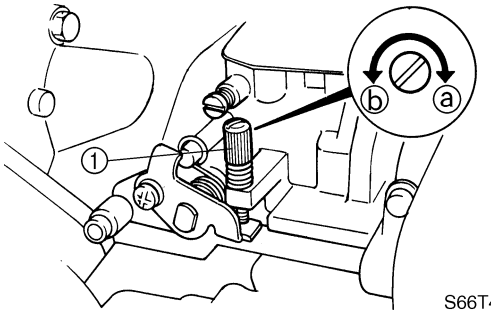
Pilot screw setting:
1 3/8–1 7/8 turns out

4. Install the carburetor assembly.

Adjusting the throttle stop screw

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

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



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

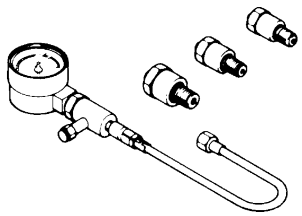
	Engine idle speed: 950–1,050 r/min

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

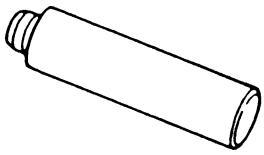
— MEMO —

Power unit

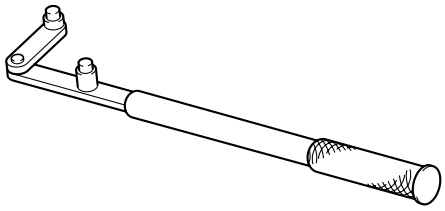
Special service tools



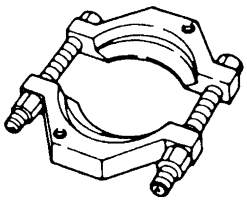
Compression gauge
90890-03160



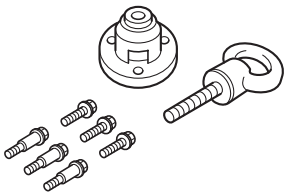
Driver rod LS
90890-06606



Flywheel holder
90890-06522



Bearing separator
90890-06534



Flywheel puller
90890-06521

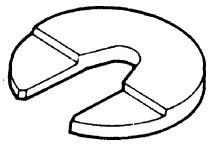
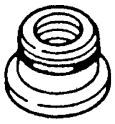
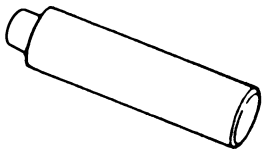


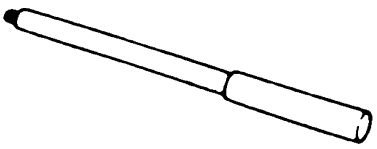
Plate C
90890-02402



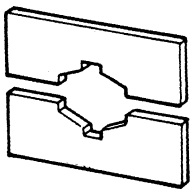
Needle bearing attachment
90890-06613, 90890-06654, 90890-06655



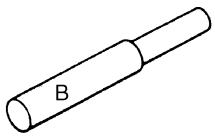
Pressure pin C
90890-02403



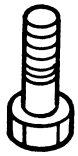
Driver rod L3
90890-06652



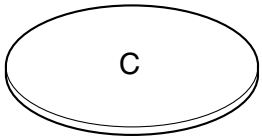
Support
90890-02394



Pressure pin B
90890-02390

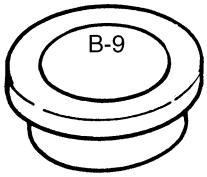


Bolt
90890-02353

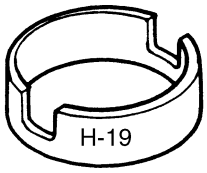


Spacer C
90890-02404

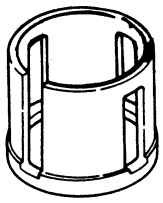
Washer
90890-02354



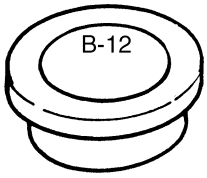
Bushing-9 (D30)
90890-02363



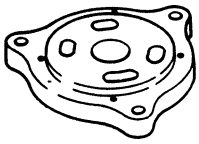
Height ring-640 (H19)
90890-06590



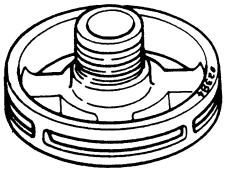
Body
90890-02352



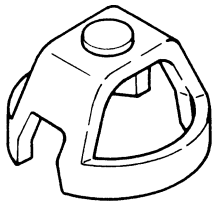
Bushing-12 (D35)
90890-02366



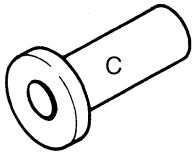
Flange
90890-02351



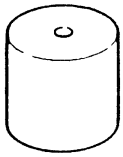
Pressure plate
90890-02384



Press body
90890-02385



Bearing pressure C
90890-02393

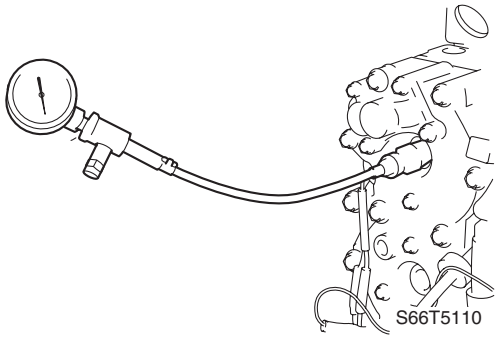


Small end bearing installer
90890-06527

Power unit

Checking the compression pressure

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



CAUTION:

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

Compression gauge: 90890-03160

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

NOTE:

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

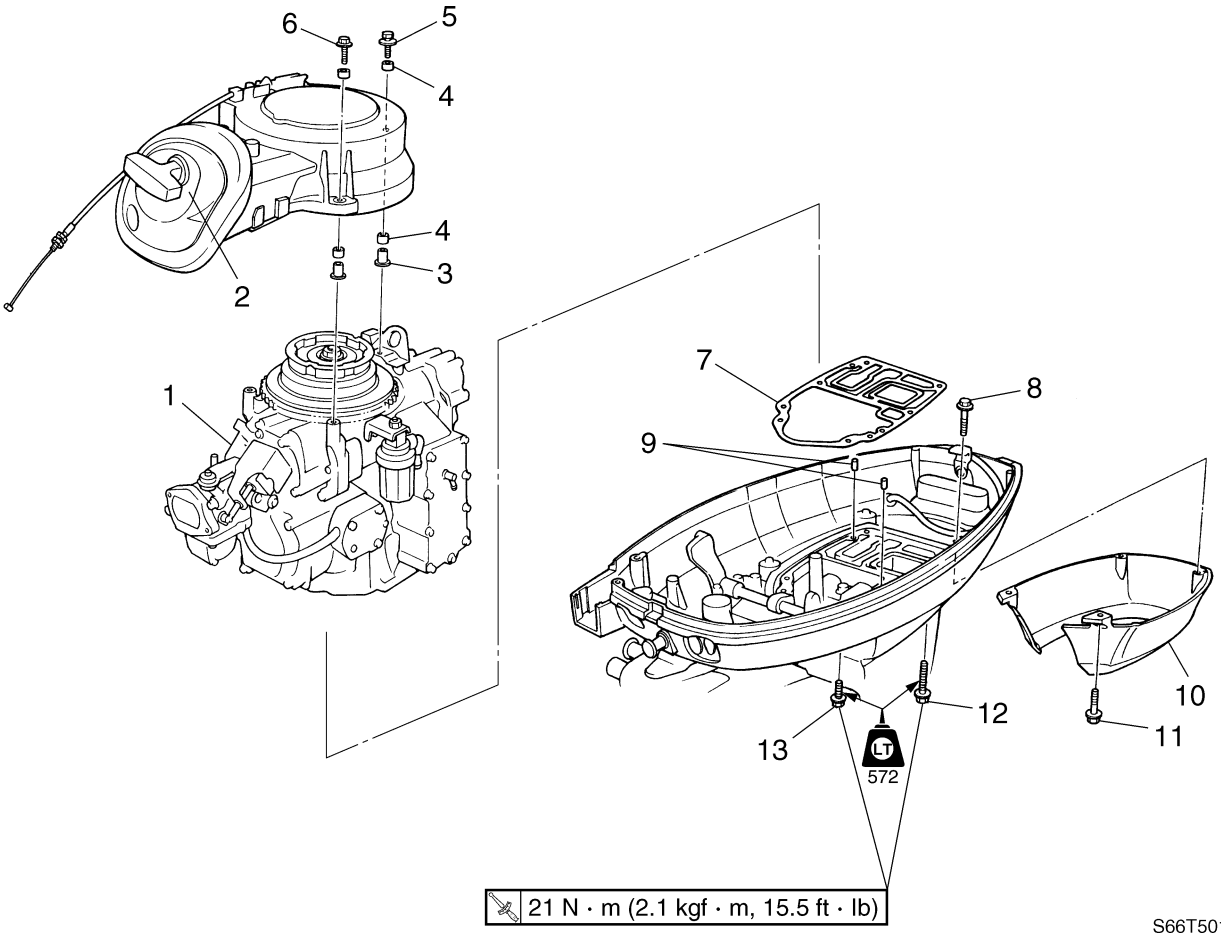
Minimum compression pressure (reference data):
630 kPa (6.3 kgf/cm^2, 91 psi)

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

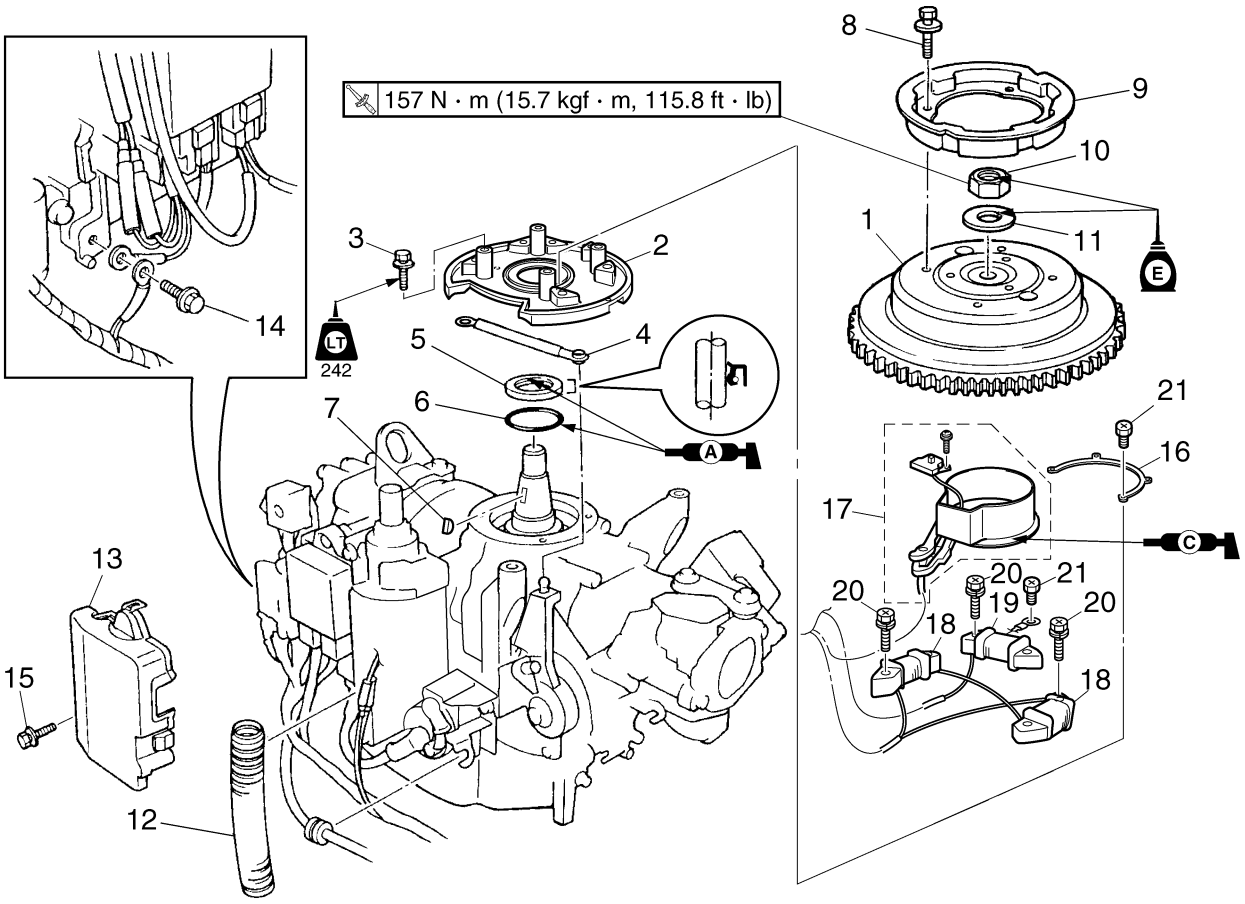
NOTE:

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

5

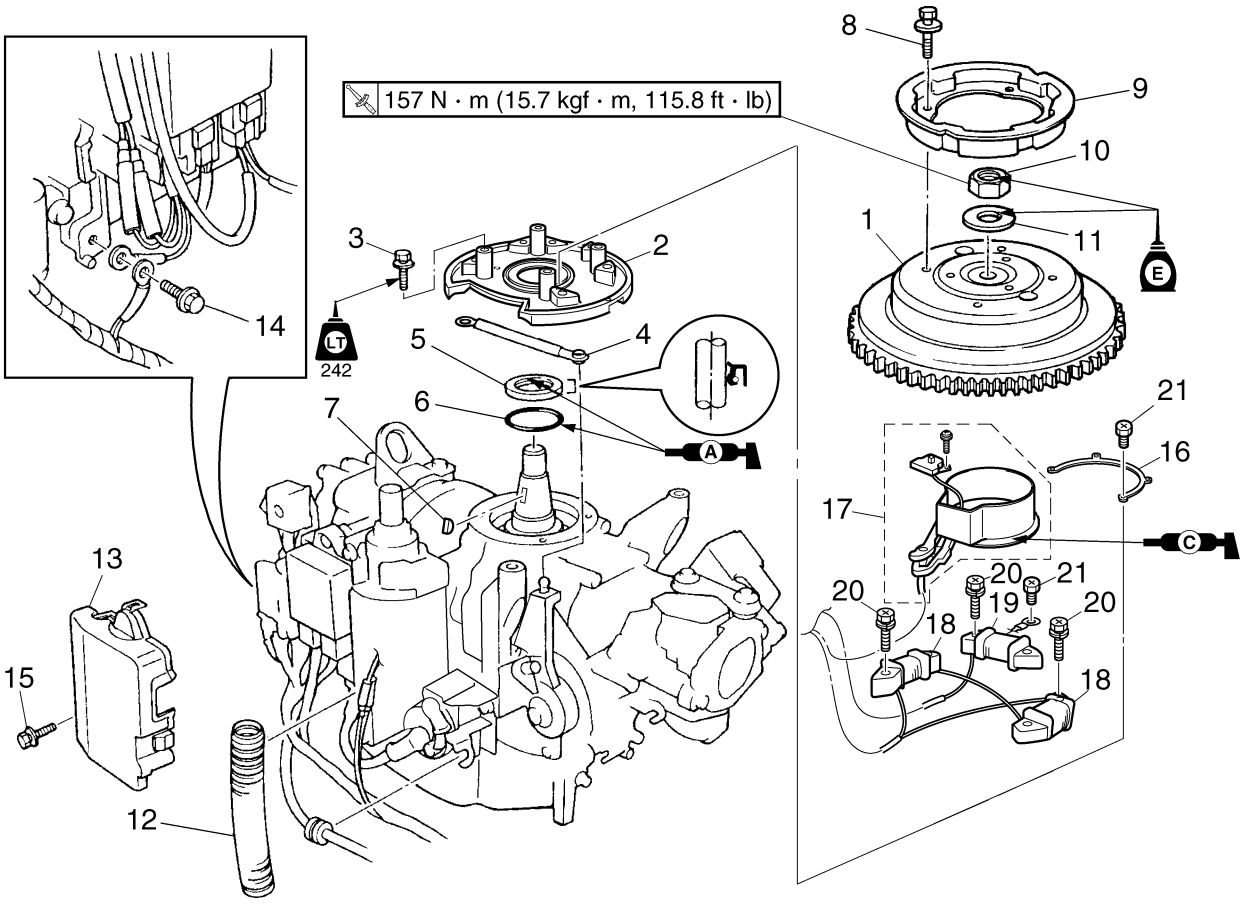


No.	Part name	Q'ty	Remarks
1	Power unit	1	
2	Manual starter	1	
3	Collar	3	
4	Grommet	6	
5	Bolt	1	M8 × 25 mm
6	Bolt	2	M8 × 35 mm
7	Gasket	1	**Not reusable**
8	Bolt	2	M6 × 16 mm
9	Dowel	2	
10	Apron	1	
11	Bolt	2	M6 × 16 mm
12	Bolt	6	M8 × 80 mm
13	Bolt	2	M8 × 30 mm



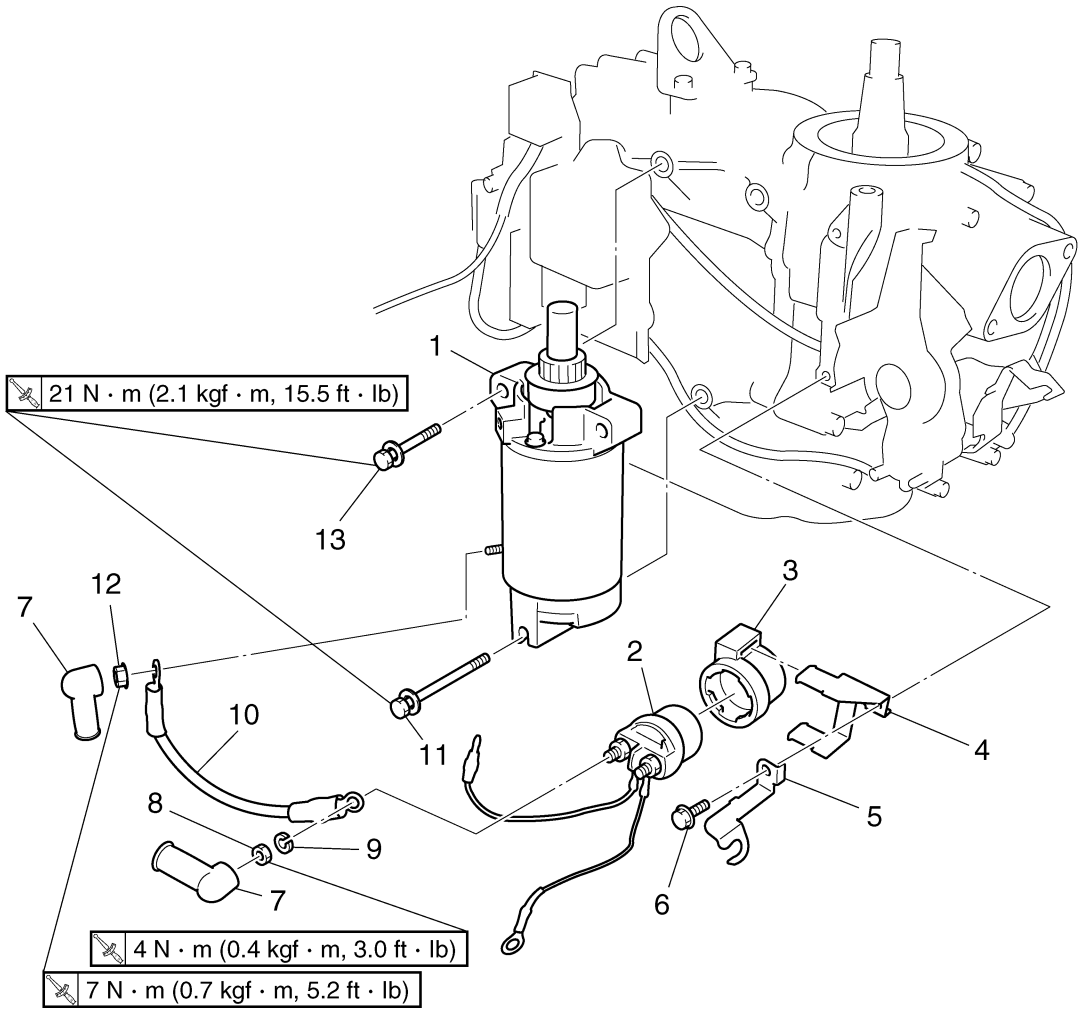
S66T5030

No.	Part name	Q'ty	Remarks
1	Flywheel magnet	1	
2	Base assembly	1	
3	Bolt	4	M6 × 40 mm
4	Link rod	1	
5	Oil seal	1	**Not reusable**
6	O-ring	1	**Not reusable**
7	Woodruff key	1	
8	Bolt	3	M6 × 40 mm
9	Starter pulley	1	
10	Nut	1	
11	Washer	1	
12	Corrugated tube	1	WH and W models
13	Cover	1	
14	Bolt	1	M6 × 16 mm
15	Bolt	1	M6 × 25 mm
16	Retainer	1	
17	Pulser coil assembly	1	



S66T5030

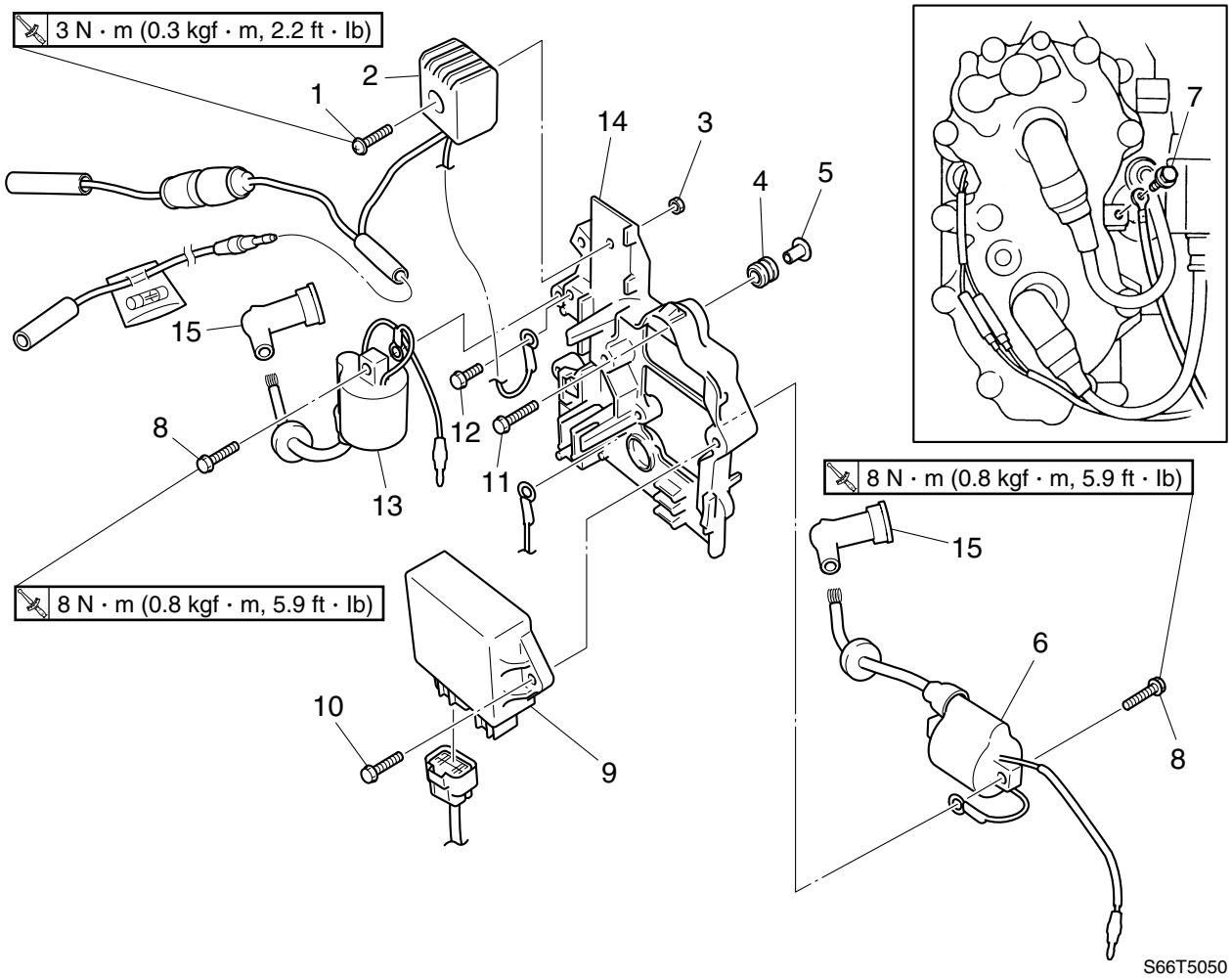
No.	Part name	Q'ty	Remarks
18	Charge coil	2	
19	Lighting coil	1	
20	Screw	6	M6 × 25 mm
21	Screw	5	M4 × 6 mm



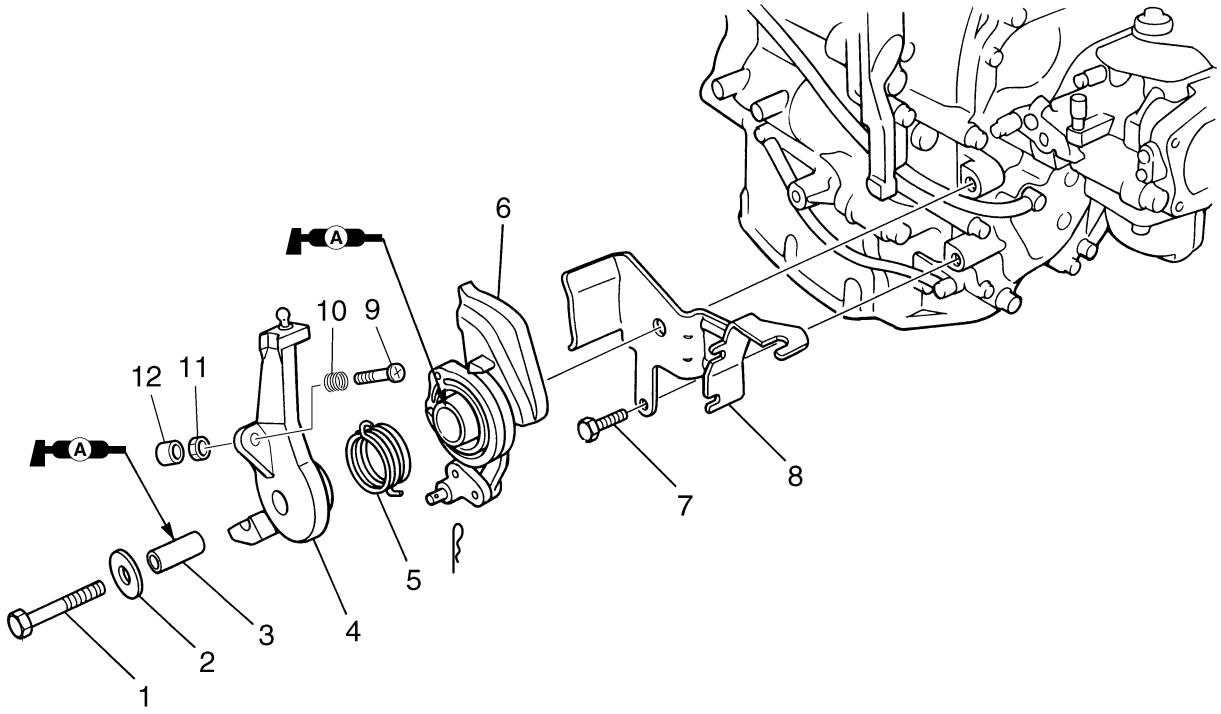
S66T5040

No.	Part name	Q'ty	Remarks
1	Starter motor	1	
2	Starter relay	1	
3	Holder	1	
4	Bracket	1	
5	Bracket	1	
6	Bolt	1	M6 × 16 mm
7	Cap	2	
8	Nut	1	
9	Spring washer	1	
10	Starter motor lead	1	
11	Bolt	1	M8 × 75 mm
12	Nut	1	
13	Bolt	2	M8 × 50 mm

All components are for WH and W models only.

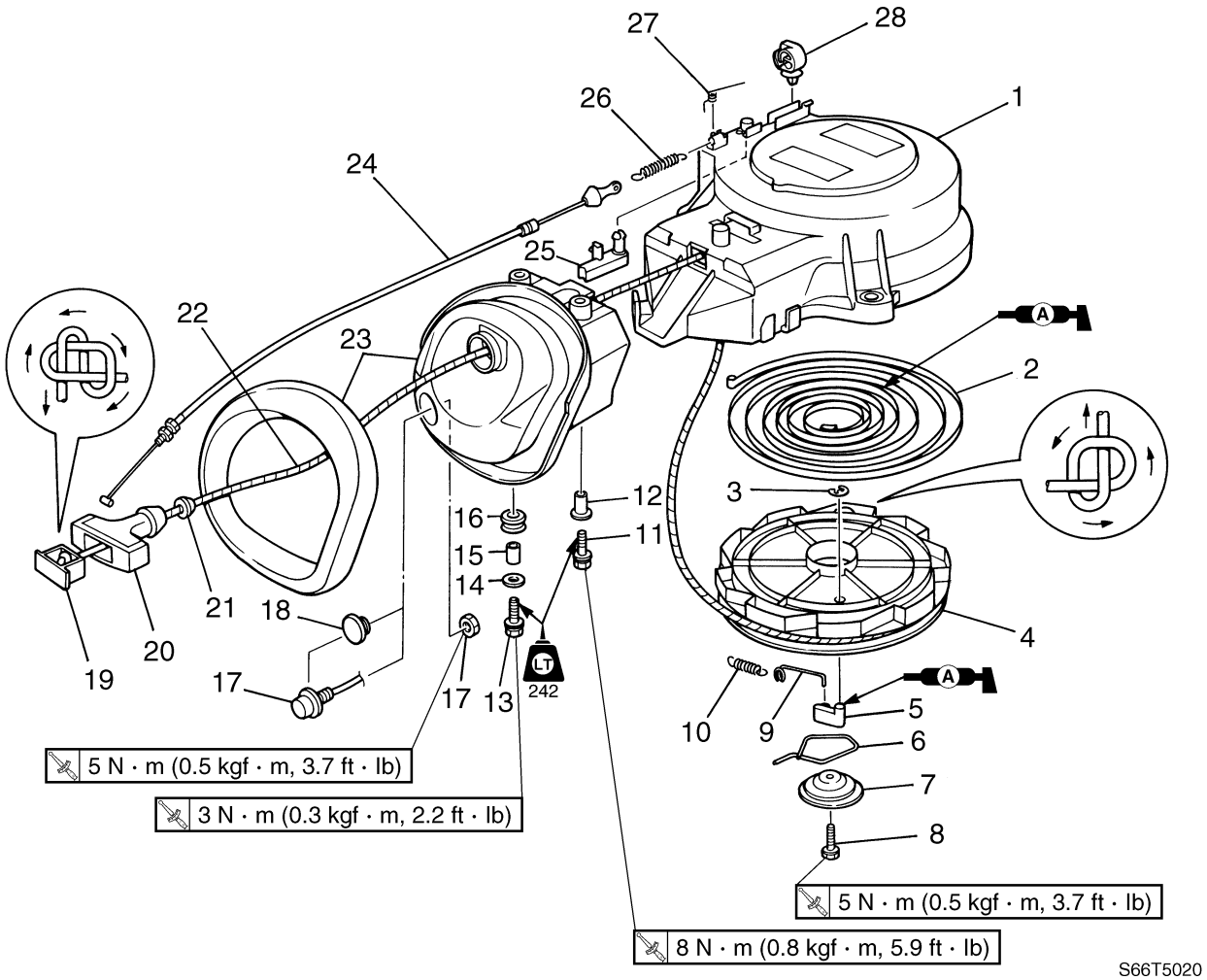


No.	Part name	Q'ty	Remarks
1	Screw	1	ø5 × 30 mm / WH and W models
2	Rectifier	1	WH and W models
3	Nut	1	WH and W models
4	Grommet	3	
5	Collar	3	
6	Ignition coil #1	1	
7	Bolt	1	M6 × 12 mm
8	Bolt	4	M6 × 25 mm
9	CDI unit	1	
10	Bolt	2	M6 × 25 mm
11	Bolt	3	M6 × 30 mm
12	Bolt	1	M6 × 16 mm
13	Ignition coil #2	1	
14	Bracket	1	
15	Spark plug cap	2	

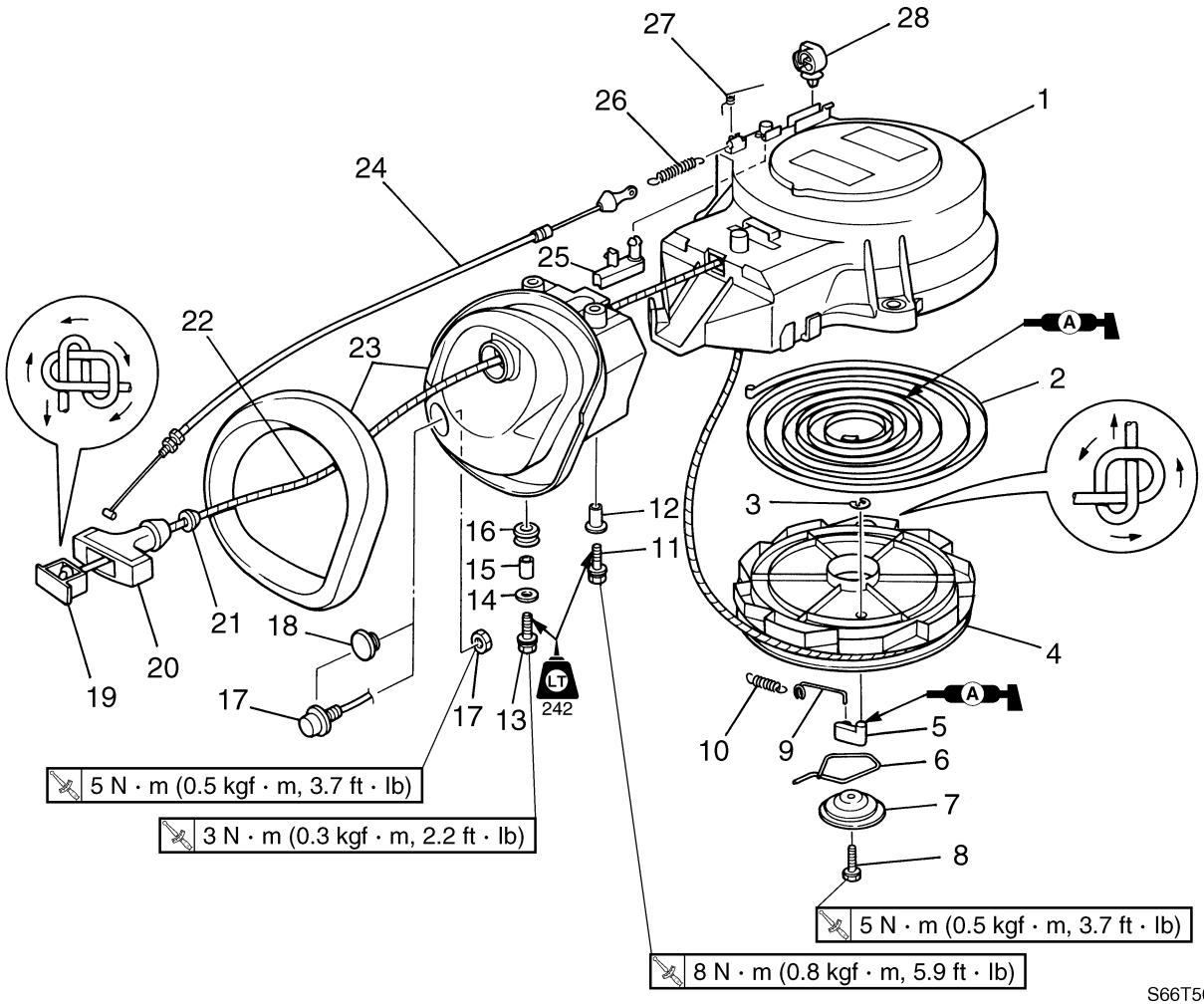


S66T5060

No.	Part name	Q'ty	Remarks
1	Bolt	1	M8 × 45 mm
2	Washer	1	
3	Collar	1	
4	Throttle control lever	1	
5	Spring	1	
6	Throttle cam	1	
7	Bolt	1	M6 × 14 mm
8	Bracket	1	
9	Screw	1	
10	Spring	1	
11	Nut	1	
12	Cap	1	



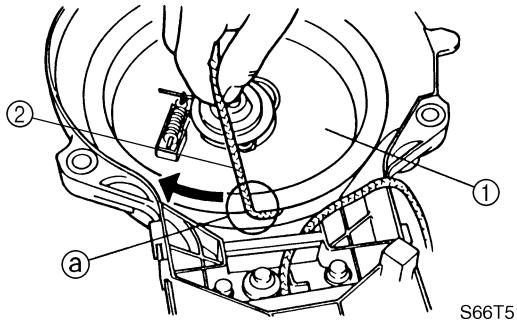
No.	Part name	Q'ty	Remarks
1	Manual starter case	1	
2	Spiral spring	1	
3	E-clip	1	
4	Sheave drum	1	
5	Drive pawl	1	
6	Spring	1	
7	Drive plate	1	
8	Bolt	1	M6 × 16 mm
9	Spring	1	
10	Spring	1	
11	Bolt	2	M6 × 35 mm
12	Collar	2	
13	Bolt	1	M6 × 25 mm
14	Washer	1	
15	Collar	1	
16	Roller	1	
17	Engine start button assembly	1	WH model



No.	Part name	Q'ty	Remarks
18	Grommet	1	MH and W models
19	Cover	1	
20	Manual starter handle	1	
21	Damper	1	
22	Starter rope	1	
23	Starter rope guide	1	
24	Start-in-gear protection cable	1	
25	Stopper	1	
26	Spring	1	
27	Spring	1	
28	Holder	1	WH and W models

Disassembling the manual starter

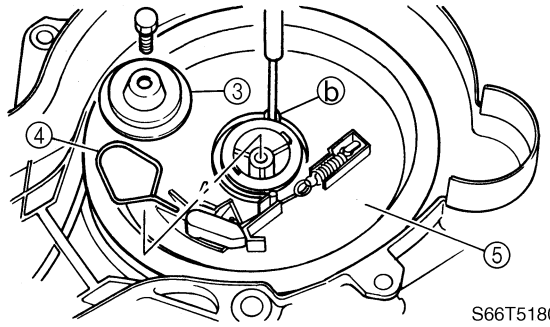
1. Turn the sheave drum ① clockwise until the spiral spring is free.



S66T5170

NOTE:
- Turn the sheave drum so that the notch on the outer surface of the sheave drum faces toward the manual starter handle.
- Pass the starter rope ② through the notch ⓐ.

2. Remove the drive plate ③ and spring ④.



S66T5180

⚠ WARNING

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

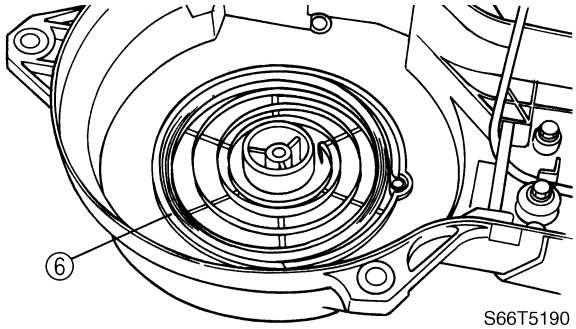
NOTE:
Insert a flathead screwdriver into the hole ⓑ in the sheave drum and push down on the spiral spring so that it releases from the sheave drum.

3. Remove the sheave drum ⑤.

⚠ WARNING

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

4. Remove the spiral spring ⑥ from the manual starter case.



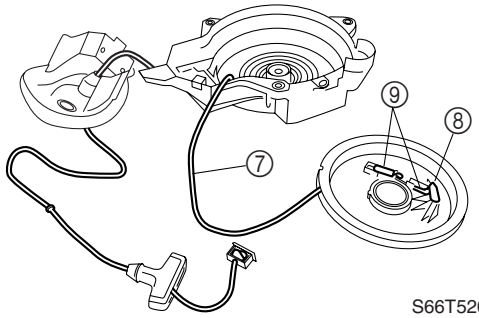
S66T5190

⚠ WARNING

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

5. Remove the starter rope ⑦.

6. Remove the drive pawl ⑧ and springs ⑨ from the sheave drum.



S66T5200

Checking the spiral spring

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

Checking the drive pawl

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

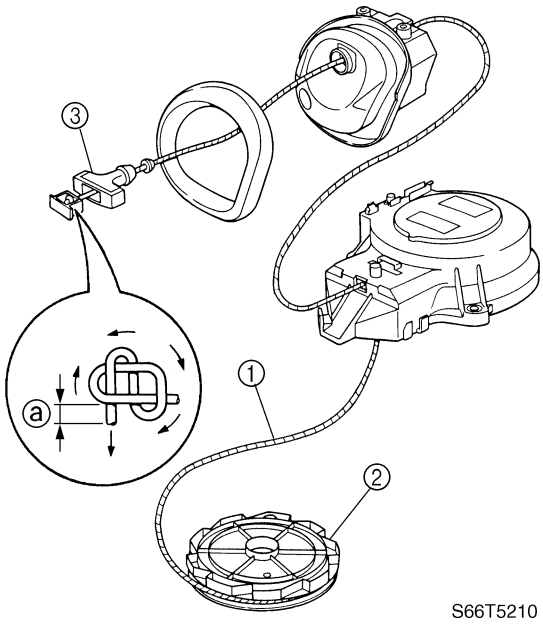
Measuring the starter rope

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

Starter rope length:
1,750 mm (68.9 in)

Assembling the manual starter

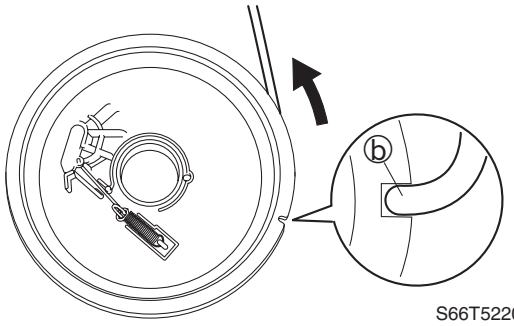
1. Install the starter rope ① to the sheave drum ②.
2. Install the drive pawl and springs.
3. Install the manual starter handle ③.



S66T5210

NOTE:
- Tie a knot at the end of the starter rope as shown in the illustration.
- Be sure to leave 7–12 mm (0.28–0.47 in) at the end ⓐ of the starter rope.

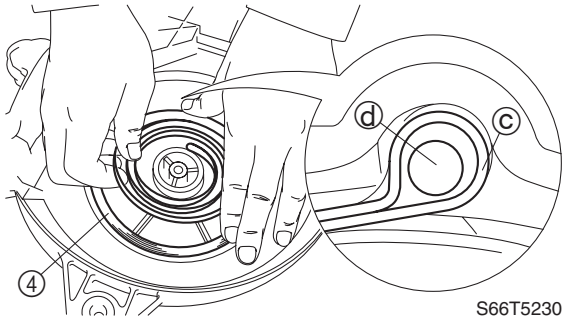
4. Wind the starter rope twice around the sheave drum in the direction of the arrow shown in the illustration.



S66T5220

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

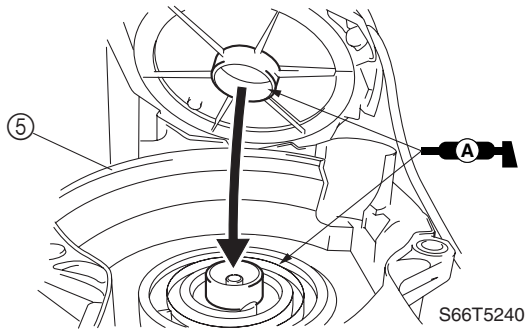
5. Install the spiral spring ④ into the starter case.



S66T5230

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

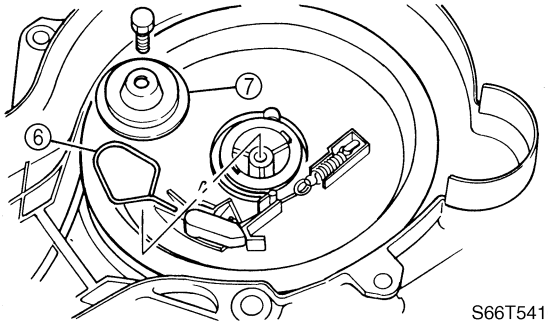
6. Install the sheave drum into the manual starter case ⑤.



S66T5240

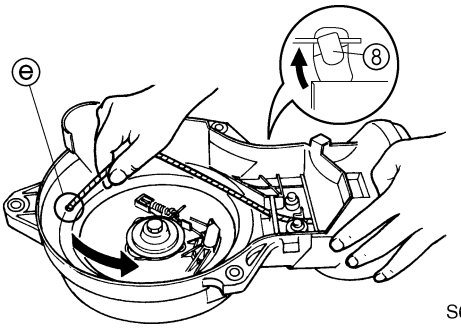
NOTE:
Install the sheave drum, then set the spiral spring by turning the sheave drum.

7. Install the spring ⑥ and drive plate ⑦.



S66T5410

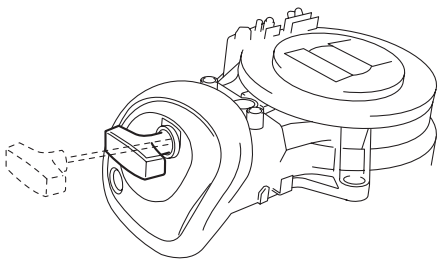
8. Turn the sheave drum 3 times in the direction of the arrow shown, and then remove the starter rope from the notch ⓔ.



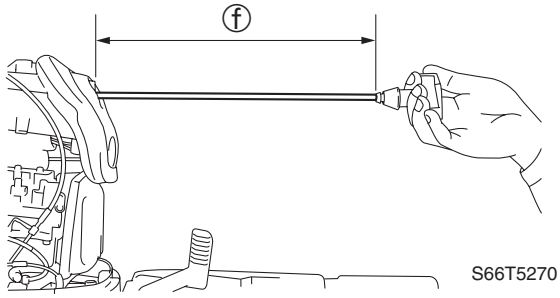
S66T5250

NOTE:
Hold the stopper ⑧ while turning the sheave drum as shown.

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


S66T5260

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



S66T5270

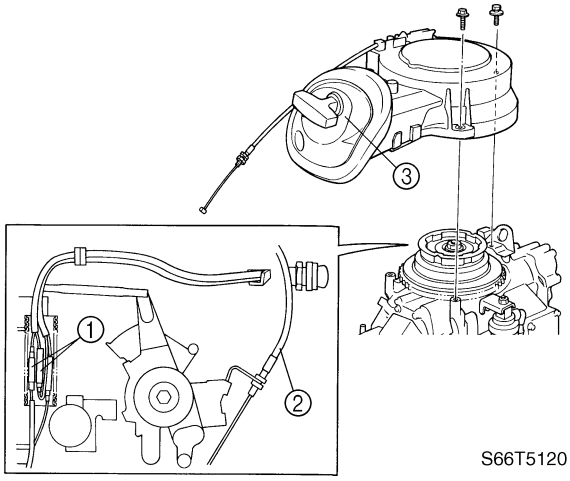
Starter rope length ⓕ:
1,400–1,600 mm (55.1–63.0 in)

Removing the power unit

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

1. Disconnect the engine starter button connectors ① (WH model).

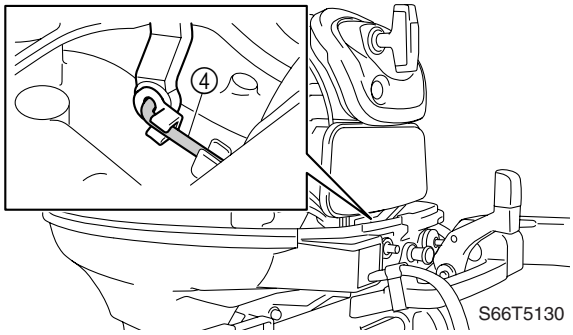
2. Disconnect the start-in-gear protection cable ②, and then remove the manual starter ③.



S66T5120

3. Remove the intake silencer.

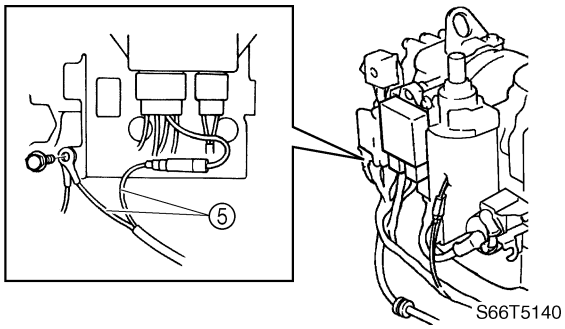
4. Disconnect the choke link rod ④.



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

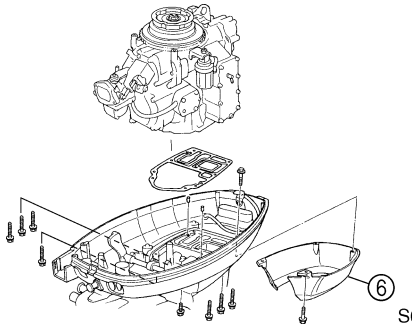
6. Disconnect the battery leads and neutral switch connectors (WH and W models).

7. Remove the cover, and then disconnect the engine stop lanyard switch leads ⑤ (MH and WH models).



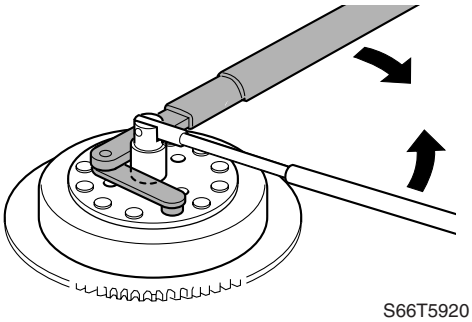
8. Disconnect the fuel hose and pilot water hose.

9. Remove the apron ⑥, and then remove the power unit by removing the bolts.



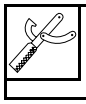
Removing the flywheel magnet

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



CAUTION:

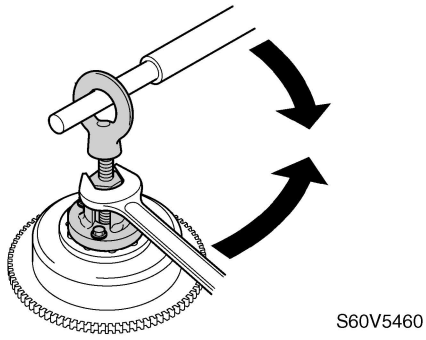
Apply force in the direction of the arrows shown, to prevent the flywheel holder from slipping off easily.



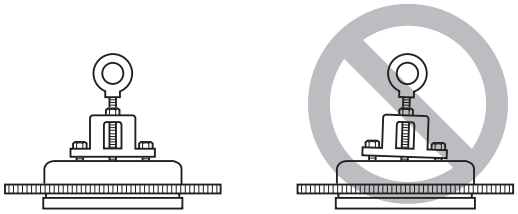
Flywheel holder: 90890-06522

5

2. Remove the flywheel magnet.



S60V5460



S60V5470

CAUTION:

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

NOTE:

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

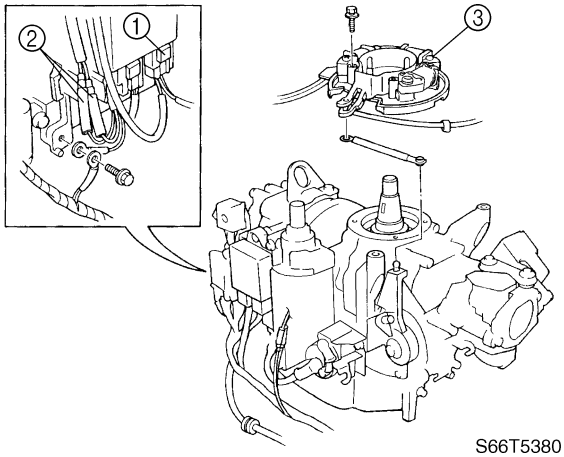
Flywheel puller: 90890-06521

3. Remove the Woodruff key.

Removing the electrical components

1. Disconnect the pulser coil and charge coil coupler ①, and disconnect the lighting coil connectors ② (WH and W models).

2. Remove the base assembly ③.

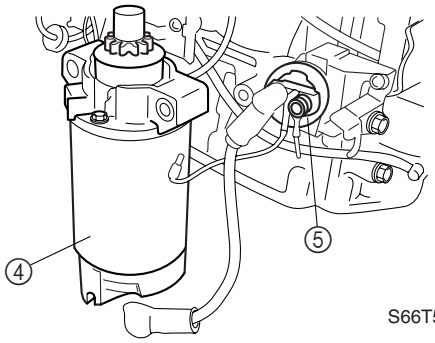


S66T5380

3. Disconnect the starter motor lead from the starter motor (WH and W models).

4. Disconnect the starter relay leads.

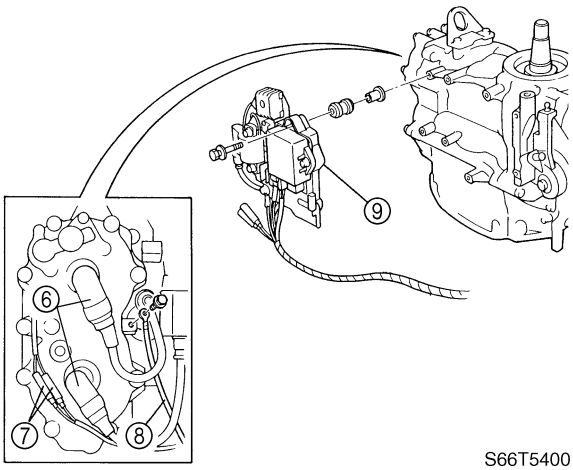
5. Remove the starter motor ④ and starter relay ⑤ (WH and W models).



S66T5390

6. Remove the spark plug caps ⑥ from the spark plugs.

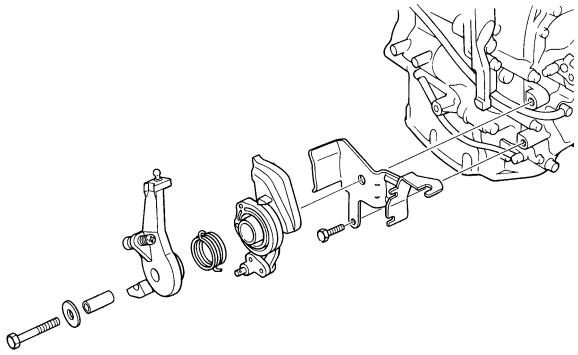
7. Disconnect the thermoswitch connectors ⑦ and ground lead ⑧, and then remove the CDI unit assembly ⑨.



S66T5400

Removing the throttle cam assembly

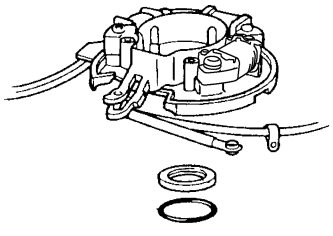
1. Remove the throttle cam assembly.



S66T5160

Disassembling the base assembly

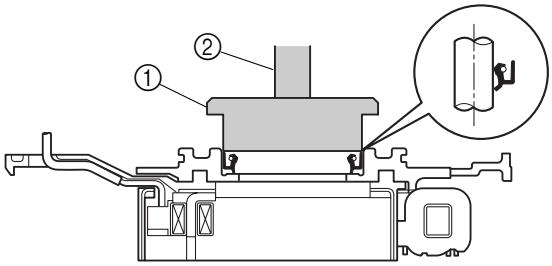
1. Remove the O-ring and oil seal.



S66T5680

Assembling the base assembly

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



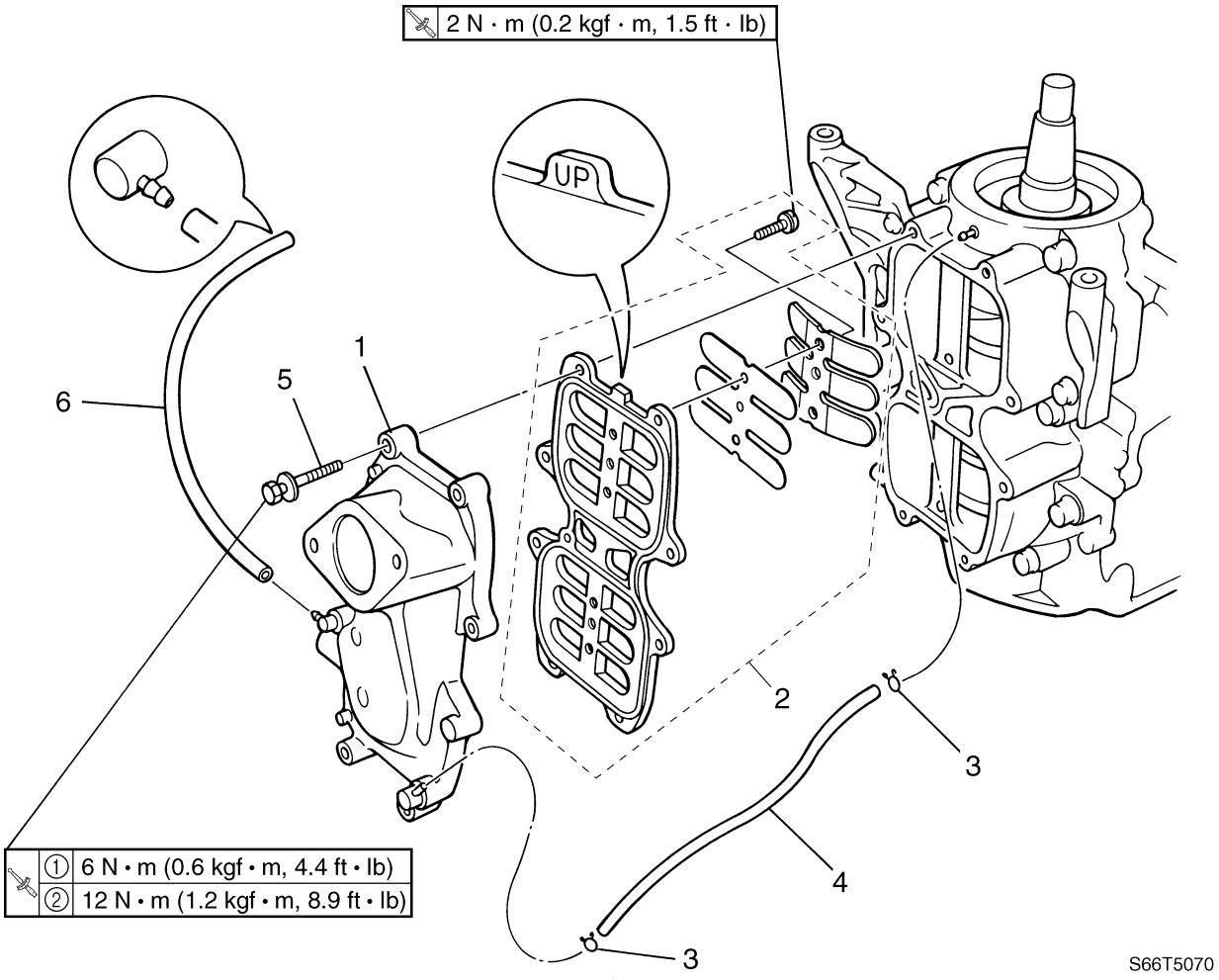
S66T5690

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

2. Install the new O-ring.

5

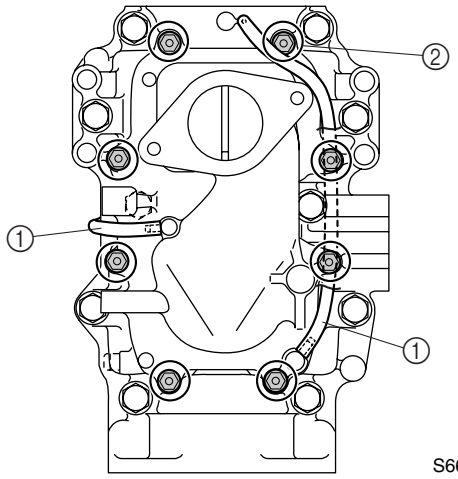
Reed valves



No.	Part name	Q'ty	Remarks
1	Intake manifold	1	
2	Reed valve assembly	1	
3	Clamp	2	
4	Hose	1	
5	Bolt	8	M6 × 35 mm
6	Hose	1	

Removing the reed valve assembly

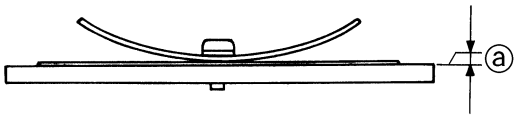
1. Disconnect the hoses ①.
2. Remove the intake manifold bolts ②, and then remove the intake manifold and reed valve assembly.



S66T5280

Checking the reed valve

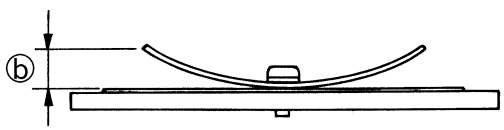
1. Check the reed valves for bends ⓐ. Replace if above specification.



S66T5290

Valve bend limit ⓐ:
0.2 mm (0.008 in)

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

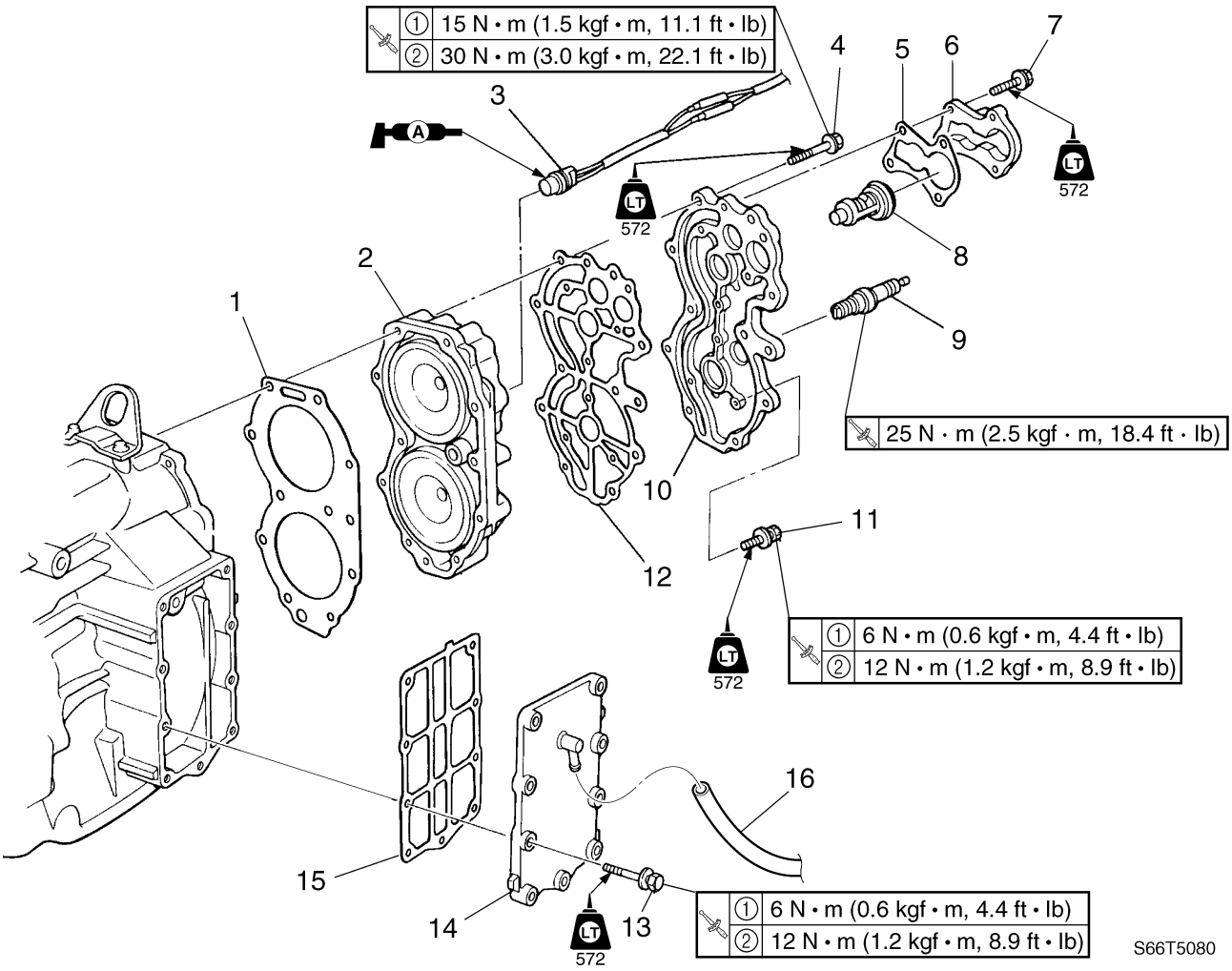


S66T5300

Valve stopper height ⓑ:
10.2–10.4 mm (0.40–0.41 in)

5

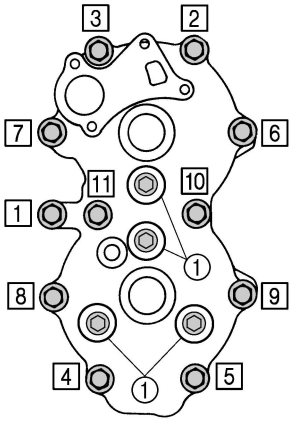
Cylinder head



No.	Part name	Q'ty	Remarks
1	Gasket	1	**Not reusable**
2	Cylinder head	1	
3	Thermoswitch	1	
4	Bolt	11	M8 × 70 mm
5	Gasket	1	**Not reusable**
6	Cover	1	
7	Bolt	4	M6 × 35 mm
8	Thermostat	1	
9	Spark plug	2	
10	Cylinder head cover	1	
11	Bolt	4	M6 × 25 mm
12	Gasket	1	**Not reusable**
13	Bolt	9	M6 × 25 mm
14	Exhaust cover	1	
15	Gasket	1	**Not reusable**
16	Pilot water hose	1	

Removing the cylinder head

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



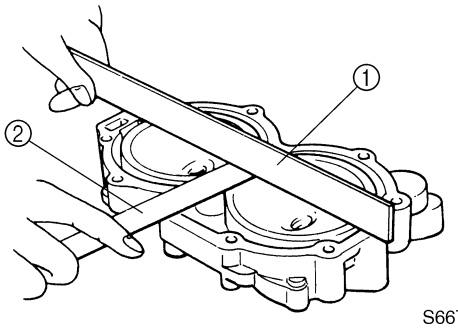
S66T5320

CAUTION:

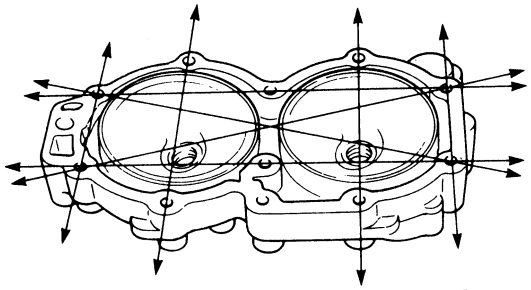
Do not scratch or damage the mating surfaces of the cylinder head and cylinder block.

Checking the cylinder head

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



S66T5330

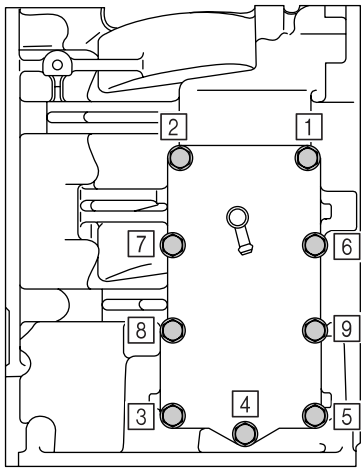


S66T5340

Cylinder head warpage limit:
0.1 mm (0.004 in)

Removing the exhaust cover

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



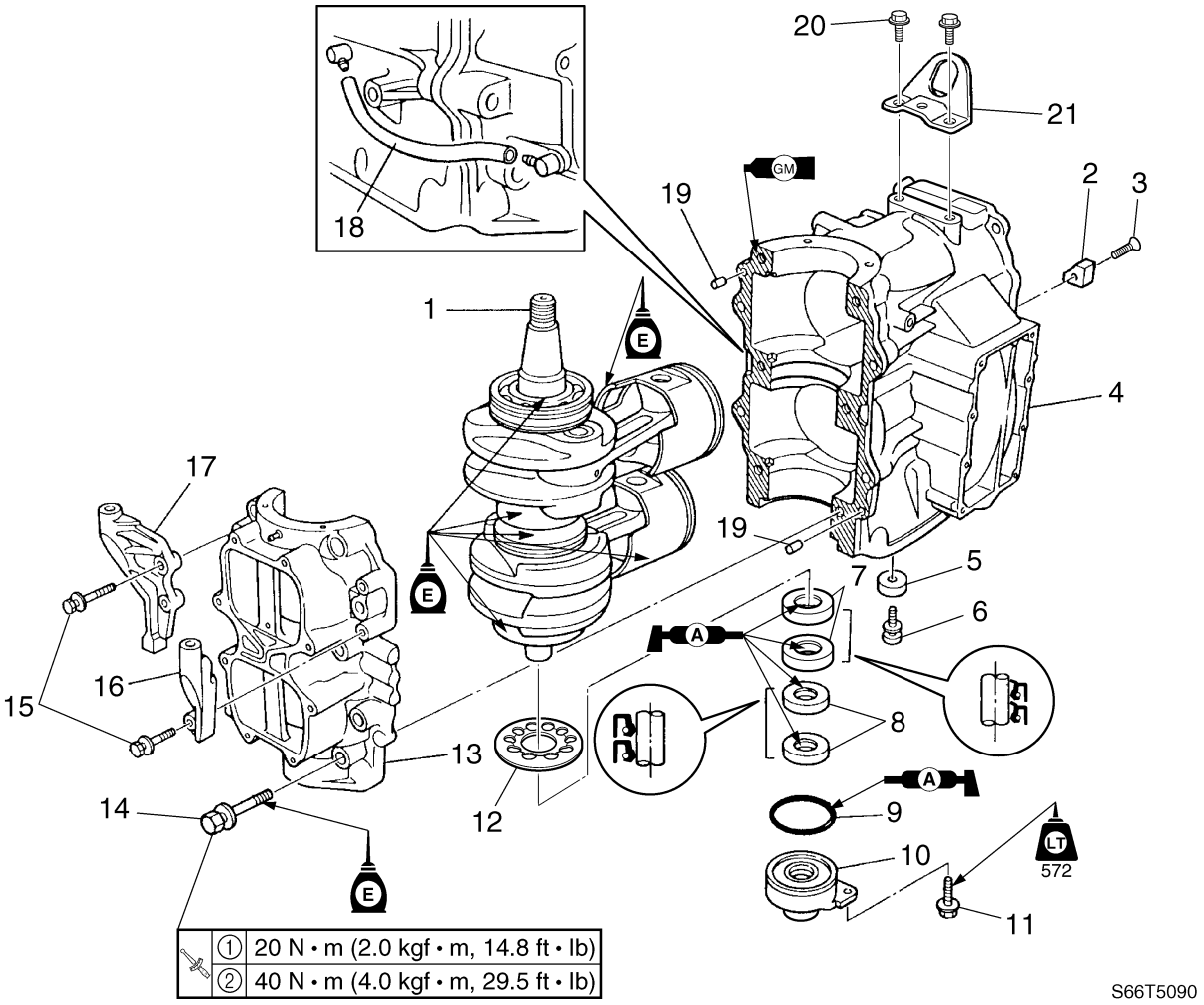
S66T5310

Checking the exhaust cover

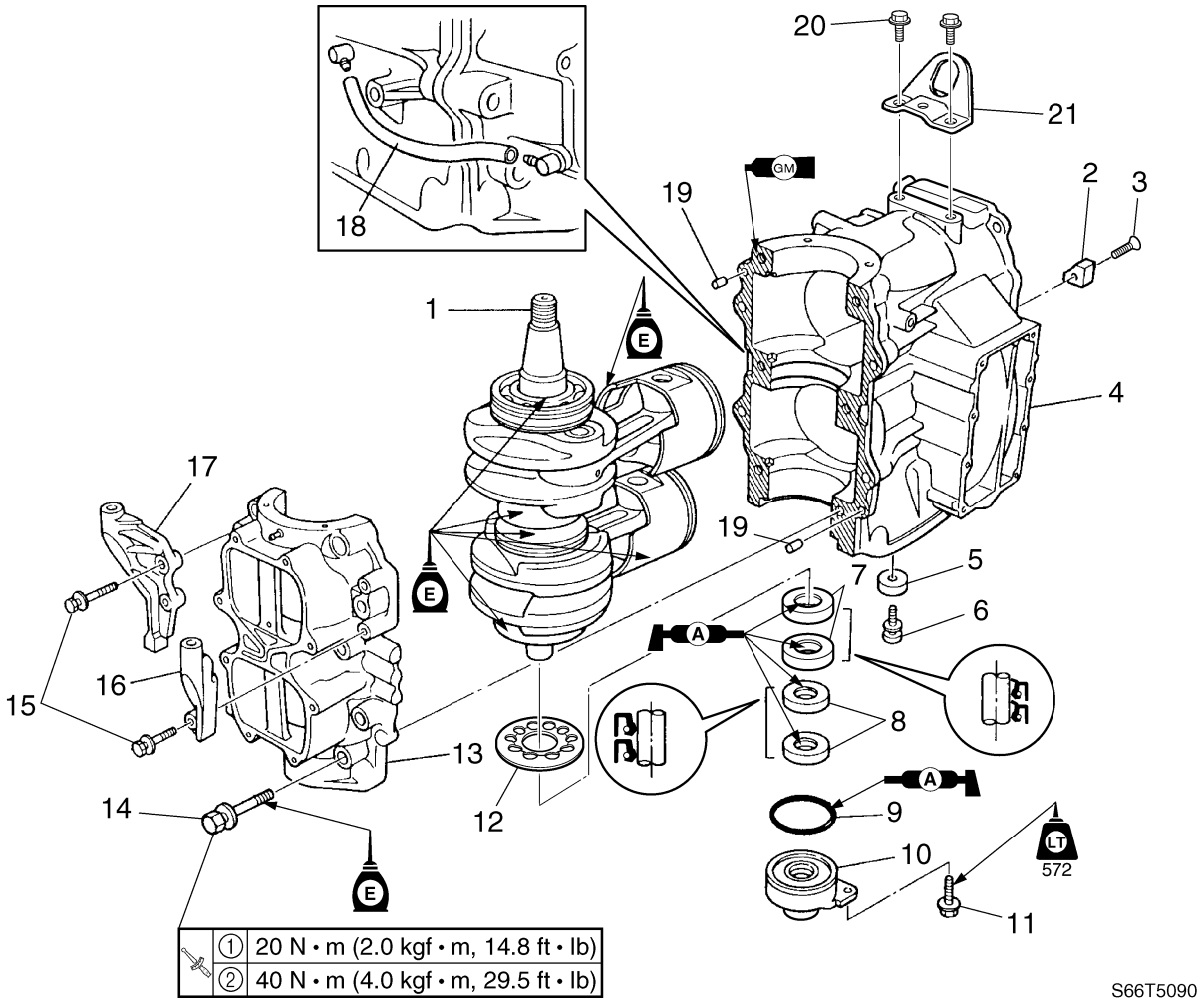
1. Check the exhaust cover for distortion or corrosion. Replace if necessary.

5

Crankcase

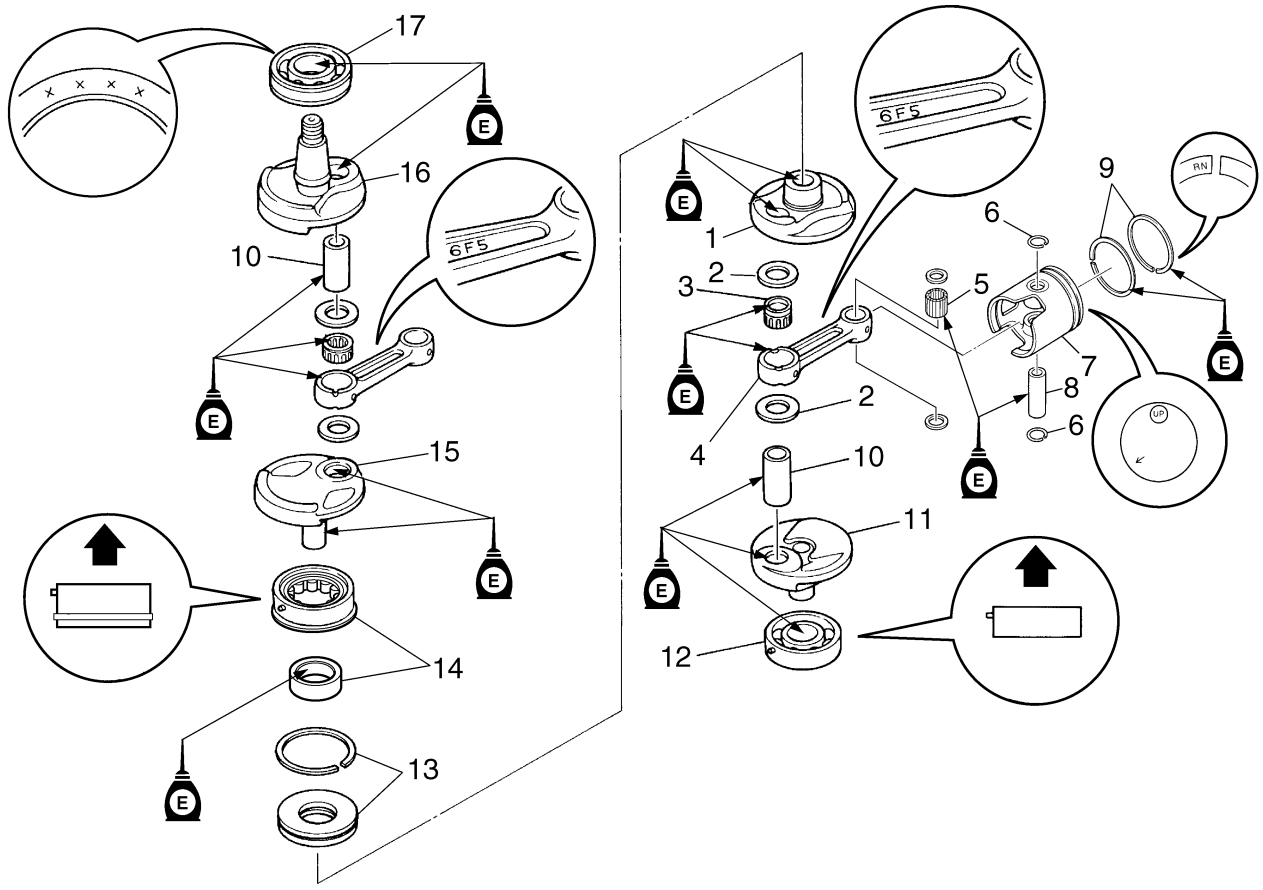


No.	Part name	Q'ty	Remarks
1	Crankshaft assembly	1	
2	Anode	1	
3	Screw	1	
4	Cylinder block	1	
5	Anode	1	
6	Screw	1	ø6 × 20 mm
7	Oil seal	2	**Not reusable**
8	Oil seal	2	**Not reusable**
9	O-ring	1	**Not reusable**
10	Oil seal housing	1	
11	Bolt	1	M6 × 20 mm
12	Spacer	1	
13	Crankcase	1	
14	Bolt	10	M10 × 55 mm
15	Bolt	4	M6 × 30 mm
16	Bracket	1	
17	Bracket	1	



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

5

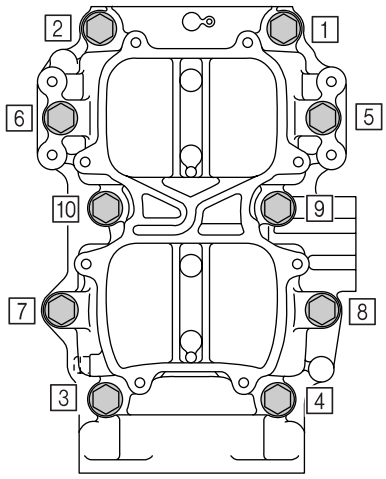


S66T5100

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

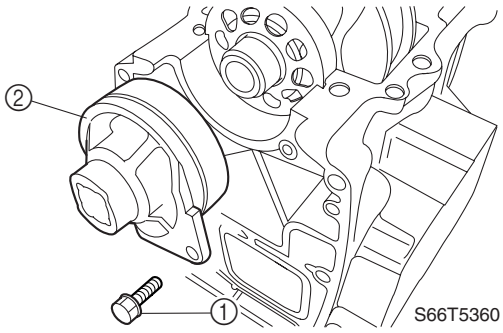
Removing the crankcase and oil seal housing

1. Remove the crankcase bolts in the sequence shown.



S66T5350

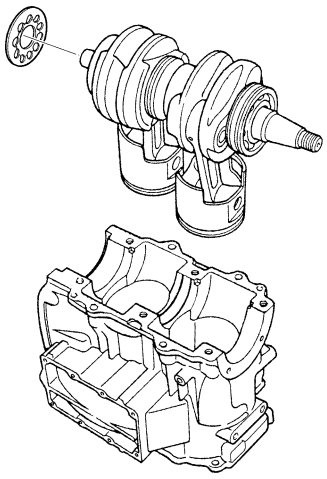
2. Remove the bolt ①, then the oil seal housing ②.



S66T5360

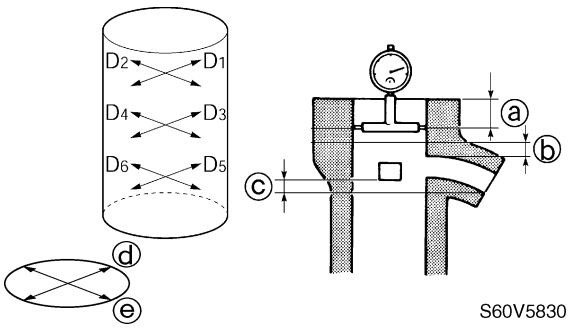
Removing the crankshaft assembly

1. Remove the crankshaft assembly.


S66T5370

Checking the cylinder bore

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



S60V5830

ⓐ: 20 mm (0.79 in) from the cylinder block surface
ⓑ: 5 mm (0.20 in) above the exhaust port upper edge
ⓒ: 5 mm (0.20 in) below the scavenging port lower edge

Cylinder bore (D_1–D_6):
80.000–80.020 mm
(3.1496–3.1504 in)

2. Calculate the taper limit. Replace or rebore the cylinder block if above specification.

Taper limit:
D_1–D_5 (direction ⓓ)
D_2–D_6 (direction ⓔ)
0.08 mm (0.0031 in)

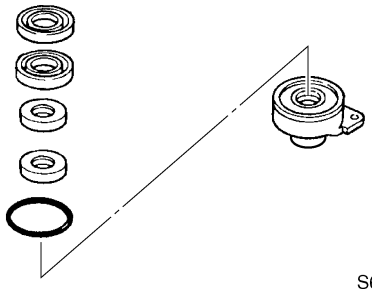
3. Calculate the out-of-round limit. Replace or rebore the cylinder block if above specification.

Out-of-round limit:
D_2–D_1 (measuring point ⓐ)
D_6–D_5 (measuring point ⓒ)
0.05 mm (0.0020 in)

5

Disassembling the oil seal housing

1. Remove the O-ring and oil seals.



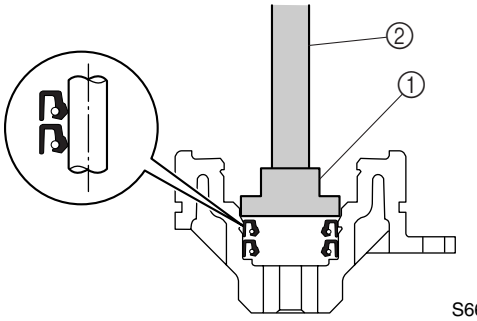
S66T5420

Checking the oil seal housing

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

Assembling the oil seal housing

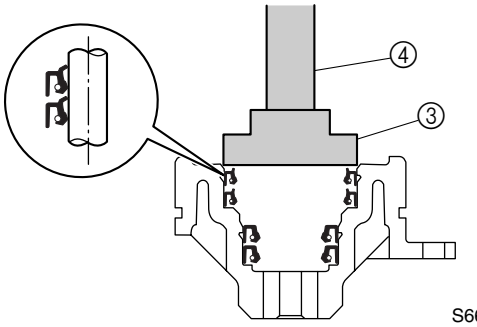
1. Apply grease to new oil seals, then install them into the oil seal housing.



S66T5430

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

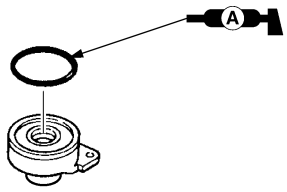
2. Apply grease to new oil seals, then install them into the oil seal housing.



S66T5440

Needle bearing attachment ③: 90890-06655
Driver rod LS ④: 90890-06606

3. Install the new O-ring.



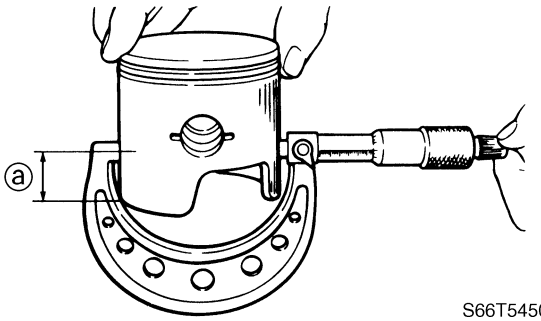
S66T5490

Disassembling the piston

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

Checking the piston diameter

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



S66T5450

Piston diameter:
79.910–79.934 mm
(3.1461–3.1470 in)
Measuring point ⓐ:
10 mm (0.39 in) up from the bottom of the piston skirt
Oversize piston diameter:
1st:
80.160–80.184 mm
(3.1559–3.1568 in)
2nd:
80.410–80.434 mm
(3.1657–3.1667 in)

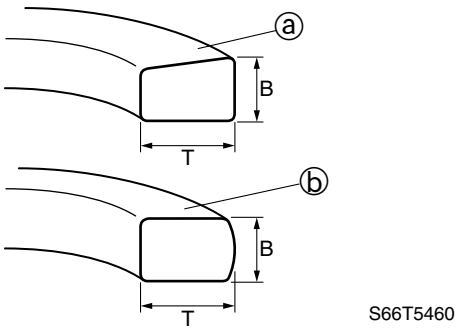
Checking the piston clearance

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

Piston clearance:
0.085–0.090 mm
(0.0033–0.0035 in)

Checking the piston rings

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

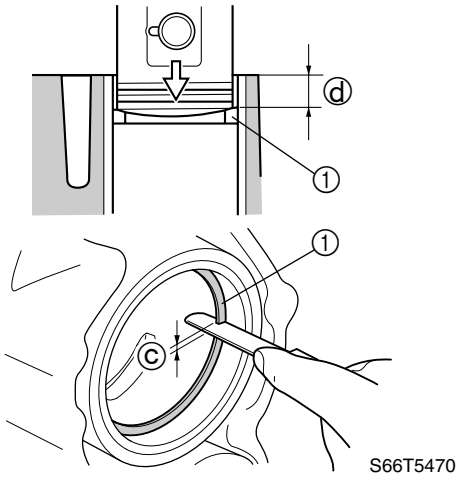


S66T5460

Piston ring dimensions:
Top ring ⓐ and 2nd piston ring ⓑ:
B: 1.97–1.99 mm
(0.0776–0.0783 in)
T: 2.40–2.60 mm
(0.0945–0.1024 in)

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

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

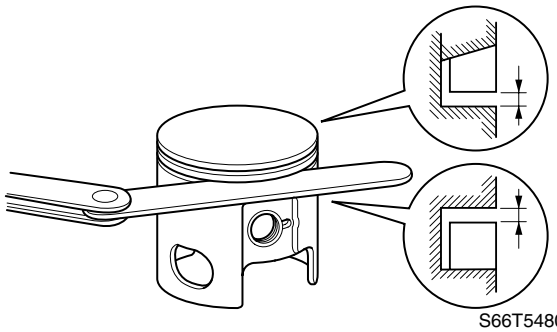


S66T5470

Piston ring end gap ⓒ:
Top ring and 2nd piston ring:
0.30–0.50 mm
(0.0118–0.0197 in)
Measuring point ⓓ: 20 mm (0.8 in)

Checking the piston ring side clearance

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

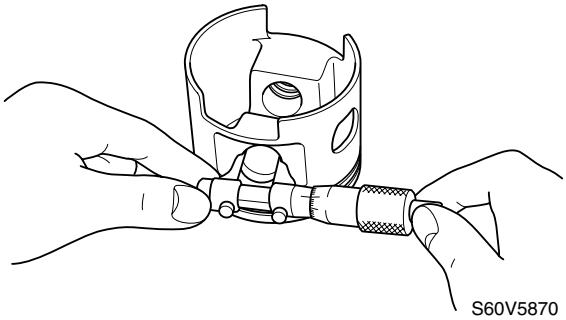

S66T5480

Piston ring side clearance:
Top ring:
0.04–0.08 mm
(0.0015–0.0031 in)
2nd piston ring:
0.03–0.07 mm
(0.0012–0.0028 in)

5

Checking the piston pin boss bore

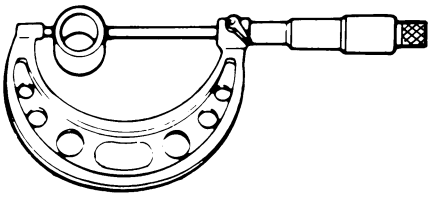
1. Measure the piston pin boss bore. Replace the piston if out of specification.


S60V5870

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

Checking the piston pin

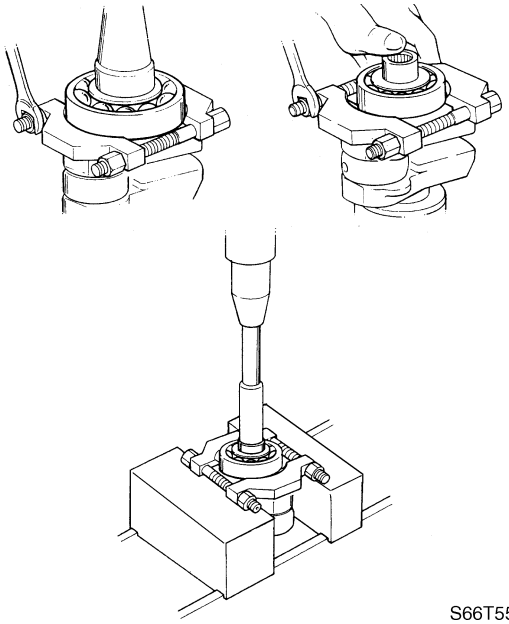
1. Measure the piston pin diameter. Replace if out of specification.


S69J5C30

Piston pin diameter:
19.895–19.900 mm
(0.7833–0.7835 in)

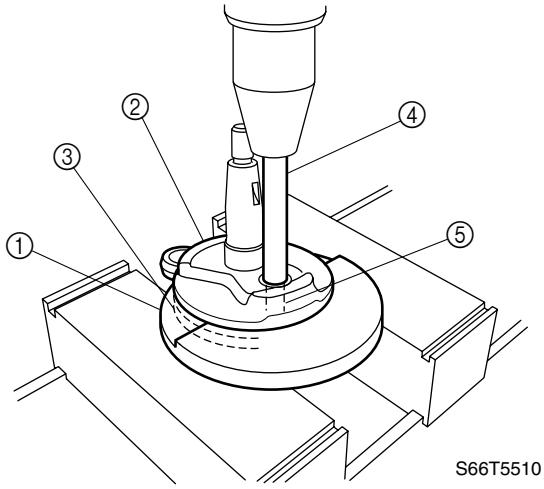
Disassembling the crankshaft

1. Remove the upper and lower bearings.


S66T5500

Bearing separator: 90890-06534

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

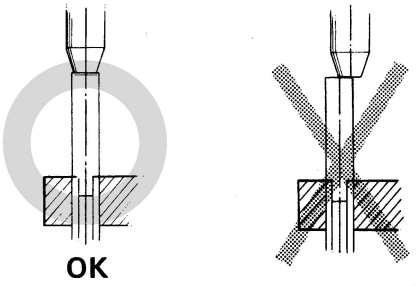


S66T5510

NOTE:
Remove the bearing before starting this procedures.

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

3. Remove the crankpin by applying pressure to pressure pin C ④ using a press.



S66T5520

CAUTION:

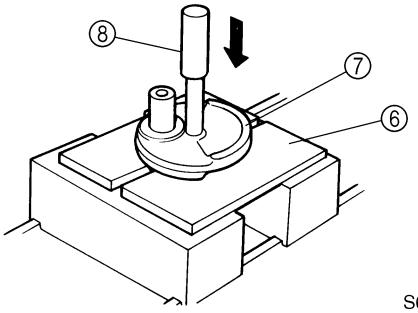
- **Apply pressure to pressure pin C slowly.**
- **Hold pressure pin C in line with the press screw spindle.**

NOTE:

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

4. Remove the washers, roller bearing and connecting rod.

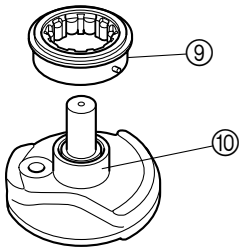
5. Insert the support ⑥ between cranks 2 and 3 ⑦ with crank 3 on top. Place pressure pin B ⑧ on the shaft, and force it out using a press.



S66T5530

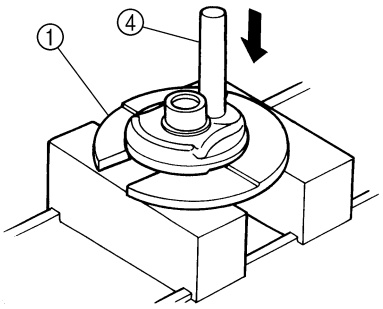
Support ⑥: 90890-02394
Pressure pin B ⑧: 90890-02390

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



S66T5540

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

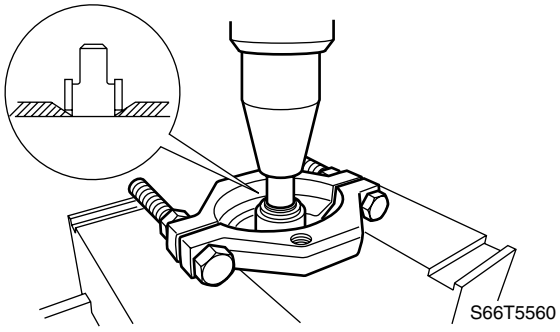


S66T5550

NOTE:
Pressure pin C should be pressed down straight.

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

8. Use the bearing separator to slightly move the inner race off the shaft, and then remove the inner race.



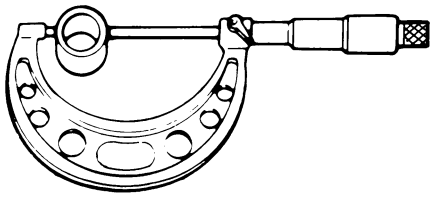
S66T5560

NOTE:
Use care not to scratch the shaft.

5

Checking the crankpin

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



S69J5C30

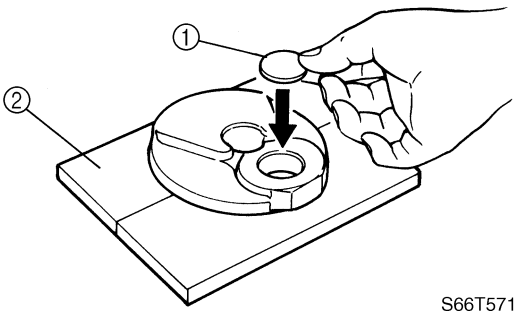
Crankpin diameter:
26.995–27.000 mm
(1.0628–1.0630 in)

Assembling the crankshaft

CAUTION:

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

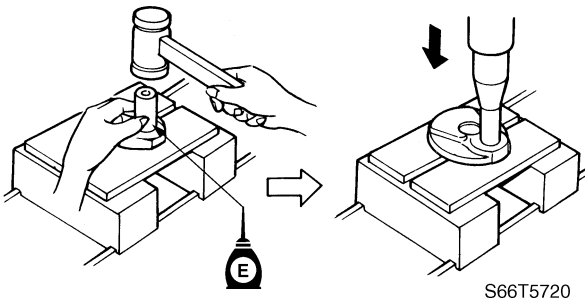
1. Insert spacer C ① into the crankpin hole of crank 2 (or crank 4).



S66T5710

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

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



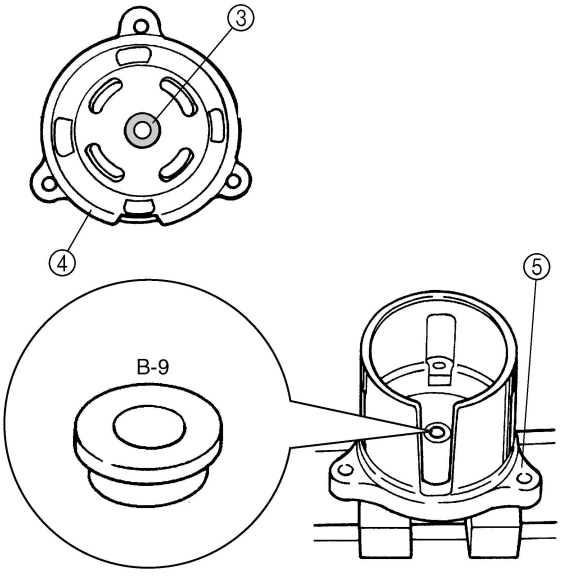
S66T5720

CAUTION:

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

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

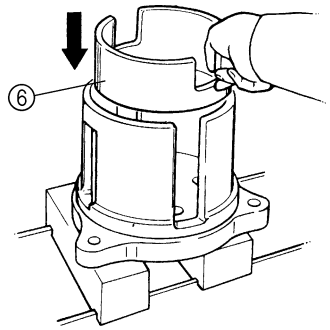
3. Insert the bushing ③ into the body ④.



S66T5730

Bushing-9 (D30) ③: 90890-02363
Body ④: 90890-02352
Flange ⑤: 90890-02351

4. Place the height ring ⑥ in the body.

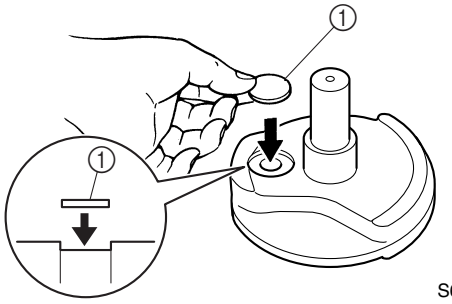


S66T5740

NOTE:
Align the slot in the height ring with the slot in the body.

Height ring-640 (H19) ⑥: 90890-06590

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

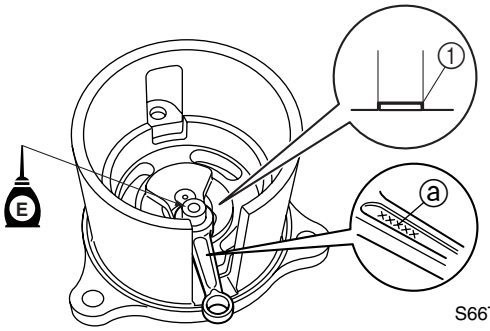


S66T5910

Spacer C ①: 90890-02404

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

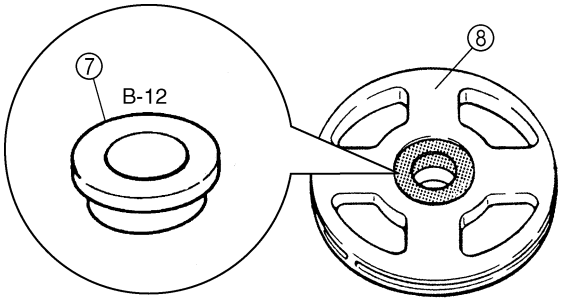
7. Mount the washers, roller bearing, and connecting rod on the crankpin.



S66T5750

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

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

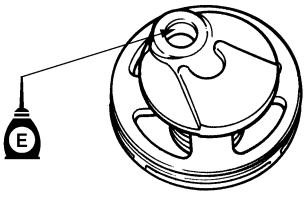


S66T5760

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

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

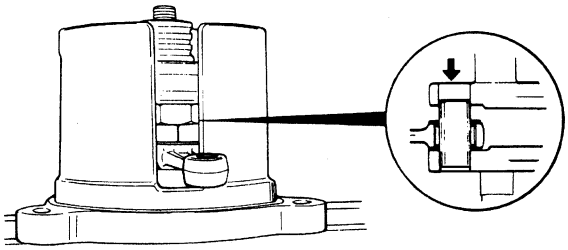
9. Install crank 1 (or crank 3) to the pressure plate.



S66T5770

5

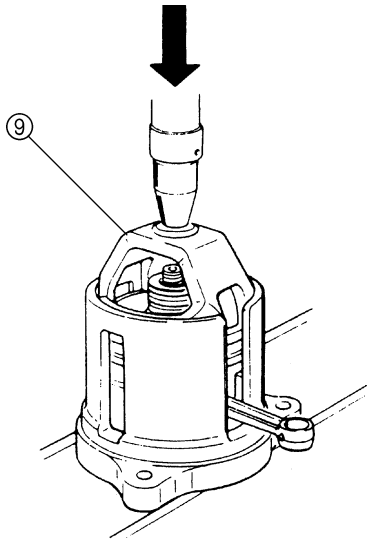
10. Align the crankpin hole in crank 1 (or crank 3) with the crankpin fitted to crank 2 (or crank 4) and place the pressure plate in the body.



S66T5780

NOTE:
Apply engine oil to the crankpin.

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

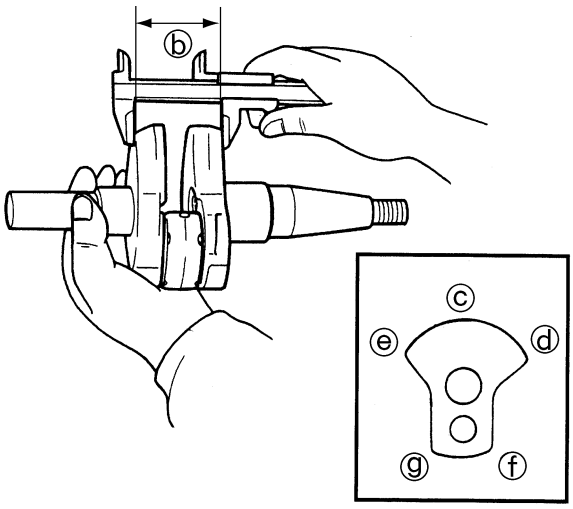


S66T5790

CAUTION:
Do not apply force in excess of 5 tons.

Press body ⑨: 90890-02385

12. Measure the width ⓑ of the assembled crankshaft using calipers. Measurements should be made at positions ⓒ to ⓖ.

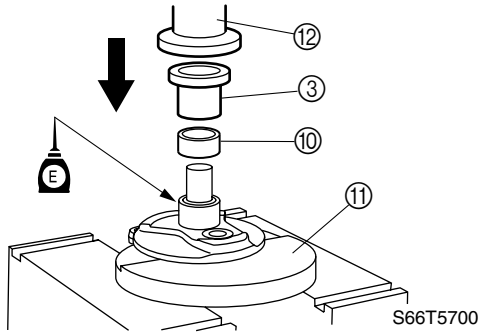


S66T5800

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

Crankshaft width ⓑ:
63.90–63.95 mm
(2.5157–2.5177 in)

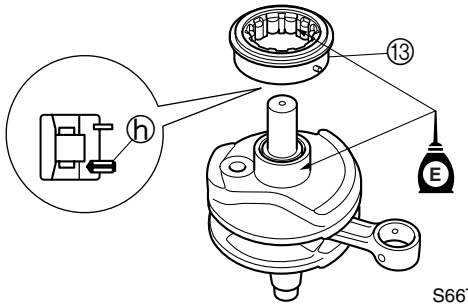
13. Install the inner race ⑩ onto crank 2 by using a press and the bushing ③. Carefully press the inner race onto the shaft.



S66T5700

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

14. Install the roller bearing ⑬ onto crank 2.

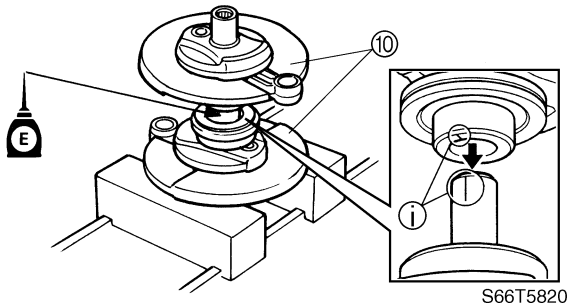


S66T5810

NOTE:
Make sure the pin ⓗ side of the bearing faces crank 2.

15. Insert plate C ⑩ between crank 1 and crank 2, and install the labyrinth ring on crank 3, before connecting crankshaft assemblies 3 and 4.

16. Insert plate C ⑩ between crank 3 and crank 4, then place them onto the crankshaft assemblies 1 and 2.

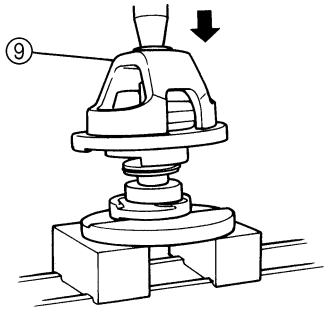


S66T5820

NOTE:
Align the alignment marks ⓘ on cranks 2 and 3.

Plate C ⑩: 90890-02402

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



S66T5830

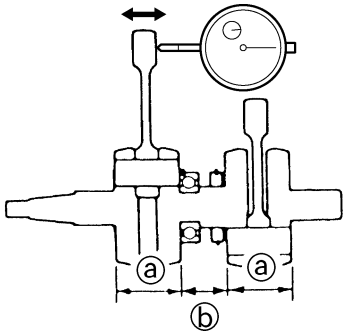
CAUTION:
Do not apply force in excess of 7 tons.

Press body ⑨: 90890-02385

Checking the crankshaft

1. Measure the crankshaft widths ⓐ and ⓑ. Repair or disassemble the crankshaft if out of specification.

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

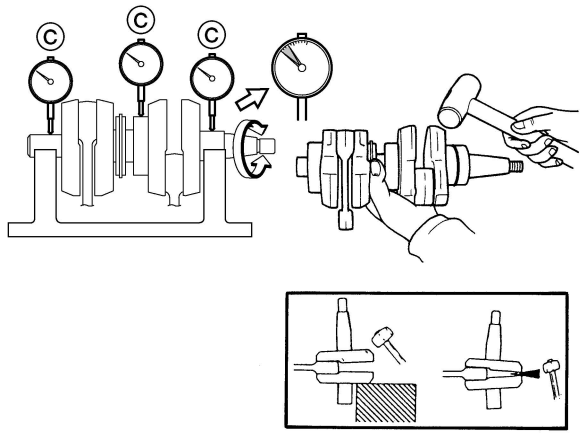


S66T5850

Crankshaft width ⓐ:
63.90–63.95 mm
(2.5157–2.5177 in)
Crankshaft width ⓑ:
40.88–41.10 mm
(1.6094–1.6181 in)
Connecting rod small end axial play limit:
2.0 mm (0.079 in)

5

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

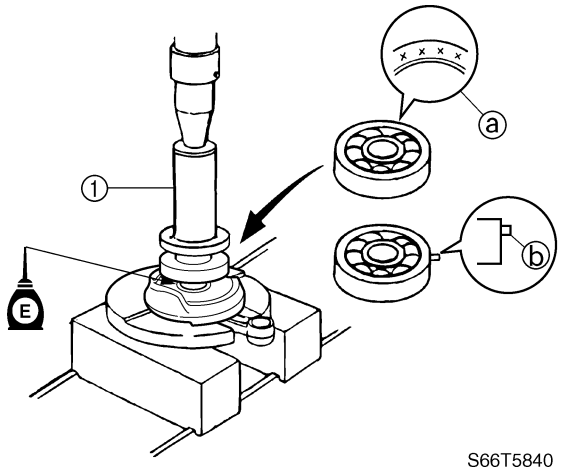


S66T5860

Crankshaft runout limit ⓒ:
0.03 mm (0.0012 in)

Installing the crankshaft bearings

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

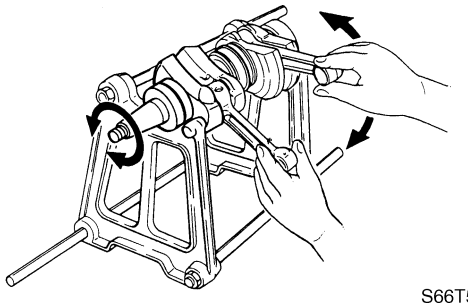


S66T5840

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

Bearing pressure C ①:
90890-02393

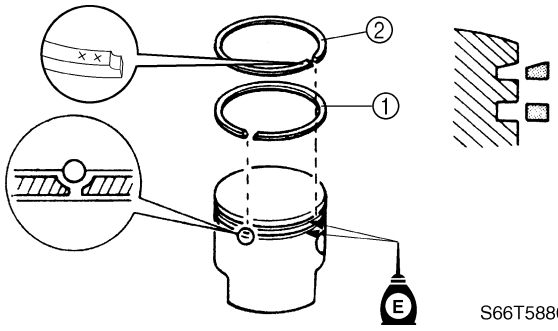
2. Slowly turn the crankshaft and connecting rods. If it does not turn smoothly, disassemble the crankshaft and adjust or replace any parts as necessary.



S66T5870

Assembling the piston

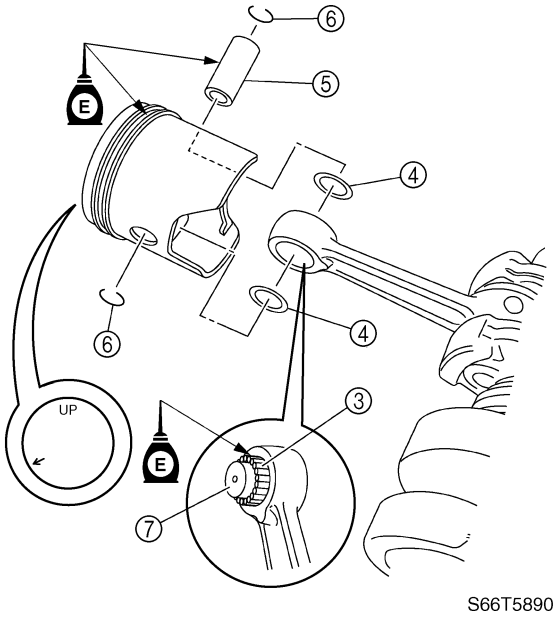
1. Install the 2nd piston ring ① and top ring ② onto the pistons.



S66T5880

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

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



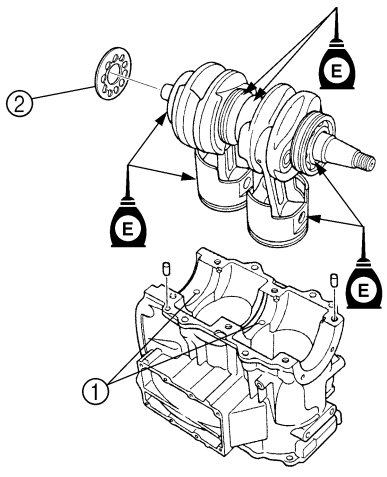
S66T5890

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

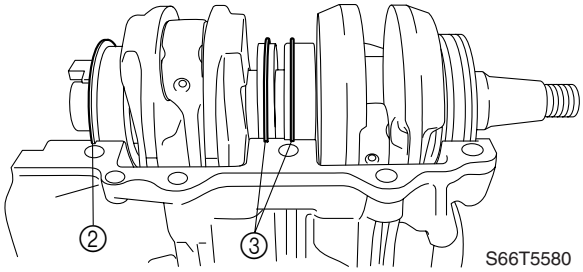
Small end bearing installer ⑦:
90890-06527

Assembling the power unit

1. Install the crankshaft assembly into the cylinder block.



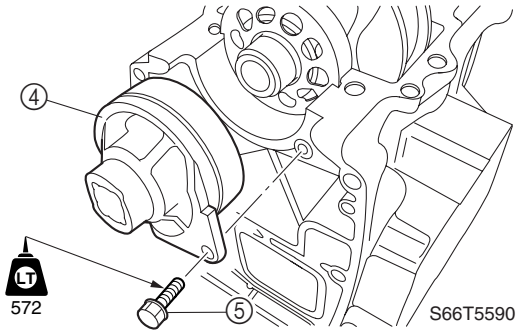
S66T5570



S66T5580

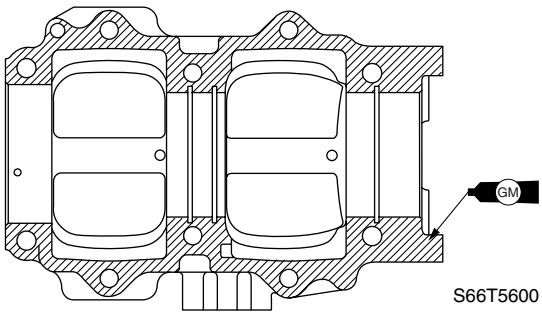
NOTE:
- Apply engine oil to the pistons, piston rings and bearings before installation.
- Align the dowels of the bearings with the holes ① on the cylinder block.
- Align the spacer ② and rings ③ with the grooves in the cylinder block.

2. Install the oil seal housing ④ and bolt ⑤, and then tighten the bolt finger tight.



S66T5590

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

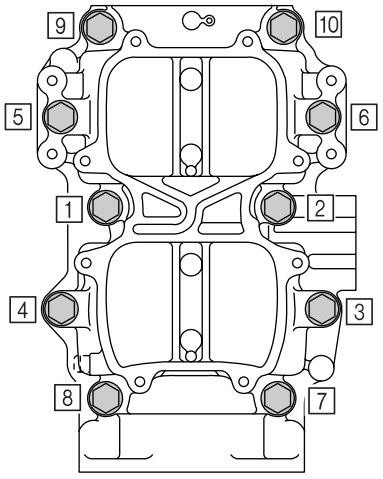


S66T5600

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

5

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



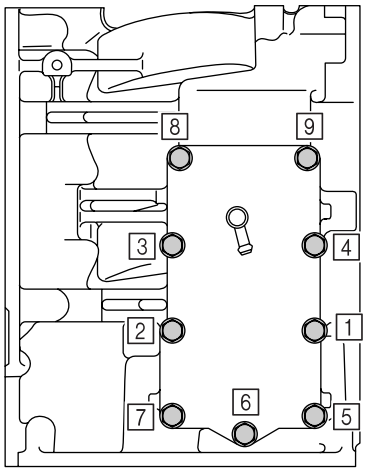
S66T5610

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

Crankcase bolt:
1st: 20 N·m (2.0 kgf·m, 14.8 ft·lb)
2nd: 40 N·m (4.0 kgf·m, 29.5 ft·lb)

5. Tighten the oil seal housing bolt.

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



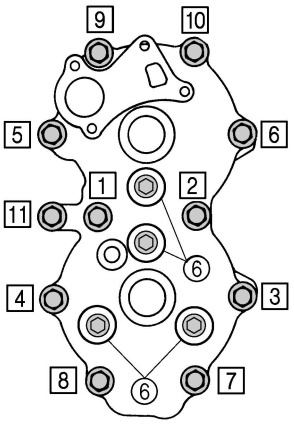
S66T5620

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

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

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

8. Install the cylinder head cover bolts ⑥, and then tighten the bolts to the specified torques in two stages.



S66T5630

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

Cylinder head bolt:
1st: 15 N·m (1.5 kgf·m, 11.1 ft·lb)
2nd: 30 N·m (3.0 kgf·m, 22.1 ft·lb)
Cylinder head cover bolt ⑥:
1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb)
2nd: 12 N·m (1.2 kgf·m, 8.9 ft·lb)

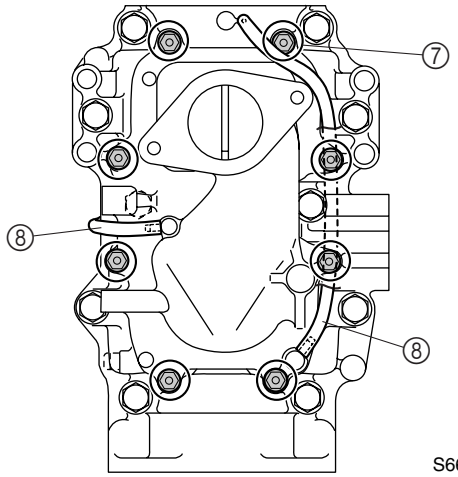
9. Install the thermostat, a new gasket and thermostat cover.

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

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

11. Install the reed valve assembly and the intake manifold assembly, and then tighten the intake manifold bolts ⑦ to the specified torques in two stages.

12. Connect the hoses ⑧.



	Intake manifold bolt ⑦: 1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb) 2nd: 12 N·m (1.2 kgf·m, 8.9 ft·lb)

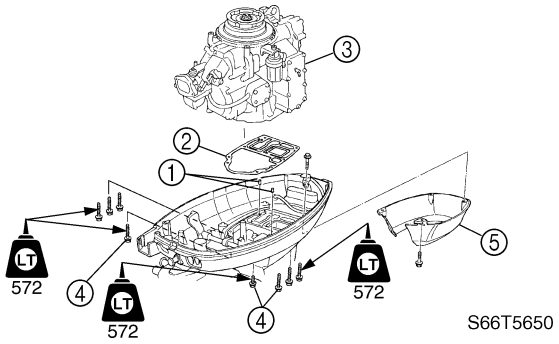
13. Install the throttle cam assembly, and the electrical components to the power unit.

Installing the power unit

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

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

3. Install the apron ⑤.

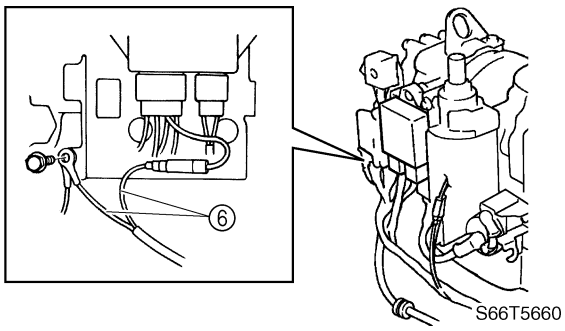


NOTE:
Apply LOCTITE 572 to the power unit mounting bolts before installation.

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

4. Connect the fuel hose and pilot water hose.

5. Connect the engine stop lanyard switch leads ⑥ (MH and WH models).

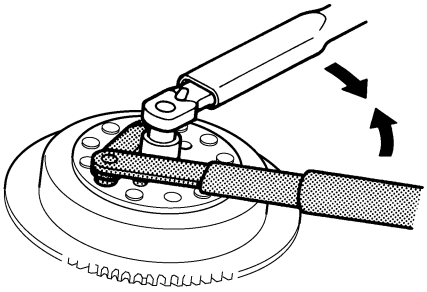


6. Connect the battery leads and neutral switch connectors (WH and W models).

7. Install the Woodruff key and flywheel magnet.

5

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



S60V5C90

CAUTION:

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

NOTE:

Apply engine oil to the flywheel magnet nut before installation.

	Flywheel holder: 90890-06522

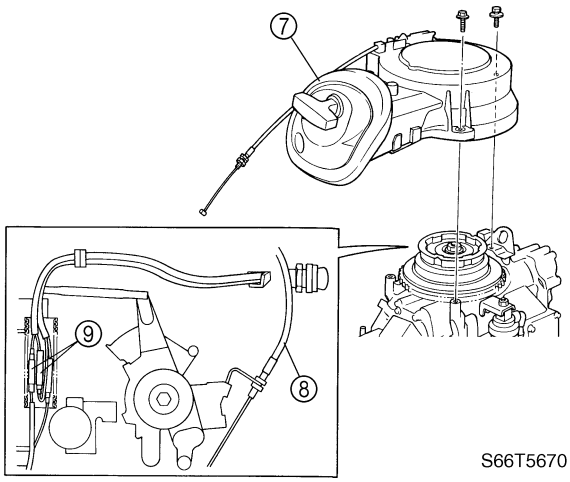
	Flywheel magnet nut: 157 N·m (15.7 kgf·m, 115.8 ft·lb)

9. Install the starter pulley.

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

11. Install the manual starter ⑦ and start-in gear protection cable ⑧, and then adjust it length. For adjustment procedures, see Chapter 3.

12. Connect the engine start button connectors ⑨ (WH model).

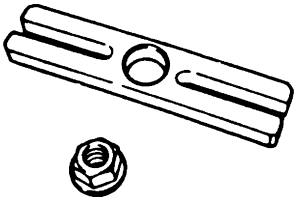


S66T5670

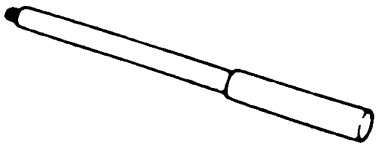
13. Install all removed parts.

Lower unit

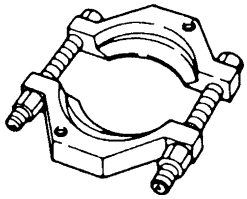
Special service tools



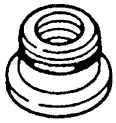
Stopper guide plate
90890-06501



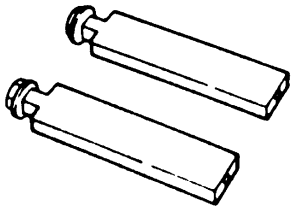
Driver rod L3
90890-06652



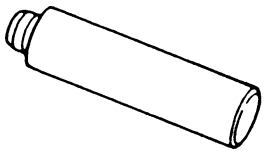
Bearing separator
90890-06534



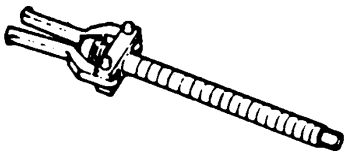
Ball bearing attachment
90890-06637



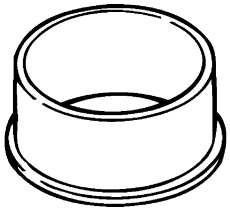
Stopper guide stand
90890-06538



Driver rod LS
90890-06606

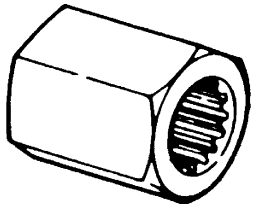


Bearing puller assembly
90890-06535

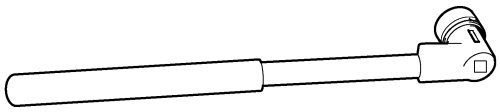


Bearing inner race attachment
90890-06639, 90890-06641, 90890-06644

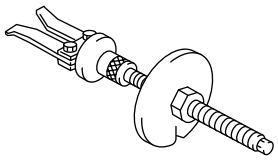
Needle bearing attachment
90890-06608, 90890-06614



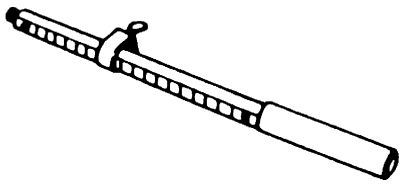
Drive shaft holder 3
90890-06517



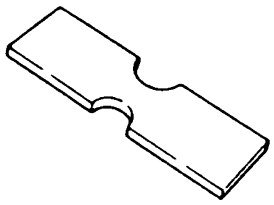
Pinion nut holder
New: 90890-06715
Current: 90890-06505



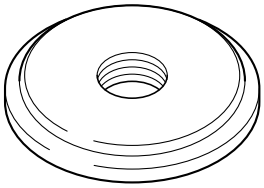
Bearing outer race puller assembly
90890-06523



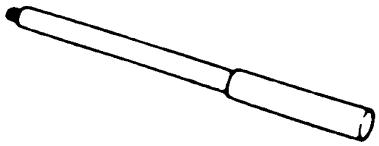
Driver rod SL
90890-06602



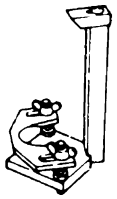
Bearing depth plate
90890-06603



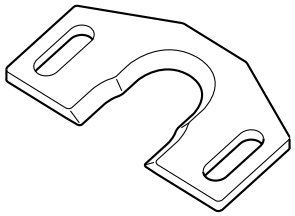
Bearing outer race attachment
90890-06622, 90890-06627



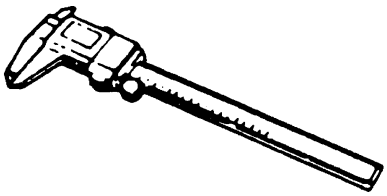
Driver rod LL
90890-06605



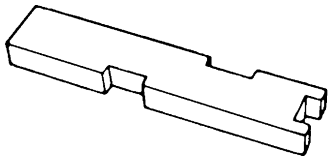
Pinion height gauge
90890-06710



Pinion height gauge plate B
90890-06712

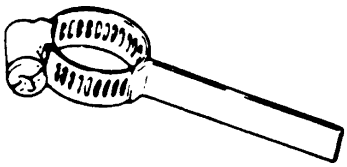


Digital caliper
90890-06704

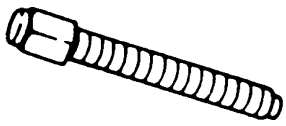


Shimming plate
90890-06701

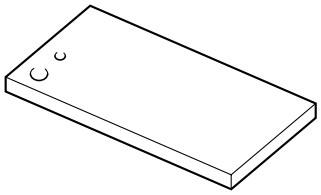
6



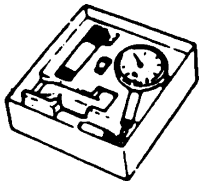
Backlash indicator
90890-06706



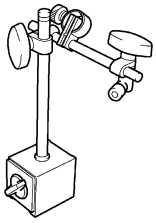
Center bolt
90890-06504



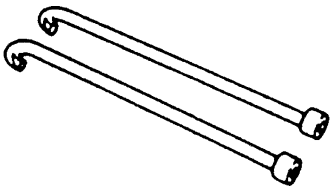
Magnet base plate
90890-07003



Dial gauge set
90890-01252

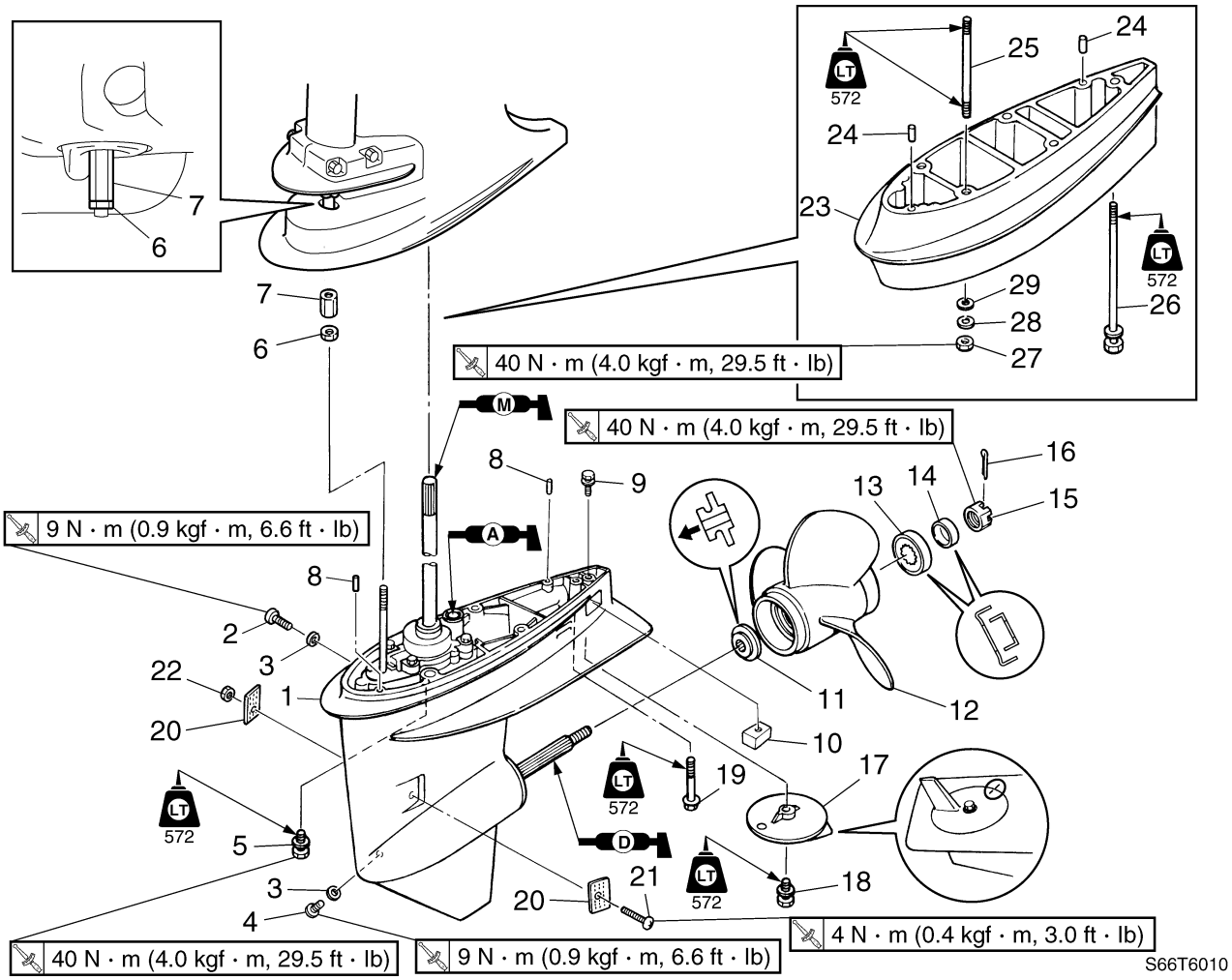


Magnet base B
90890-06844

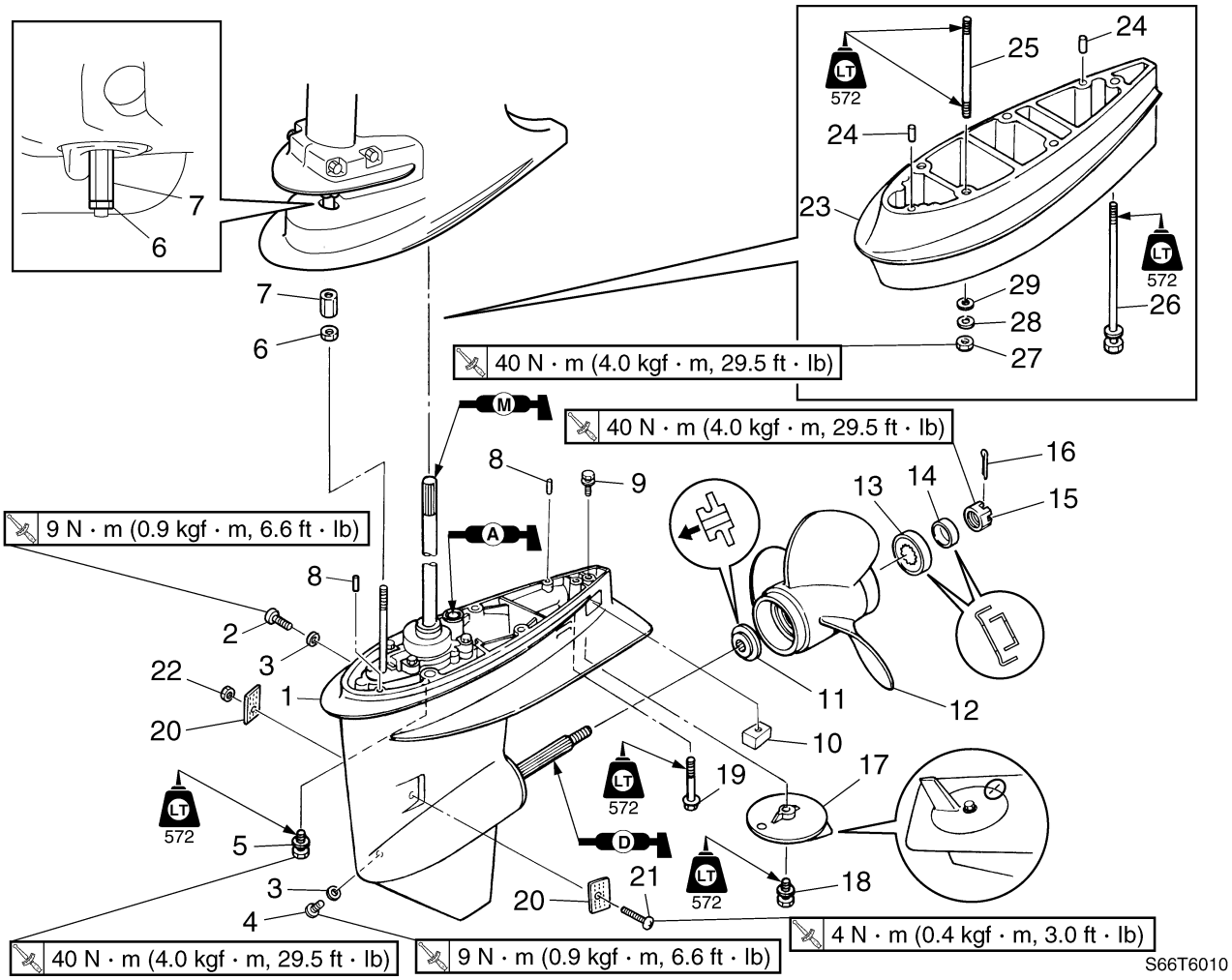


Bearing housing puller claw S
90890-06564

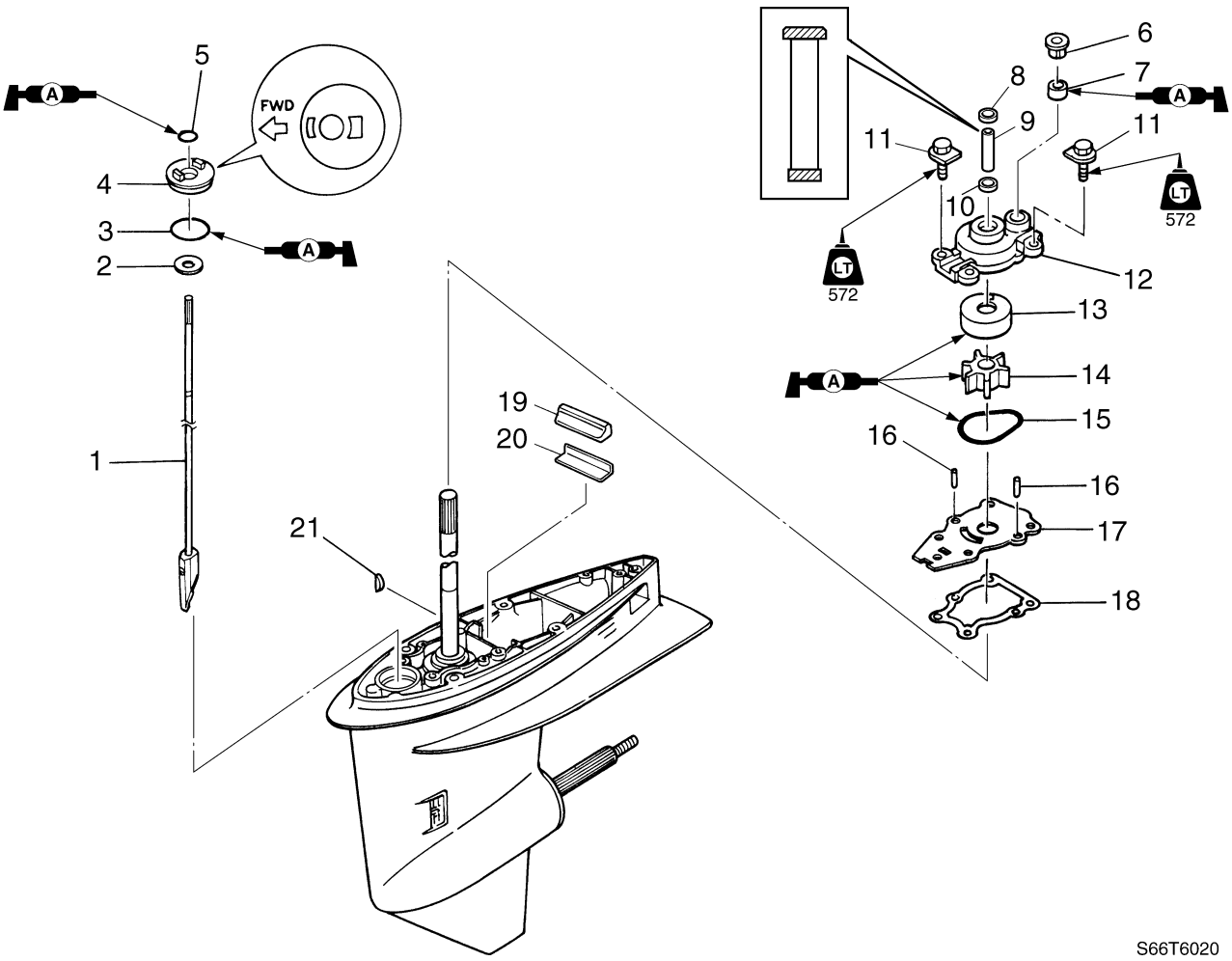
Lower unit



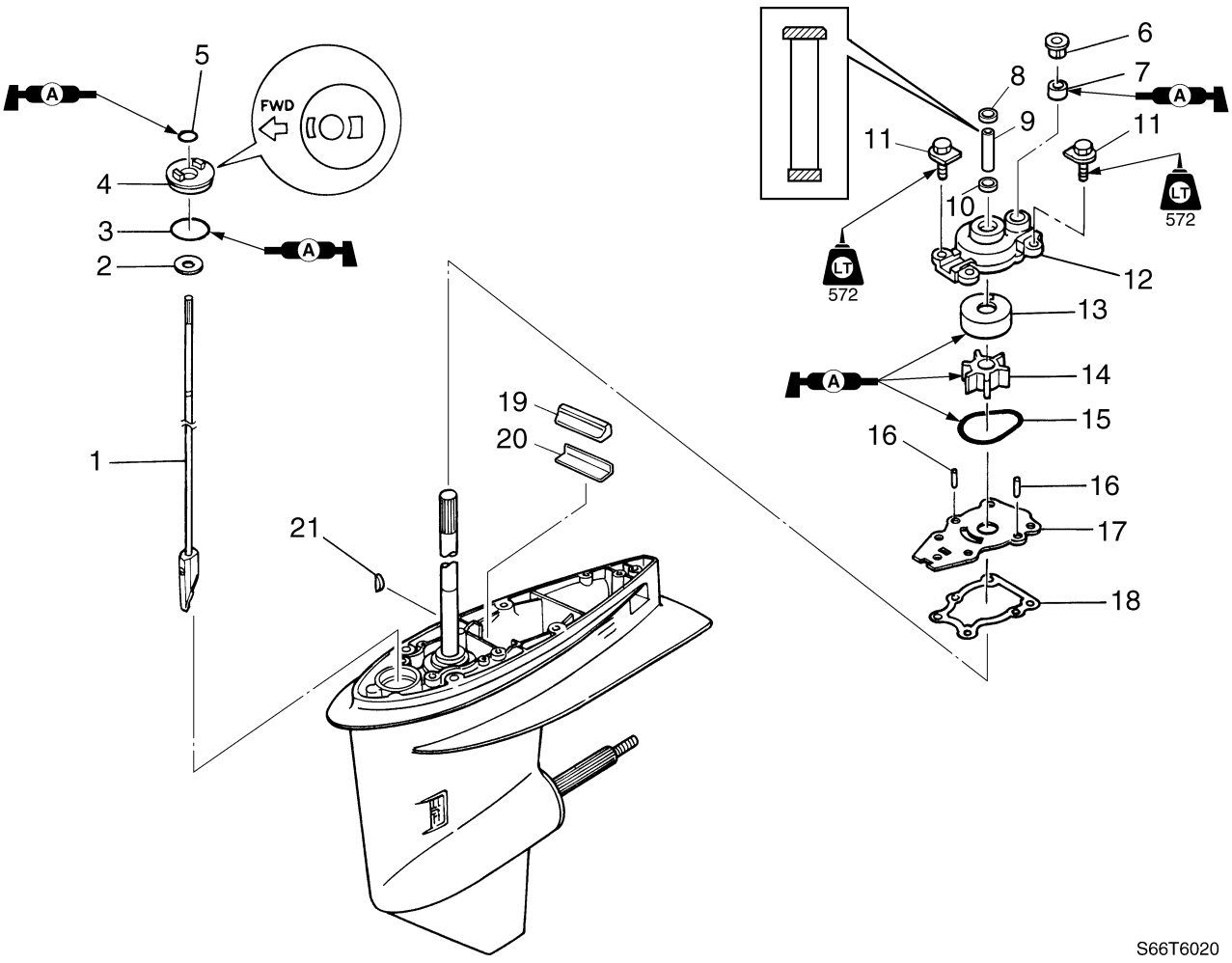
No.	Part name	Q'ty	Remarks
1	Lower unit	1	
2	Check screw	1	
3	Gasket	2	**Not reusable**
4	Drain screw	1	
5	Bolt	4	M10 × 40 mm / S- and L-transom models
6	Locknut	1	
7	Adjusting nut	1	
8	Dowel	2	
9	Bolt	1	M8 × 35 mm
10	Anode	1	
11	Spacer	1	
12	Propeller	1	
13	Washer	1	
14	Washer	1	
15	Propeller nut	1	
16	Cotter pin	1	**Not reusable**
17	Trim tab	1	



No.	Part name	Q'ty	Remarks
18	Bolt	1	M8 × 25 mm
19	Bolt	1	M8 × 65 mm / S- and L-transom models
20	Cooling water inlet cover	2	
21	Screw	1	ø5 × 28 mm
22	Nut	1	
23	Extension	1	X-transom model
24	Dowel	2	X-transom model
25	Stud bolt	4	X-transom model
26	Bolt	1	M8 × 170 mm / X-transom model
27	Nut	4	X-transom model
28	Spring washer	4	X-transom model
29	Washer	4	X-transom model



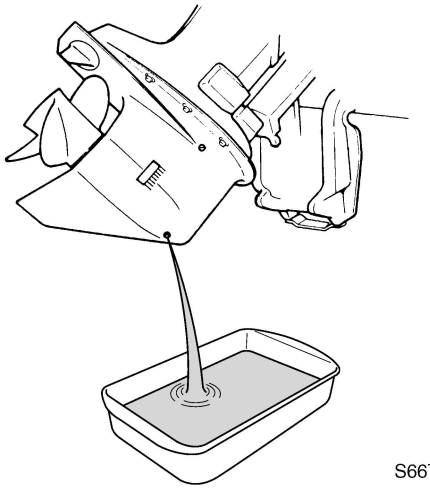
No.	Part name	Q'ty	Remarks
1	Shift rod	1	
2	Washer	1	
3	O-ring	1	**Not reusable**
4	Shift rod housing	1	
5	O-ring	1	**Not reusable**
6	Cover	1	
7	Seal	1	
8	Grommet	1	L- and X-transom models
9	Water tube	1	L- and X-transom models
10	Grommet	1	L- and X-transom models
11	Bolt	4	M8 × 30 mm
12	Water pump housing	1	
13	Insert cartridge	1	
14	Impeller	1	
15	O-ring	1	**Not reusable**
16	Dowel	2	
17	Outer plate cartridge	1	



No.	Part name	Q'ty	Remarks
18	Gasket	1	**Not reusable**
19	Seal	1	
20	Plate	1	
21	Woodruff key	1	

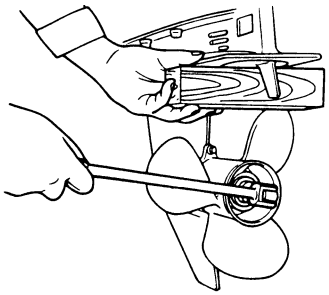
Removing the lower unit

1. Drain the gear oil.



S66T6370

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



S69J6015

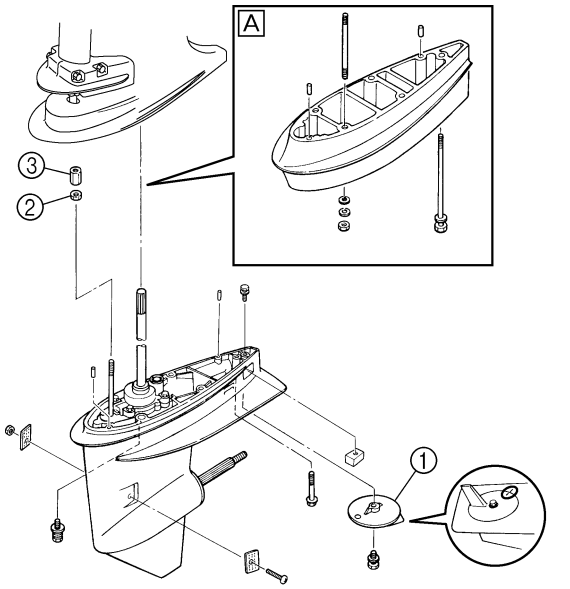
⚠ WARNING

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

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

4. Loosen the locknut ②, and then remove the adjusting nut ③.

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



S66T6030

A X-transom model

Removing the water pump and shift rod

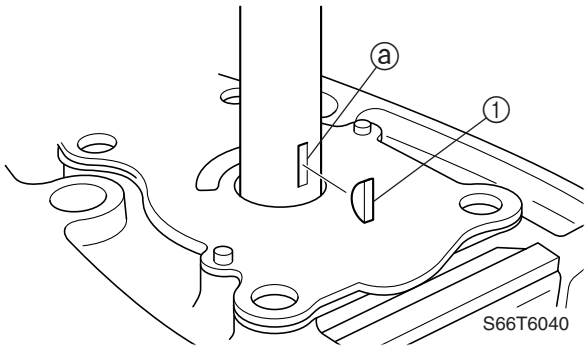
1. Remove the water pump assembly and shift rod assembly.

Checking the water pump and shift rod

1. Check the water pump housing for deformation. Replace if necessary.

2. Check the impeller and insert cartridge for cracks or wear. Replace if necessary.

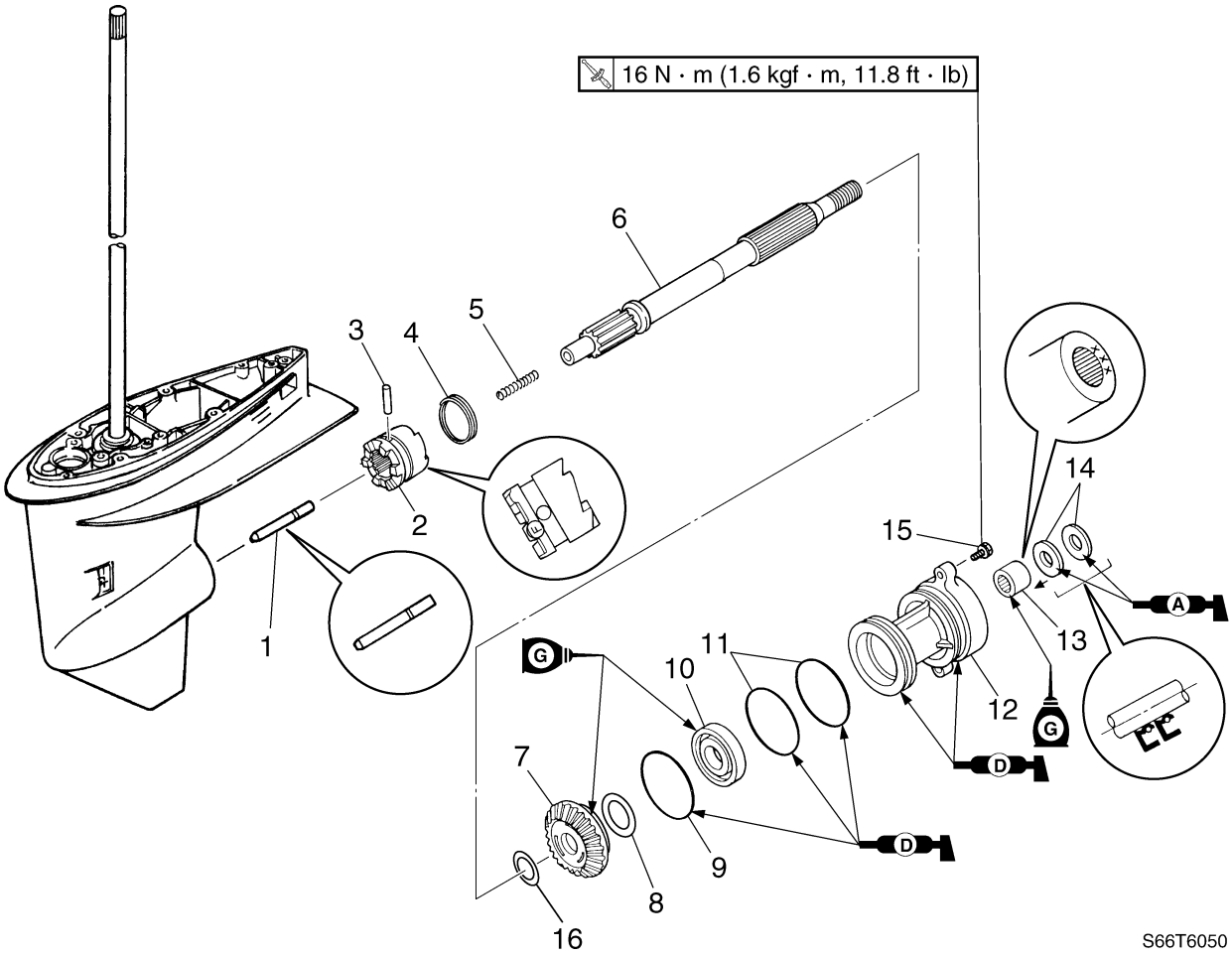
3. Check the Woodruff key ① and the keyway ⓐ in the drive shaft for wear. Replace if necessary.



S66T6040

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

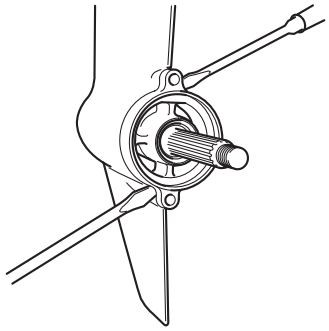
Propeller shaft housing



No.	Part name	Q'ty	Remarks
1	Shift plunger	1	
2	Dog clutch	1	
3	Cross pin	1	
4	Spring	1	
5	Spring	1	
6	Propeller shaft	1	
7	Reverse gear	1	
8	Reverse gear shim	—	
9	O-ring	1	**Not reusable**
10	Ball bearing	1	**Not reusable**
11	O-ring	2	**Not reusable**
12	Propeller shaft housing	1	
13	Needle bearing	1	
14	Oil seal	2	
15	Bolt	2	M8 × 25 mm
16	Washer	1	

Removing the propeller shaft housing assembly

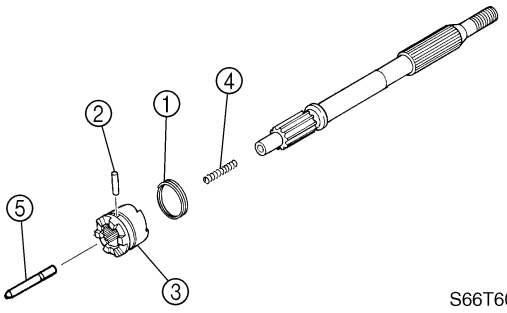
1. Remove the bolts, then the propeller shaft housing assembly.


S66T6330

NOTE:
- Insert two flat head screwdrivers between the propeller shaft housing assembly and the lower case to pry the propeller shaft housing assembly loose.
- If the drive shaft housing assembly is stack to the lower case, use the special service tools. See “Backlash” in this chapter.

Disassembling the propeller shaft assembly

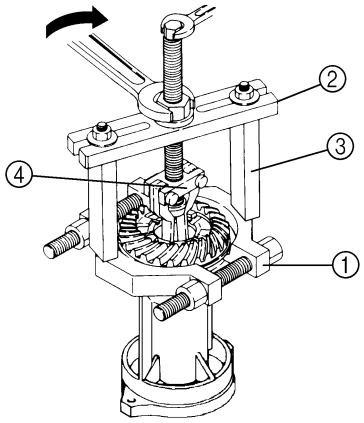
1. Remove the spring ①, then the cross pin ②, dog clutch ③, spring ④, and shift plunger ⑤.



S66T6060

Disassembling the propeller shaft housing

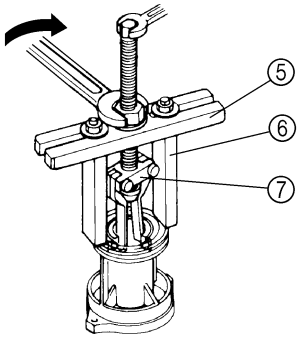
1. Remove the reverse gear.



S6D56470

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

2. Remove the ball bearing.



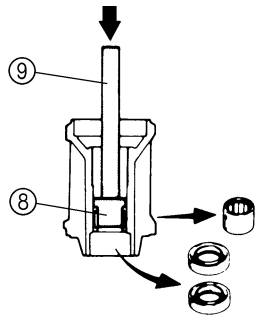
S6D56480

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

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

6

3. Remove the oil seals and needle bearing.



S68S6350

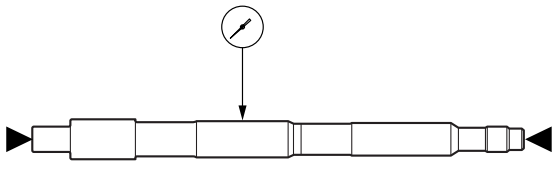
Needle bearing attachment ⑧: 90890-06614
Driver rod L3 ⑨: 90890-06652

Checking the propeller shaft housing

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

Checking the propeller shaft

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

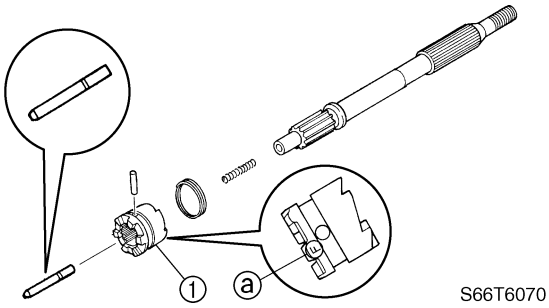

S6D56510

Runout limit: 0.02 mm (0.0008 in)

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

Assembling the propeller shaft assembly

1. Install the dog clutch as shown.

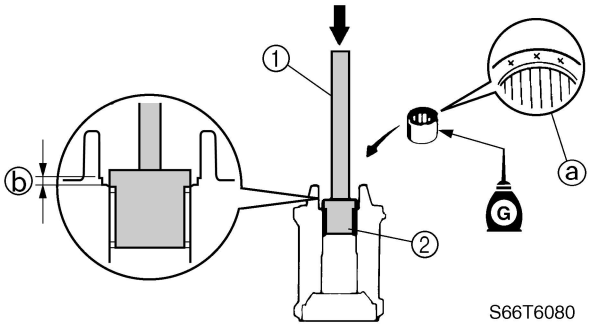


S66T6070

NOTE:
Install the dog clutch ① with the "F" mark ⓐ facing toward the shift plunger.

Assembling the propeller shaft housing

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



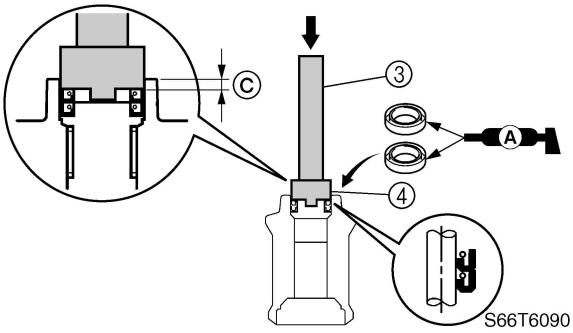
S66T6080

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

Driver rod L3 ①: 90890-06652
Needle bearing attachment ②: 90890-06614

Depth ⓑ: 3.0–3.5 mm (0.118–0.138 in)

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

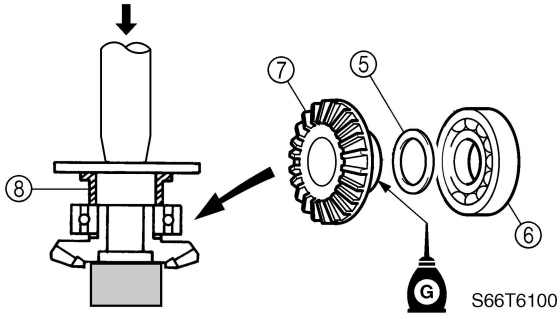


NOTE:
Install an oil seal halfway into the propeller shaft housing, then the other oil seal.

Driver rod LS ③: 90890-06606
Ball bearing attachment ④: 90890-06637

Depth Ⓒ:
4.0–4.5 mm (0.157–0.177 in)

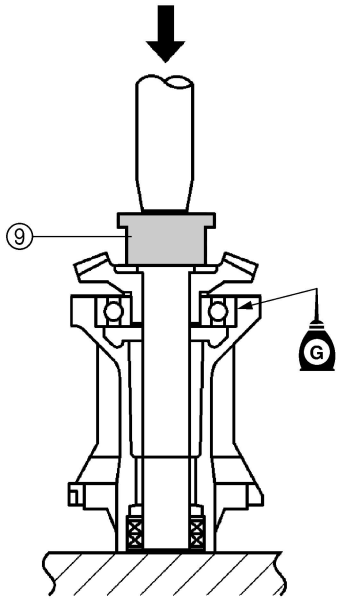
3. Install the original shim(s) ⑤ and new ball bearing ⑥ onto the reverse gear ⑦ using a press.



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

Bearing inner race attachment ⑧: 90890-06639

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



Needle bearing attachment ⑨: 90890-06608

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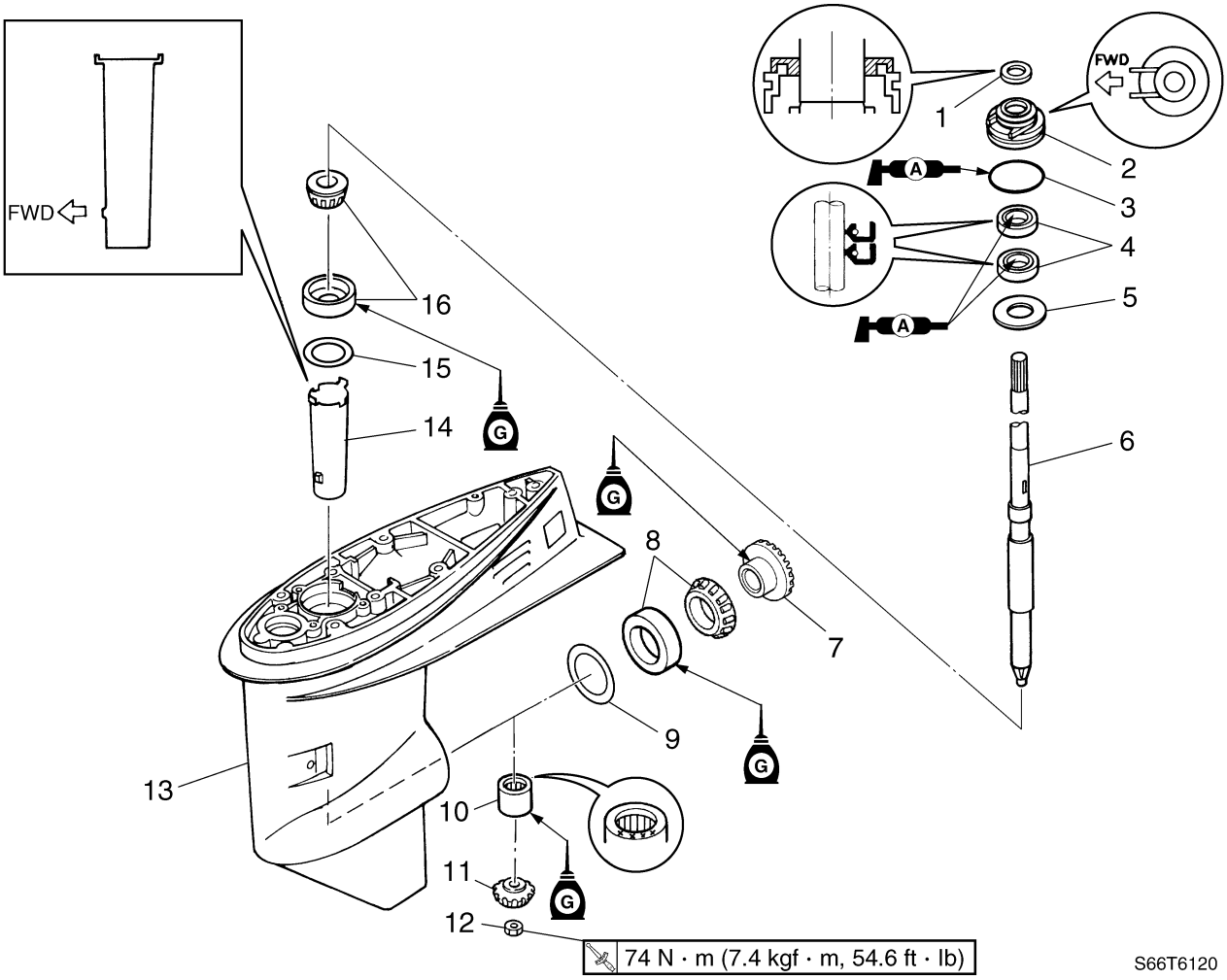
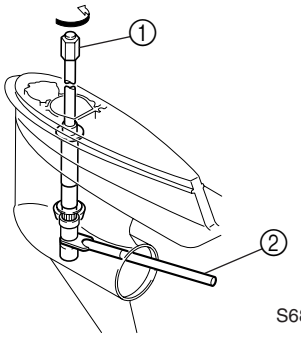
Drive shaft and lower case



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

Removing the drive shaft

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

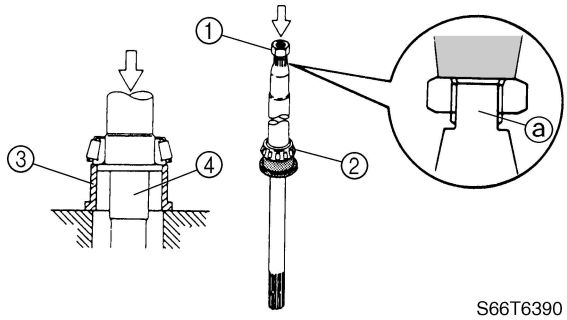


S68S6360J

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

Disassembling the drive shaft

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



S66T6390

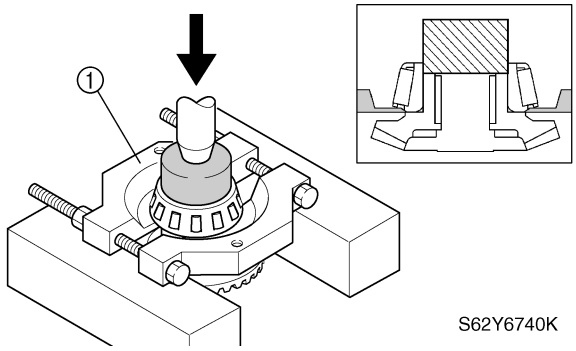
CAUTION:

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

Bearing inner race attachment ③:
90890-06641

Disassembling the forward gear

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



S62Y6740K

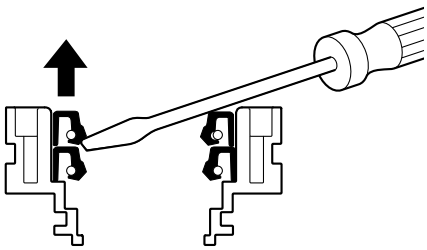
CAUTION:

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

Bearing separator ①: 90890-06534

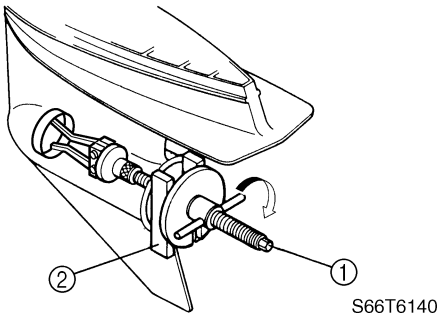
Disassembling the oil seal housing

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


S66T6130

Disassembling the lower case

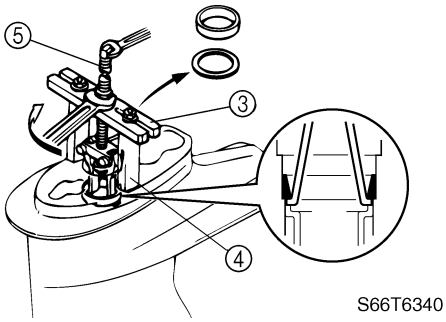
1. Remove the taper roller bearing outer race and shim(s).



NOTE:
Install the claws as shown.

Bearing outer race puller assembly ①:
90890-06523
Stopper guide stand ②:
90890-06538

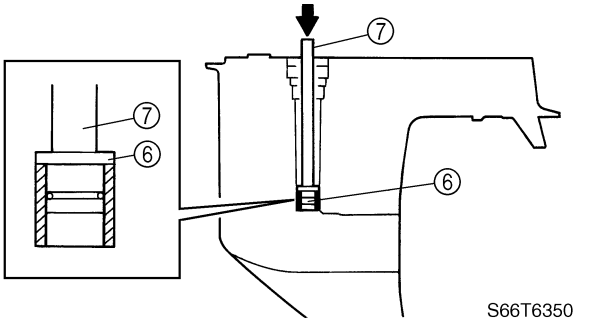
2. Remove the drive shaft bearing outer race, shim(s), and drive shaft sleeve.



NOTE:
Install the claws as shown.

Stopper guide plate ③: 90890-06501
Stopper guide stand ④:
90890-06538
Bearing puller assembly ⑤:
90890-06535

3. Remove the needle bearing.



Needle bearing attachment ⑥:
90890-06614
Driver rod L3 ⑦: 90890-06652

Checking the pinion and forward gear

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

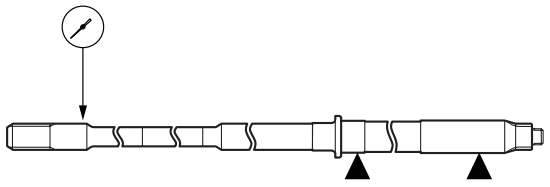
Checking the bearings

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

Checking the drive shaft

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

2. Measure the drive shaft runout.



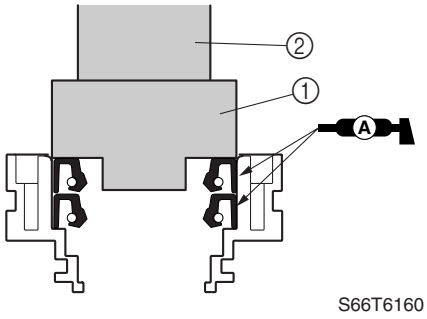
Runout limit: 0.5 mm (0.020 in)

Checking the lower case

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

Assembling the oil seal housing

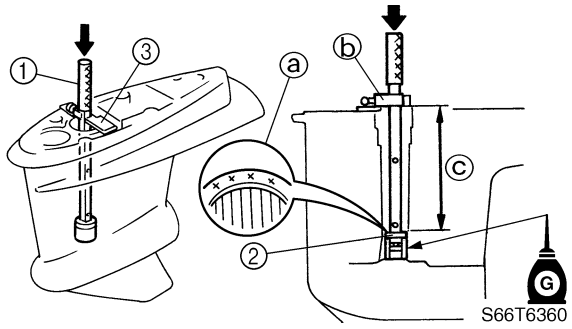
1. Apply grease to new oil seals, and then install them into the oil seal housing.



Ball bearing attachment ①:
90890-06637
Driver rod LS ②: 90890-06606

Assembling the lower case

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



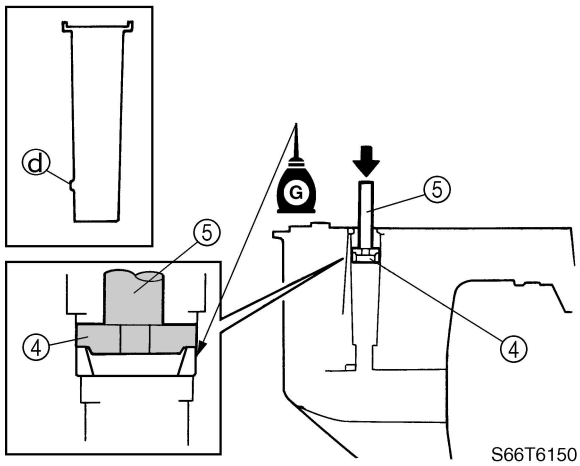
NOTE:

- Install the needle bearing with the manufacture identification mark ⓐ facing up.
- When using the driver rod, do not strike the special service tool in a manner that will force the stopper ⓑ out of place.

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

Depth ⓒ:
182.5–183.0 mm (7.19–7.20 in)

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



CAUTION:

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

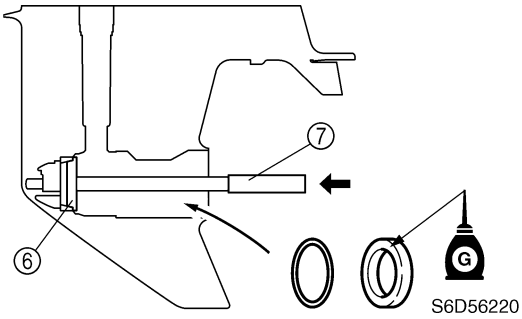
NOTE:

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

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

6

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



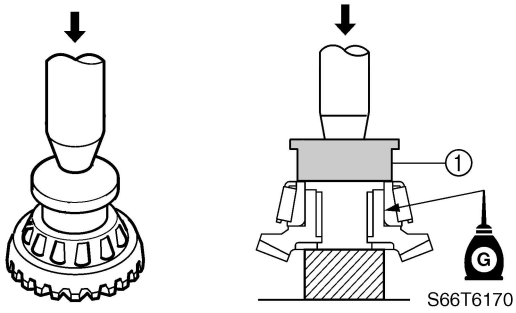
CAUTION:

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

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

Assembling the forward gear

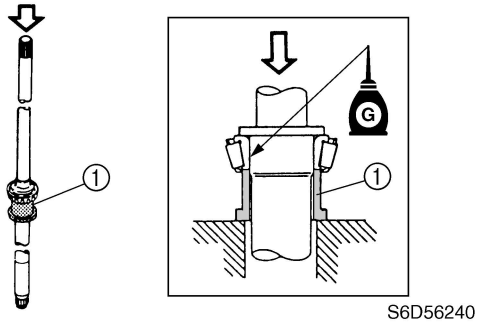
1. Install a new taper roller bearing into the forward gear using a press.



Needle bearing attachment ①: 90890-06608

Assembling the drive shaft

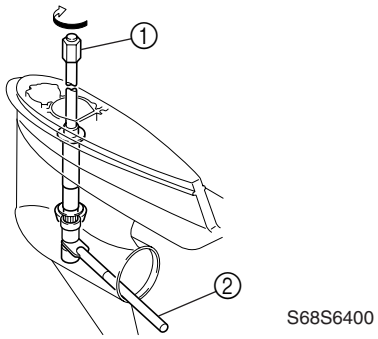
1. Install a new drive shaft bearing onto the drive shaft using a press.



Bearing inner race attachment ①: 90890-06644

Installing the pinion

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

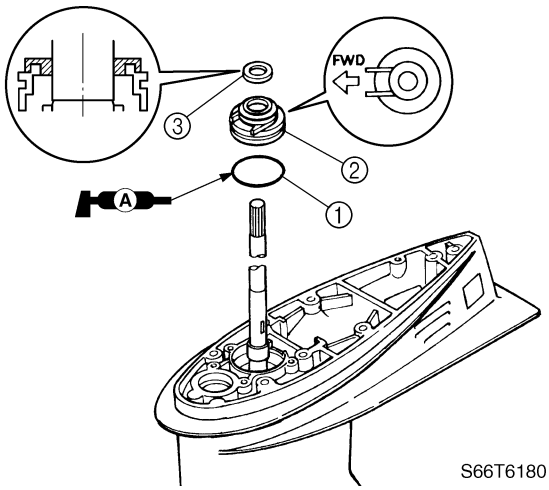


Drive shaft holder 3 ①: 90890-06517
Pinion nut holder ②:
New: 90890-06715
Current: 90890-06505

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

Installing the oil seal housing

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

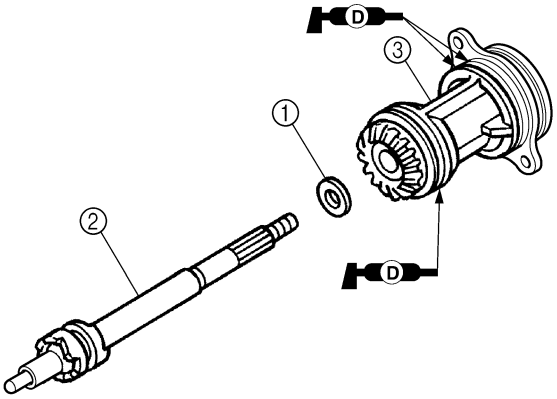


S66T6180

Installing the propeller shaft housing

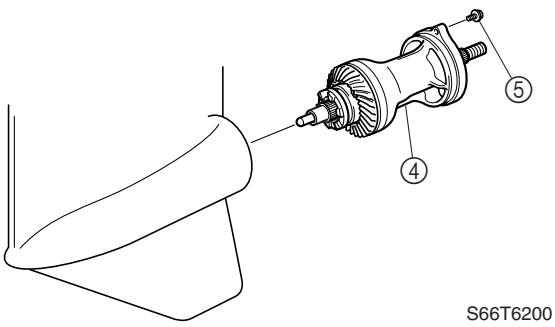
1. Install the washer ① and propeller shaft assembly ② into the propeller shaft housing assembly ③.

2. Apply grease to new O-rings.



S66T6190

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

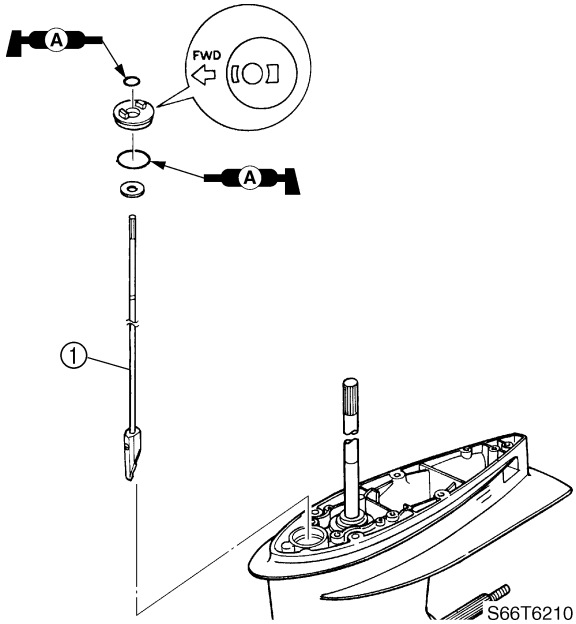


S66T6200

	Propeller shaft housing bolt ⑤: 16 N·m (1.6 kgf·m, 11.8 ft·lb)

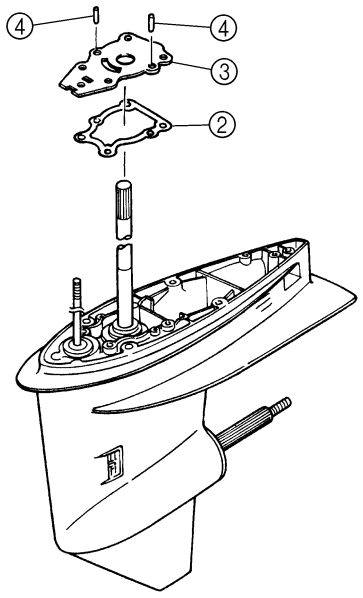
Installing the water pump and shift rod

1. Install the shift rod ①.



S66T6210

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

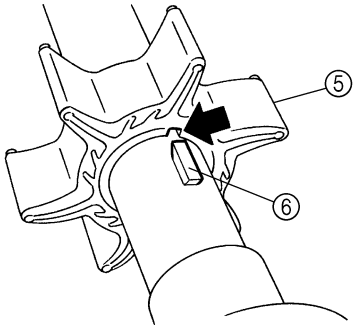


S66T6220

6

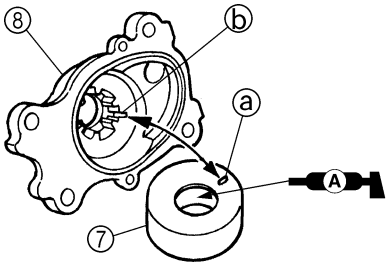
3. Install the Woodruff key into the drive shaft.

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



S69J6300

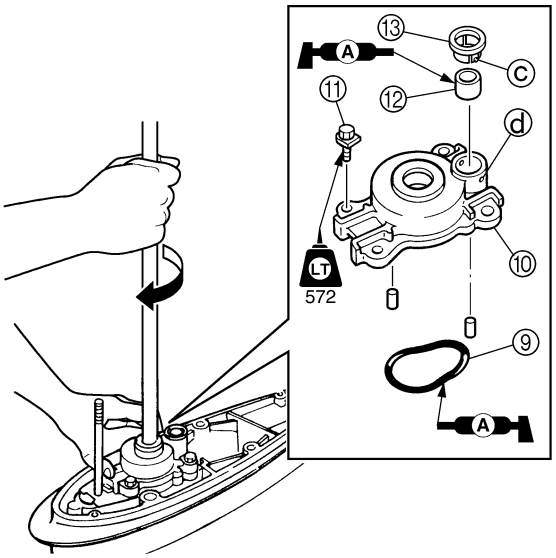
5. Install the insert cartridge ⑦ into the pump housing ⑧, and then apply grease to the inside of the insert cartridge.



S66T6230

NOTE:
Align the insert cartridge projection ⓐ with the hole ⓑ in the pump housing.

6. Install the new O-ring ⑨ and pump housing assembly ⑩ into the lower case, tighten the bolts ⑪, and then install the seal ⑫ and cover ⑬.



S66T6240

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

Installing the lower unit

1. Set the gear shift to the reverse position at the lower unit. Make sure that the shift rod is in the reverse position.

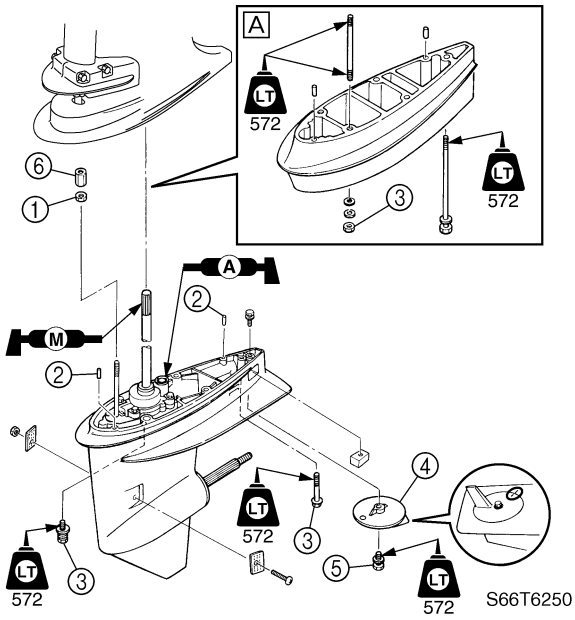
2. Screw in the locknut ① completely.

3. Install the two dowels ② into the lower unit.

4. Install the lower unit into the upper case, and then tighten the lower case mounting bolts (nuts) ③ to the specified torque.

5. Connect the shift rod.

6. Install the trim tab ④ to its original position, and then tighten the trim tab bolt ⑤.



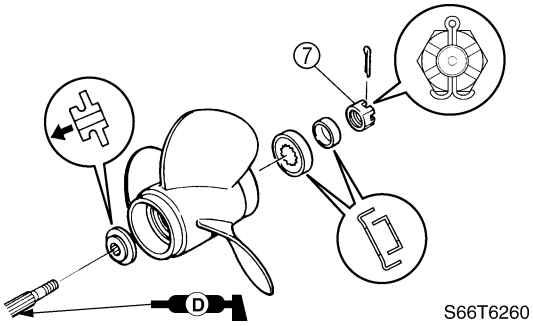
A X-transom model

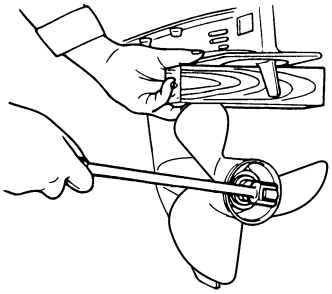
NOTE:

Screw the adjusting nut ⑥ down until it contacts the locknut, and then tighten the locknut.

	Lower case mounting bolt (nut) ③: 40 N·m (4.0 kgf·m, 29.5 ft·lb)

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




S69J6340

⚠ WARNING

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

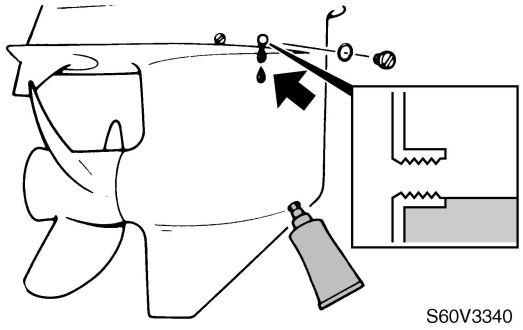
NOTE:

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

	Propeller nut ⑦: 40 N·m (4.0 kgf·m, 29.5 ft·lb)

6

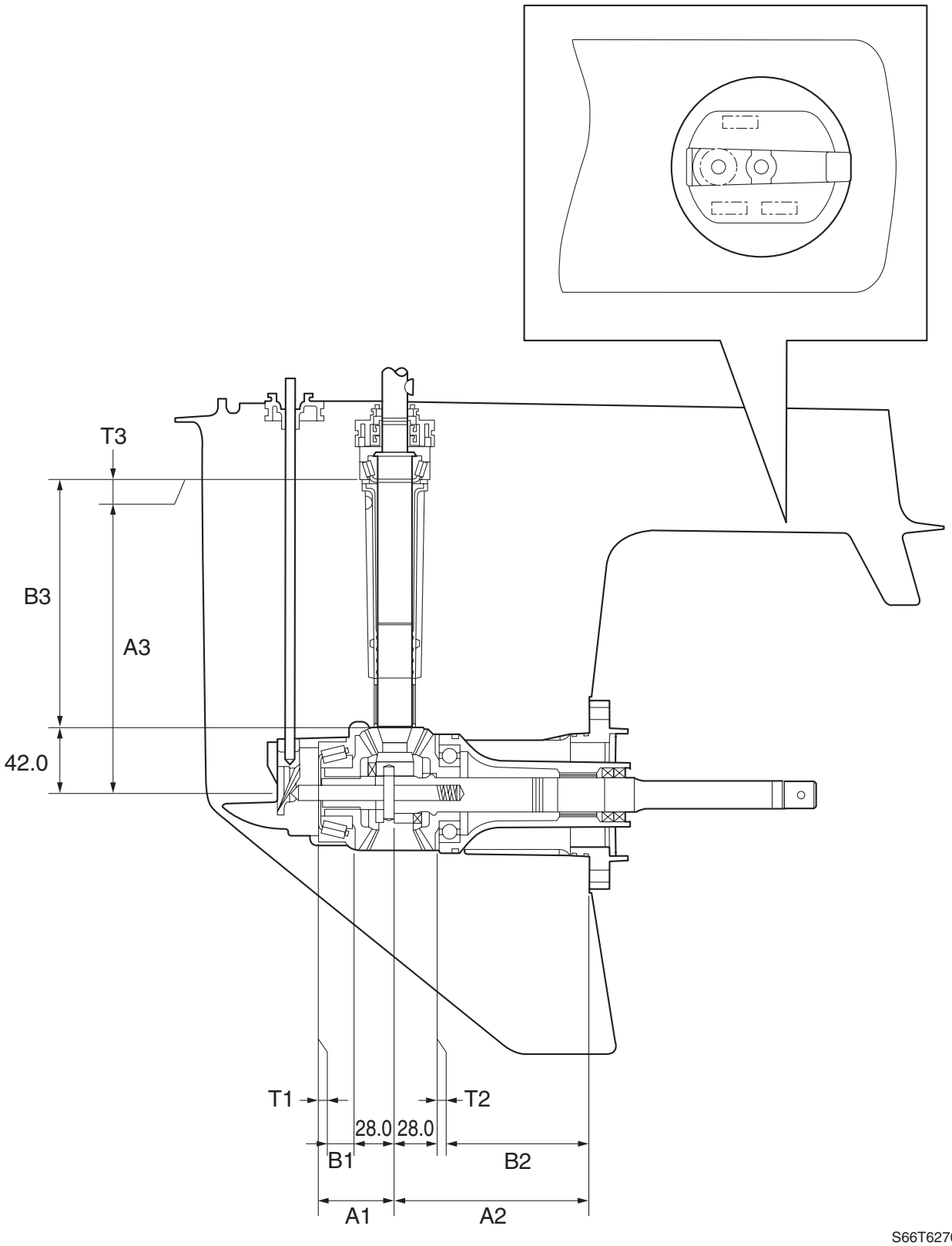
8. Insert a gear oil tube or gear oil pump into the drain hole and slowly fill the gear oil until oil flows out of the check hole and no air bubbles are visible.



Recommended gear oil:
Hypoid gear oil
API: GL-4
SAE: 90
Oil quantity:
430 cm^3
(14.54 US oz, 15.17 Imp oz)

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

Shimming



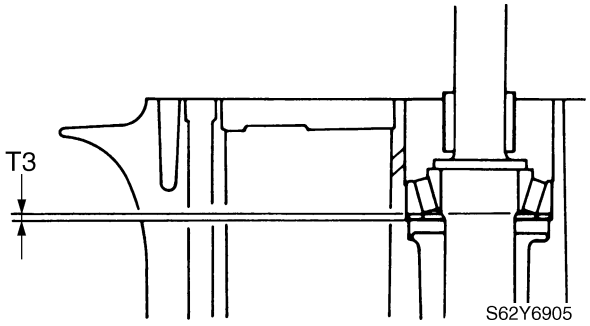
S66T6270

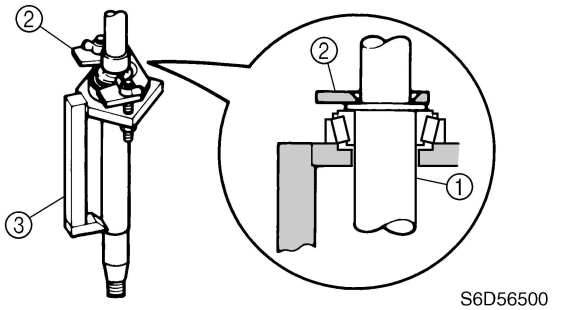
Shimming

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

Selecting the pinion shims

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





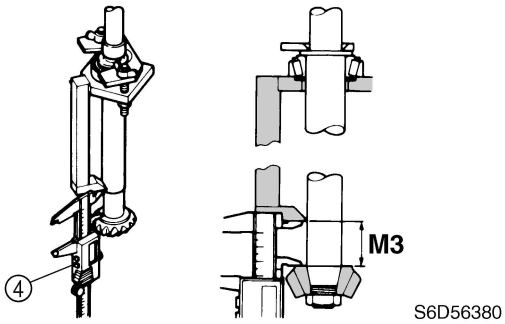
NOTE:
- Select the shim thickness (T3) by using the specified measurement(s) and the calculation formula.
- Install the special service tool onto the drive shaft so that the shaft is at the center of the hole.
- Tighten the wing nuts another 1/4 of a turn after they contact the plate ②.

Pinion height gauge plate B ②:
90890-06712
Pinion height gauge ③:
90890-06710

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

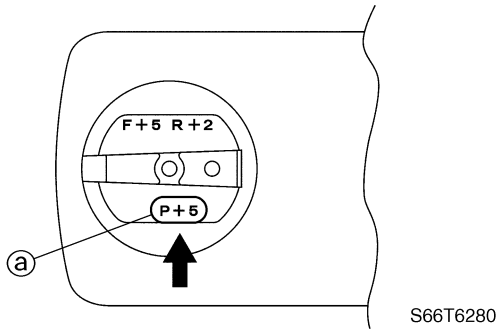
Pinion nut:
74 N·m (7.4 kgf·m, 54.6 ft·lb)

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



Digital caliper ④: 90890-06704

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



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

Calculation formula:
Pinion shim thickness (T3) =
M3 – 11.30 – P/100

Example:
If "M3" is 11.70 mm and "P" is (+5), then
T3 = 11.70 – 11.30 – (+5)/100 mm
= 0.40 – 0.05 mm
= 0.35 mm

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

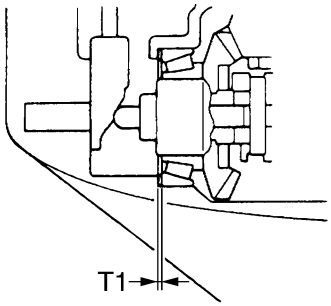
Calculated numeral at 1/100 place	Rounded numeral
1, 2	2
3, 4, 5	5
6, 7, 8	8
9, 10	10

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

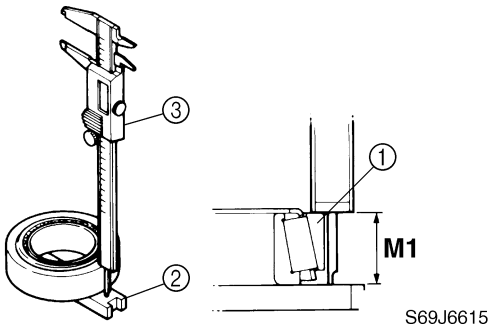
Example:
If "T3" is 0.35 mm, then the pinion shim is 0.35 mm.
If "T3" is 0.46 mm, then the pinion shim is 0.48 mm.

Selecting the forward gear shims

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



S65W6500

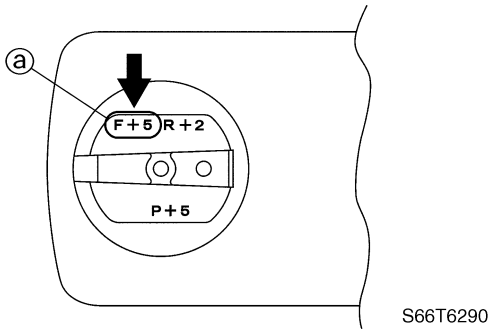


S69J6615

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

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

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



S66T6290

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

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Calculation formula:
Forward gear shim thickness (T1) =
22.75 + F/100 – M1

Example:
If “M1” is 22.30 mm and “F” is (+4), then
T1 = 22.75 + (+4)/100 – 22.30 mm
= 22.75 + 0.04 – 22.30 mm
= 0.49 mm

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

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

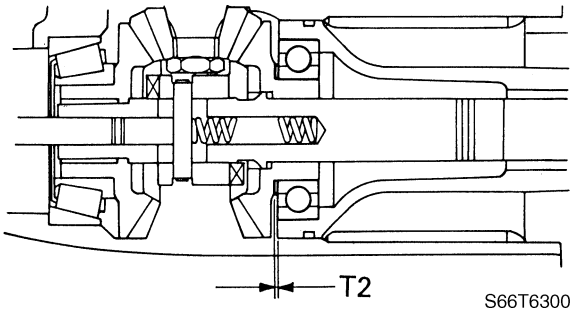
Available shim thicknesses:
0.10, 0.12, 0.15, 0.18, 0.30, 0.40, and 0.50 mm

Example:
If “T1” is 0.49 mm, then the forward gear shim is 0.48 mm.
If “T1” is 0.58 mm, then the forward gear shim is 0.55 mm.

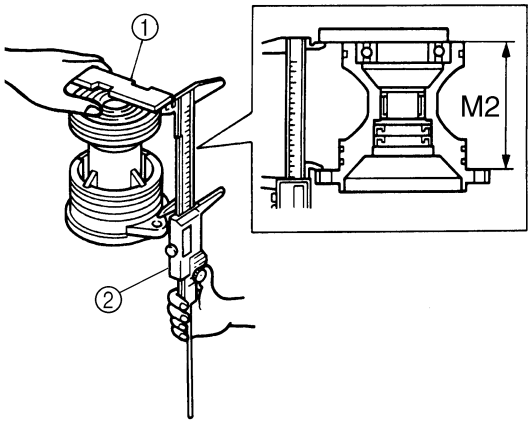
Selecting the reverse gear shims

1. Install the ball bearing onto the propeller shaft housing.

2. Measure the bearing housing height (M2) as shown.



S66T6300

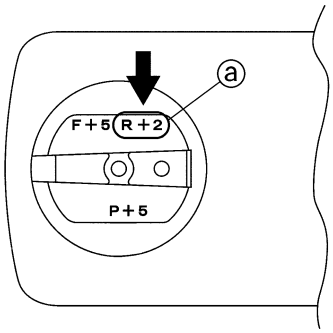


S6D56420

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

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

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



S66T6310

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

Calculation formula:
Reverse gear shim thickness (T2) =
98.00 + R/100 – M2

Example:
If “M2” is 97.74 mm and “R” is (+5), then
T2 = 98.00 + (+5)/100 – 97.74 mm
= 98.00 + 0.05 – 97.74 mm
= 0.31 mm

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

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

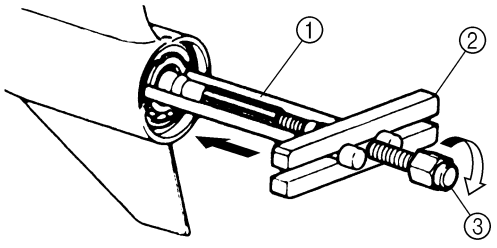
Available shim thicknesses:
0.10, 0.12, 0.15, 0.18, 0.30, 0.40, and 0.50 mm

Example:
If “T2” is 0.31 mm, then the reverse gear shim is 0.32 mm.
If “T2” is 0.49 mm, then the reverse gear shim is 0.50 mm.

Backlash

Measuring the forward and reverse gear backlash

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

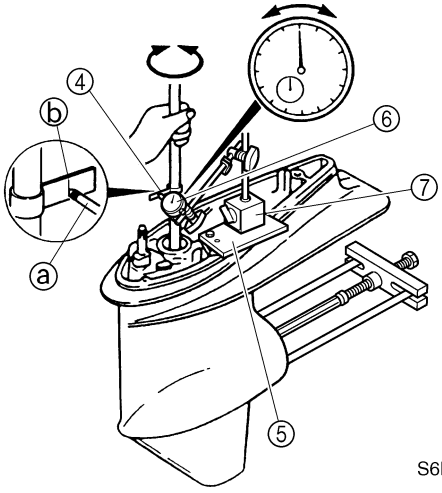


S60X6370

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

Bearing housing puller claw S ①: 90890-06564
Stopper guide plate ②: 90890-06501
Center bolt ③: 90890-06504

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



S6D56440

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

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

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

Forward gear backlash:
0.19–0.56 mm (0.0075–0.0220 in)

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

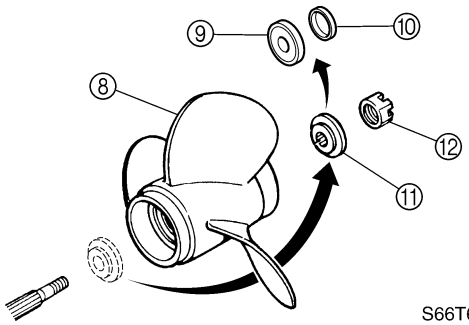
Forward gear backlash	Shim thickness
Less than 0.19 mm (0.0075 in)	To be decreased by (0.38 – M) × 0.53
More than 0.56 mm (0.0220 in)	To be increased by (M – 0.38) × 0.53

M: Measurement

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

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

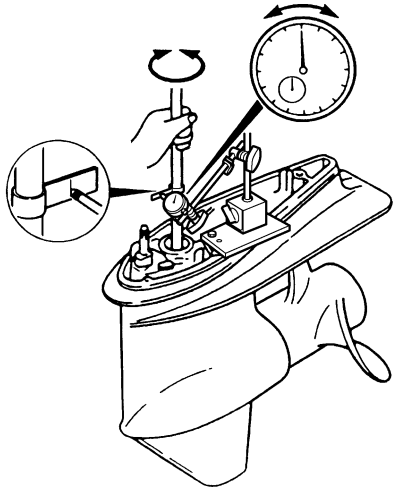
8. Apply a load to the reverse gear by installing the propeller ⑧ (without the washer ⑨ and ⑩), then the spacer ⑪ as shown.



S66T6320

NOTE:
Tighten the propeller nut ⑫ while turning the drive shaft until the drive shaft can no longer be turned.

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


S6D56460

Reverse gear backlash:
0.75–1.13 mm (0.0295–0.0445 in)

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

Reverse gear backlash	Shim thickness
Less than 0.75 mm (0.0295 in)	To be decreased by (0.94 – M) × 0.53
More than 1.13 mm (0.0445 in)	To be increased by (M – 0.94) × 0.53

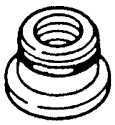
M: Measurement

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

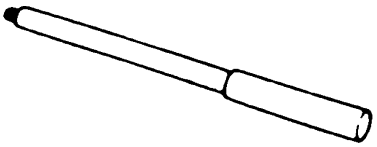
11. Remove the special service tools, and then install the water pump assembly.

Bracket unit

Special service tools

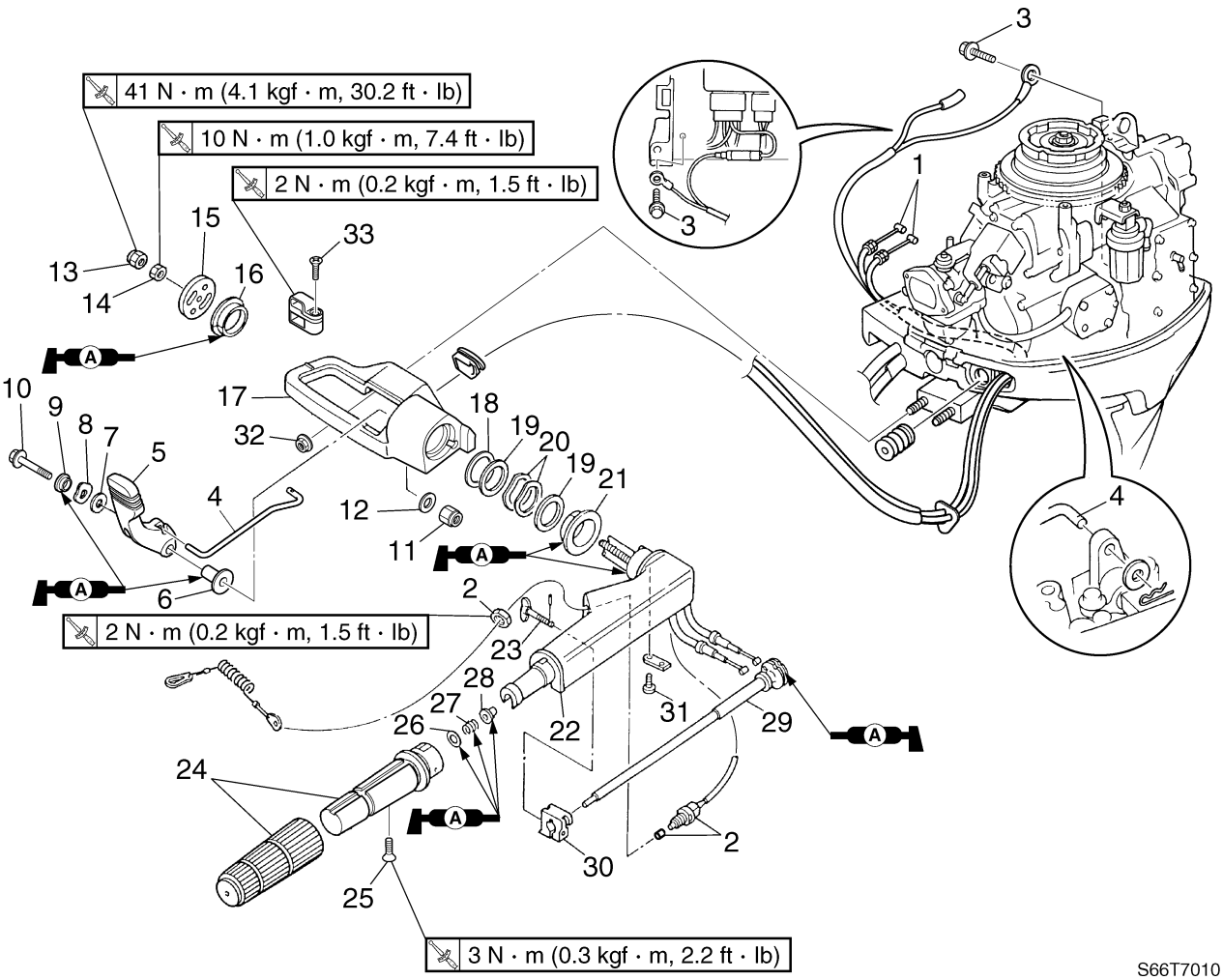


Needle bearing attachment
90890-06613



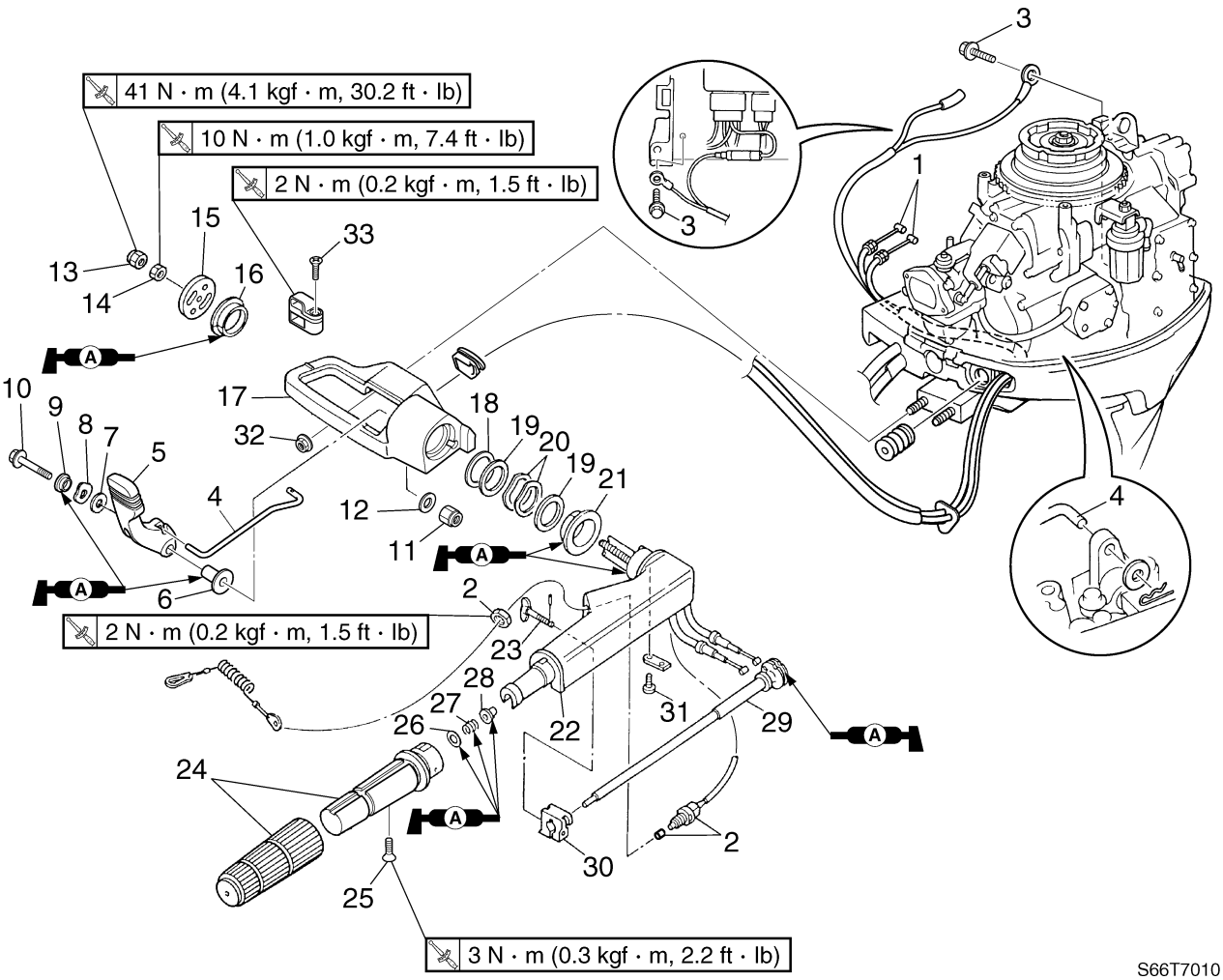
Driver rod L3
90890-06652

Tiller handle (MH, WH)



No.	Part name	Q'ty	Remarks
1	Throttle cable	2	
2	Engine stop lanyard switch	1	
3	Bolt	1	M6 × 16 mm
4	Shift link rod	1	
5	Shift lever	1	
6	Collar	1	
7	Washer	1	
8	Wave washer	1	
9	Collar	1	
10	Bolt	1	M6 × 50 mm
11	Nut	1	
12	Washer	1	
13	Self-locking nut	1	
14	Nut	1	
15	Cable guide	1	
16	Bushing	1	
17	Steering bracket	1	

7

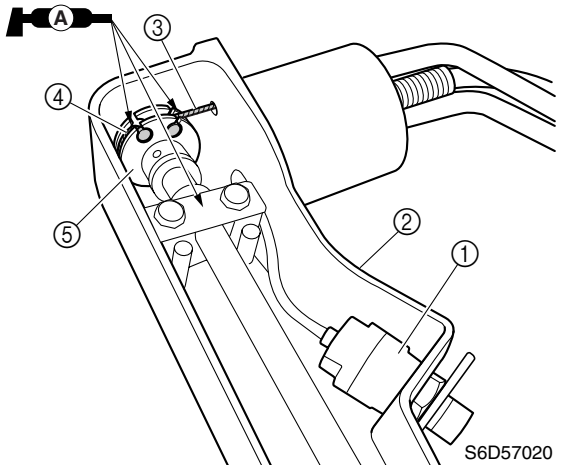


No.	Part name	Q'ty	Remarks
18	Plastic washer	1	
19	Metal washer	2	
20	Wave washer	2	
21	Bushing	1	
22	Tiller handle bracket	1	
23	Throttle friction adjuster	1	
24	Throttle grip	1	
25	Screw	1	ø5 × 20 mm
26	Washer	1	
27	Spring	1	
28	Bushing	1	
29	Throttle shaft	1	
30	Friction piece	1	
31	Bolt	2	M6 × 20 mm
32	Nut	2	
33	Screw	1	ø6 × 25 mm

Assembling the tiller handle

1. Install the engine stop lanyard switch ① to the tiller handle bracket ②. Tighten the nut to the specified torque.

2. Install the throttle cables ③ and ④ to the throttle shaft ⑤.

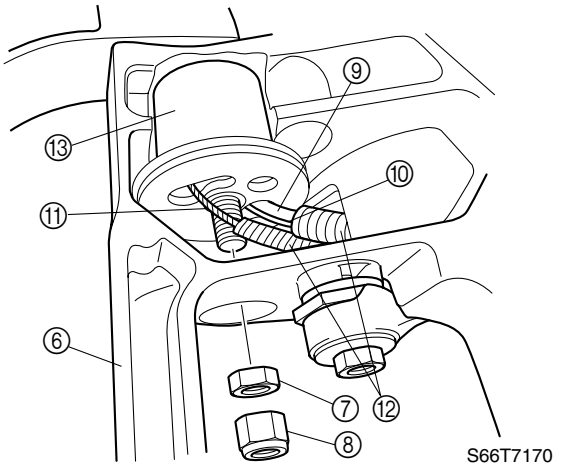


Engine stop lanyard switch nut:
2 N·m (0.2 kgf·m, 1.5 ft·lb)

3. Install the shift lever to the steering bracket ⑥.

4. Install the washers and bushings into the steering bracket ⑥.

5. Install the tiller handle bracket to the steering bracket ⑥, tighten the tiller handle bracket nut ⑦ to the specified torque, and then tighten the self-locking nut ⑧ to the specified torque.

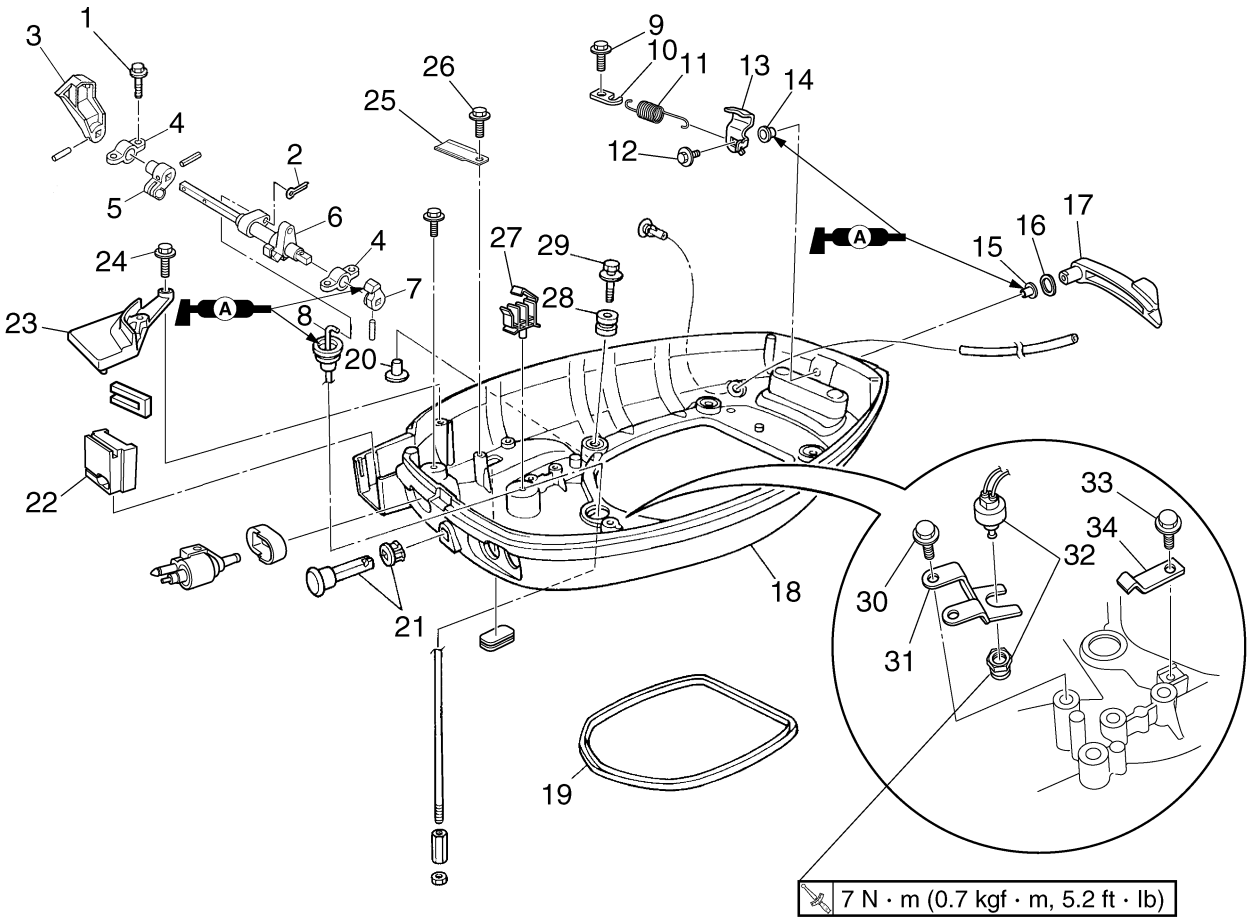


NOTE:
- Route the engine stop lanyard switch lead ⑨ and throttle cables ⑩ and ⑪ as shown.
- Install the corrugated tubes ⑫ so that they contact the tiller handle bracket ⑬.

Tiller handle bracket nut ⑦:
10 N·m (1.0 kgf·m, 7.4 ft·lb)
Self-locking nut ⑧:
41 N·m (4.1 kgf·m, 30.2 ft·lb)

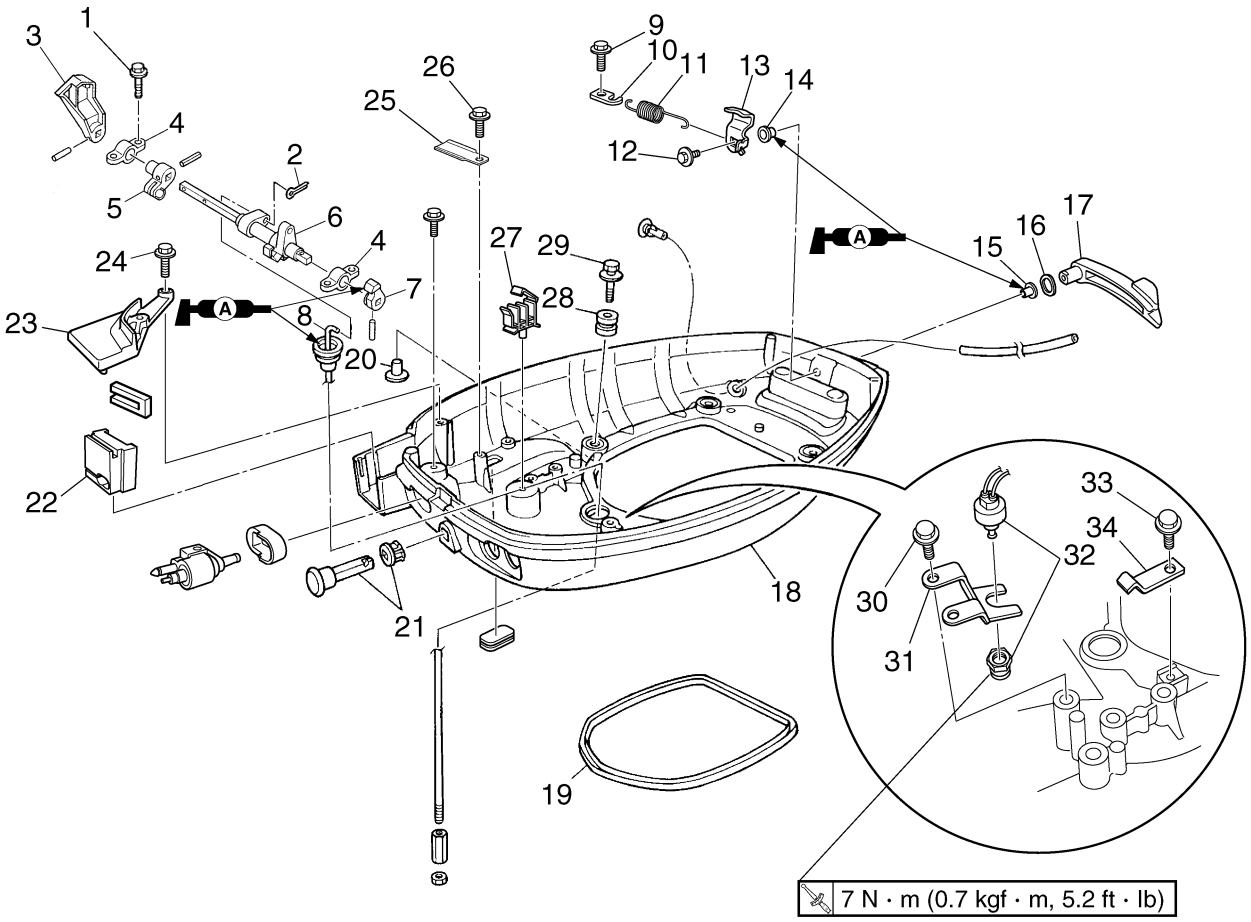
7

Bottom cowling



S66T7160

No.	Part name	Q'ty	Remarks
1	Bolt	4	M6 × 25 mm
2	Cotter pin	1	**Not reusable**
3	Shift lever	1	
4	Bracket	2	
5	Bushing	1	
6	Shift rod lever	1	
7	Shift control lever	1	
8	Shift rod	1	
9	Bolt	1	M6 × 20 mm
10	Hook	1	
11	Spring	1	
12	Bolt	1	M6 × 10 mm
13	Lever	1	
14	Bushing	1	
15	Bushing	1	
16	Wave washer	1	
17	Cowling lock lever	1	

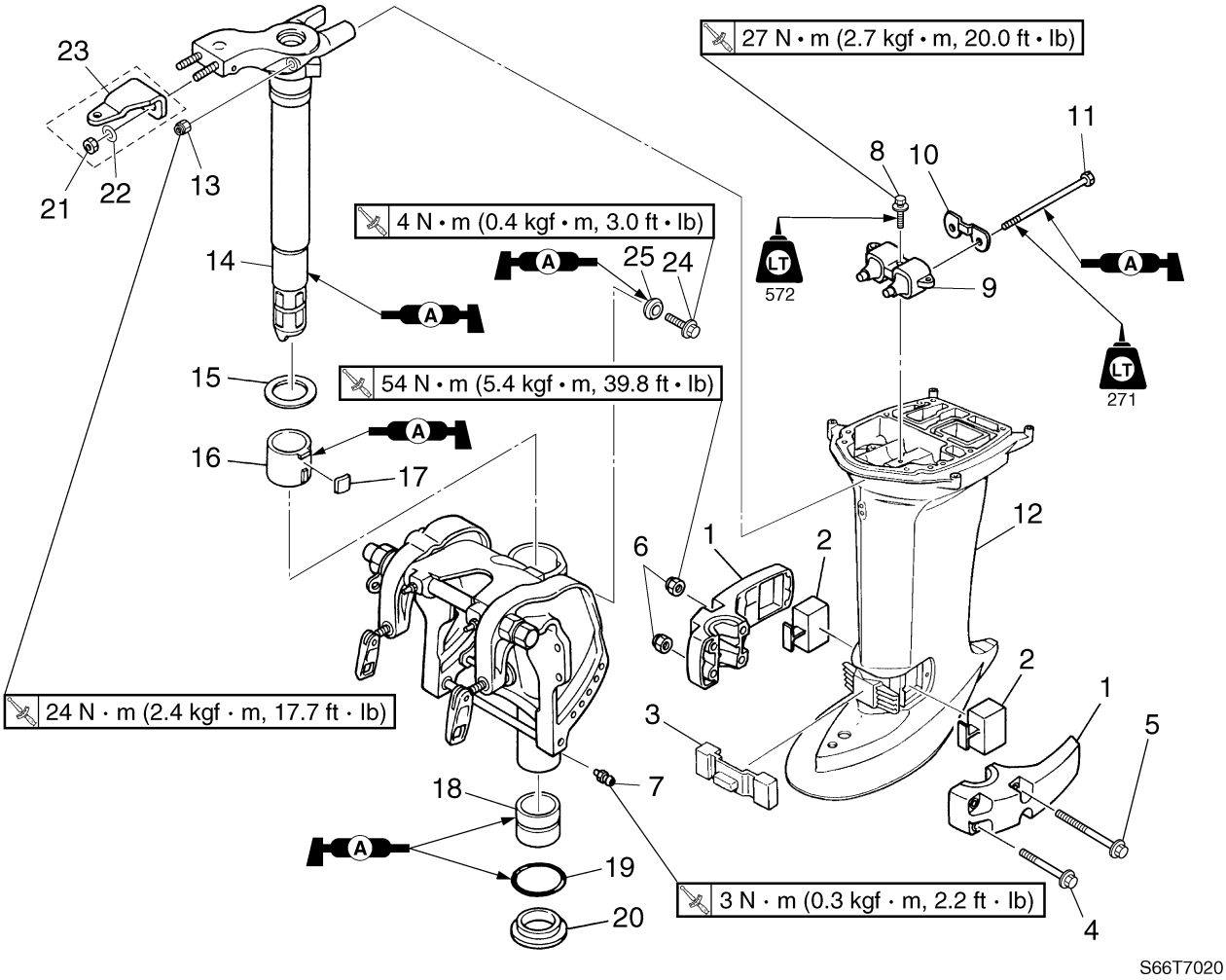


S66T7160

No.	Part name	Q'ty	Remarks
18	Bottom cowling	1	
19	Rubber seal	1	
20	Collar	4	
21	Choke knob	1	
22	Grommet	1	
23	Retaining plate	1	
24	Bolt	2	M6 × 25 mm
25	Retaining plate	1	
26	Bolt	1	M6 × 20 mm
27	Cable holder	1	
28	Grommet	4	
29	Bolt	4	M6 × 30 mm
30	Bolt	2	M6 × 20 mm
31	Bracket	1	
32	Neutral switch	1	
33	Bolt	1	M6 × 20 mm
34	Spring plate	1	

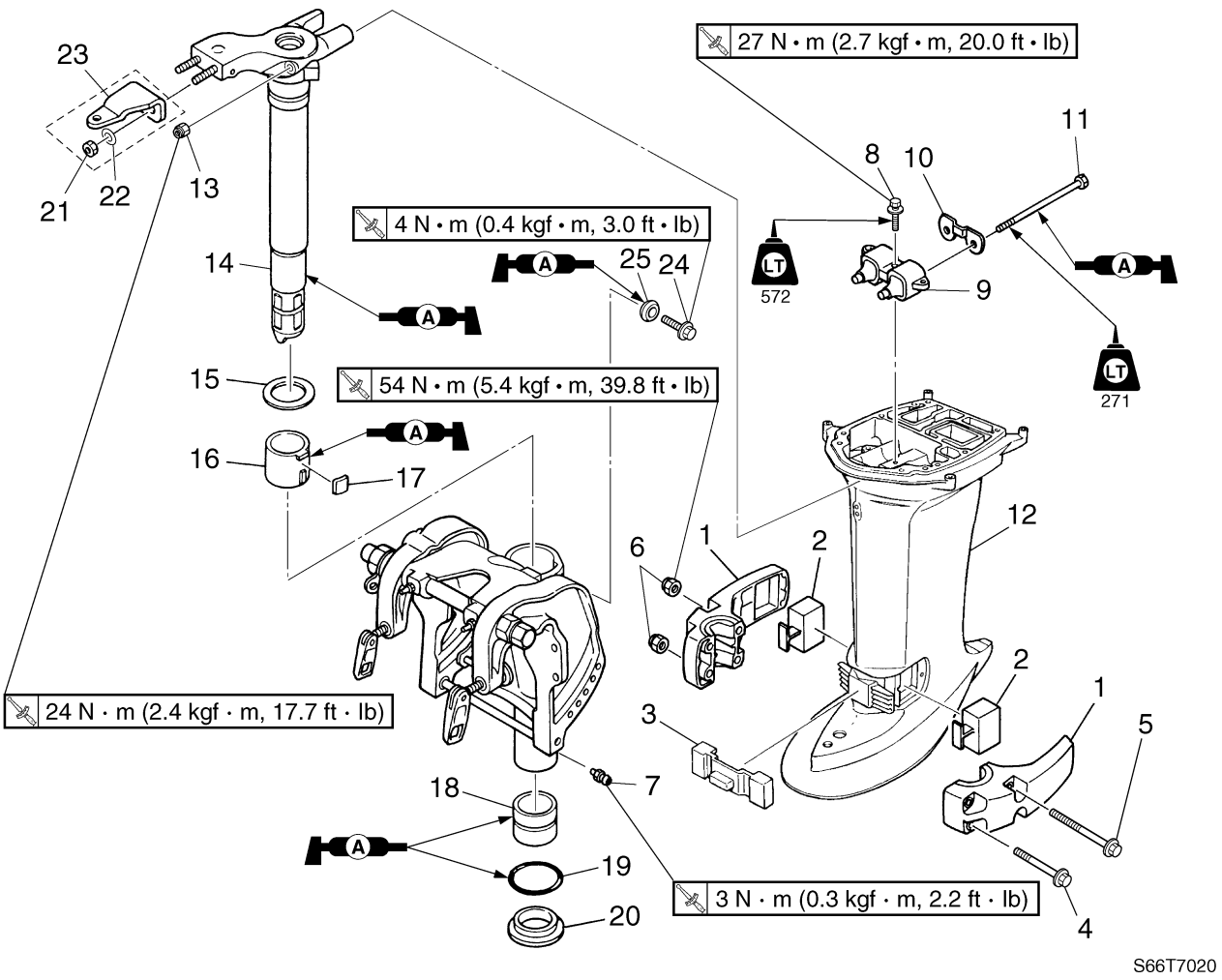
7

Upper case, steering arm



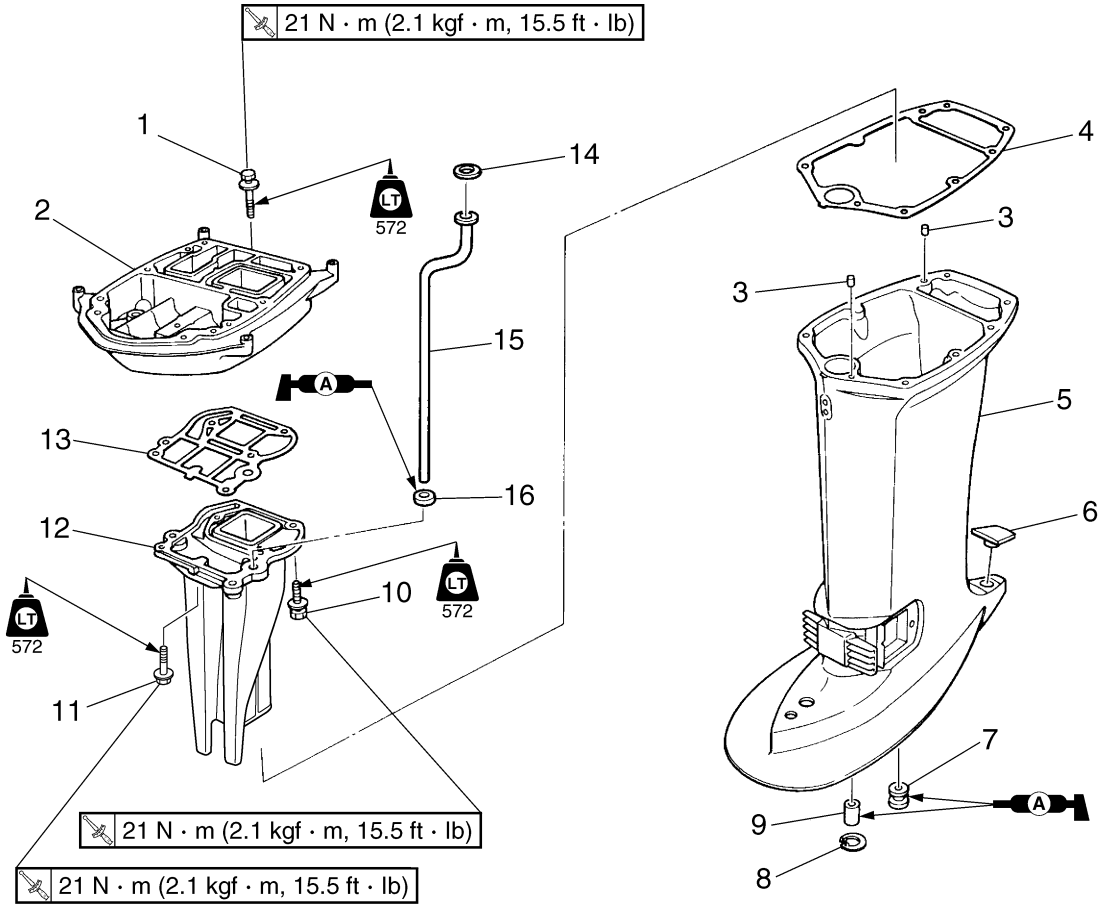
S66T7020

No.	Part name	Q'ty	Remarks
1	Mount housing	2	
2	Rubber damper	2	
3	Rubber damper	1	
4	Bolt	2	M10 × 80 mm
5	Bolt	2	M10 × 120 mm
6	Nut	4	
7	Grease nipple	1	
8	Bolt	3	M8 × 30 mm
9	Upper mount	1	
10	Plate	1	
11	Bolt	2	M8 × 185 mm
12	Upper case assembly	1	
13	Nut	2	
14	Steering arm	1	
15	Washer	1	
16	Bushing	1	
17	Straight key	1	



No.	Part name	Q'ty	Remarks
18	Bushing	1	
19	O-ring	1	**Not reusable**
20	Bushing	1	
21	Nut	2	W model
22	Washer	2	W model
23	Steering hook	1	W model
24	Bolt	1	M8 × 20 mm
25	Rubber seal	1	

7

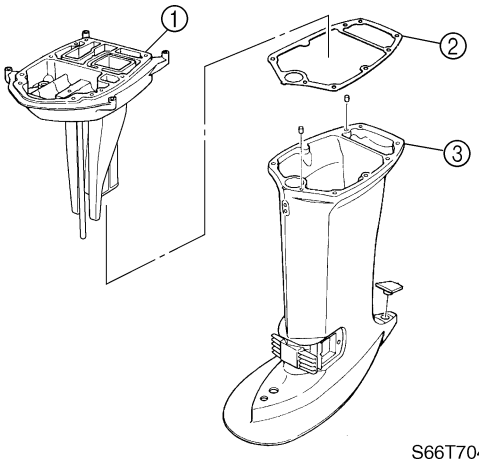


S66T7030

No.	Part name	Q'ty	Remarks
1	Bolt	2	M8 × 30 mm
2	Exhaust guide	1	
3	Dowel	2	
4	Gasket	1	**Not reusable**
5	Upper case	1	
6	Grommet	1	
7	Rubber seal	1	
8	Circlip	1	
9	Bushing	1	
10	Bolt	3	M8 × 45 mm
11	Bolt	2	M8 × 30 mm
12	Exhaust manifold	1	
13	Gasket	1	**Not reusable**
14	Washer	1	
15	Pipe	1	
16	Rubber seal	1	

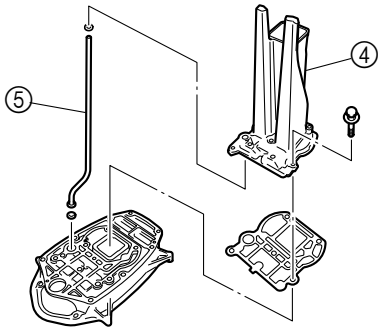
Disassembling the upper case

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



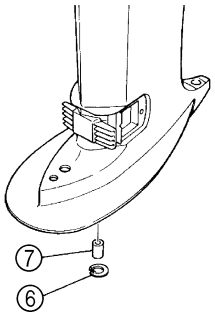
S66T7040

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



S66T7050

3. Remove the circlip ⑥ and the drive shaft bushing ⑦ from the upper case.



S66T7060

Checking the upper case

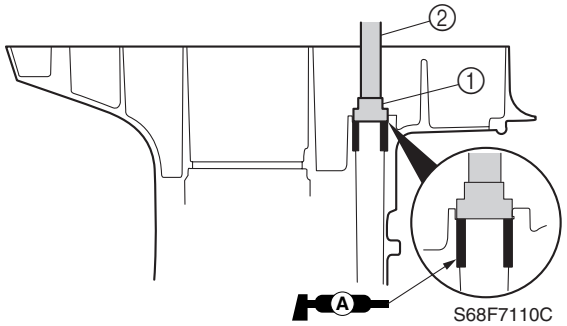
1. Check the drive shaft bushing for wear or cracks. Replace if necessary.

2. Check the cooling water pipe for deformation or corrosion. Replace if necessary.

3. Check the exhaust guide and exhaust manifold for damage or corrosion. Replace if necessary.

Assembling the upper case

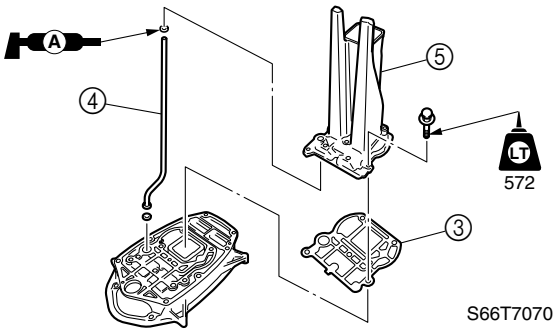
1. Install the drive shaft bushing and the circlip to the upper case.



S68F7110C

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

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



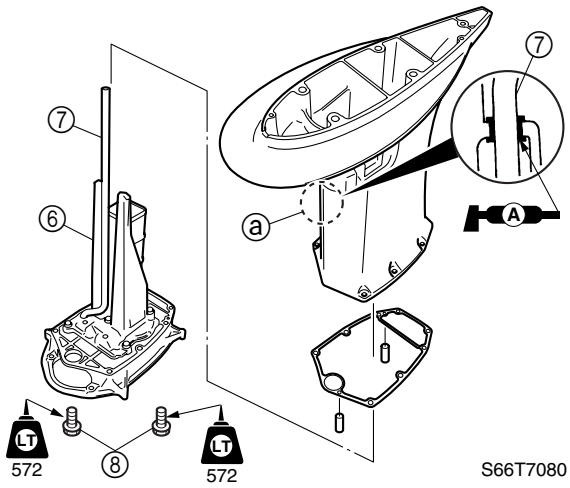
S66T7070

Exhaust manifold bolts:
21 N·m (2.1 kgf·m, 15.5 ft·lb)

7

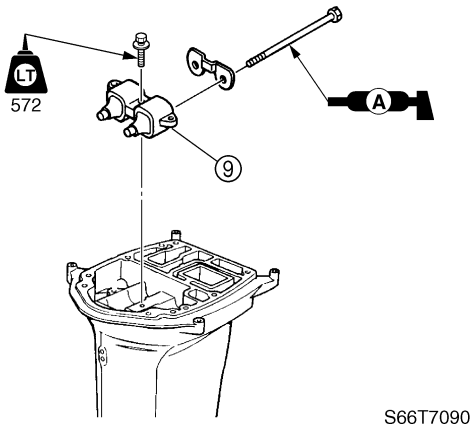
3. Install the muffler assembly ⑥ by inserting the tip of the cooling water pipe ⑦ into the joint hole ⓐ of the upper case.

4. Tighten the muffler assembly bolts ⑧ to the specified torque.



Muffler assembly bolt ⑧:
21 N·m (2.1 kgf·m, 15.5 ft·lb)

5. Install the upper mount ⑨ and bolts into the upper case.

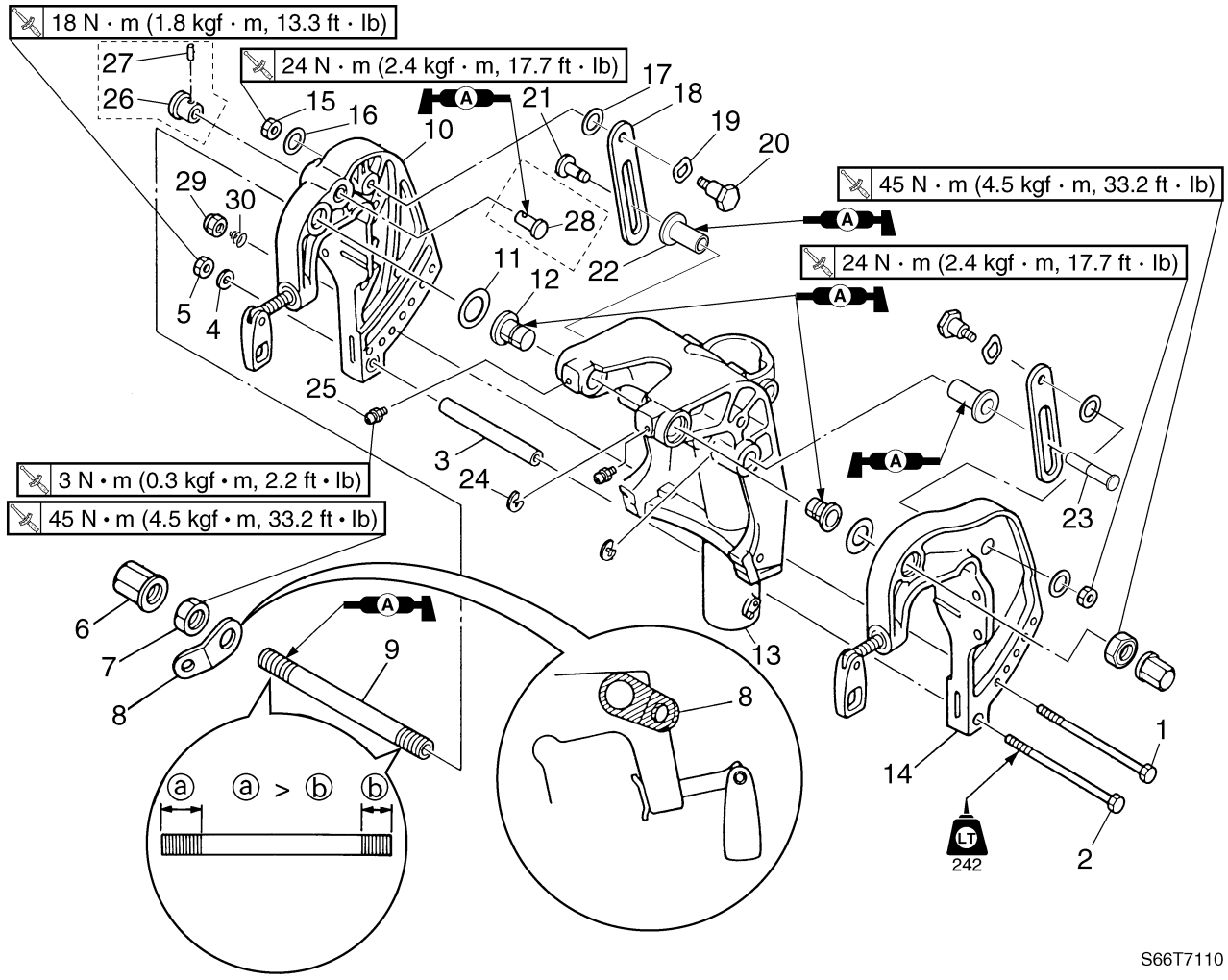


Upper mount bolt:
27 N·m (2.7 kgf·m, 20.0 ft·lb)

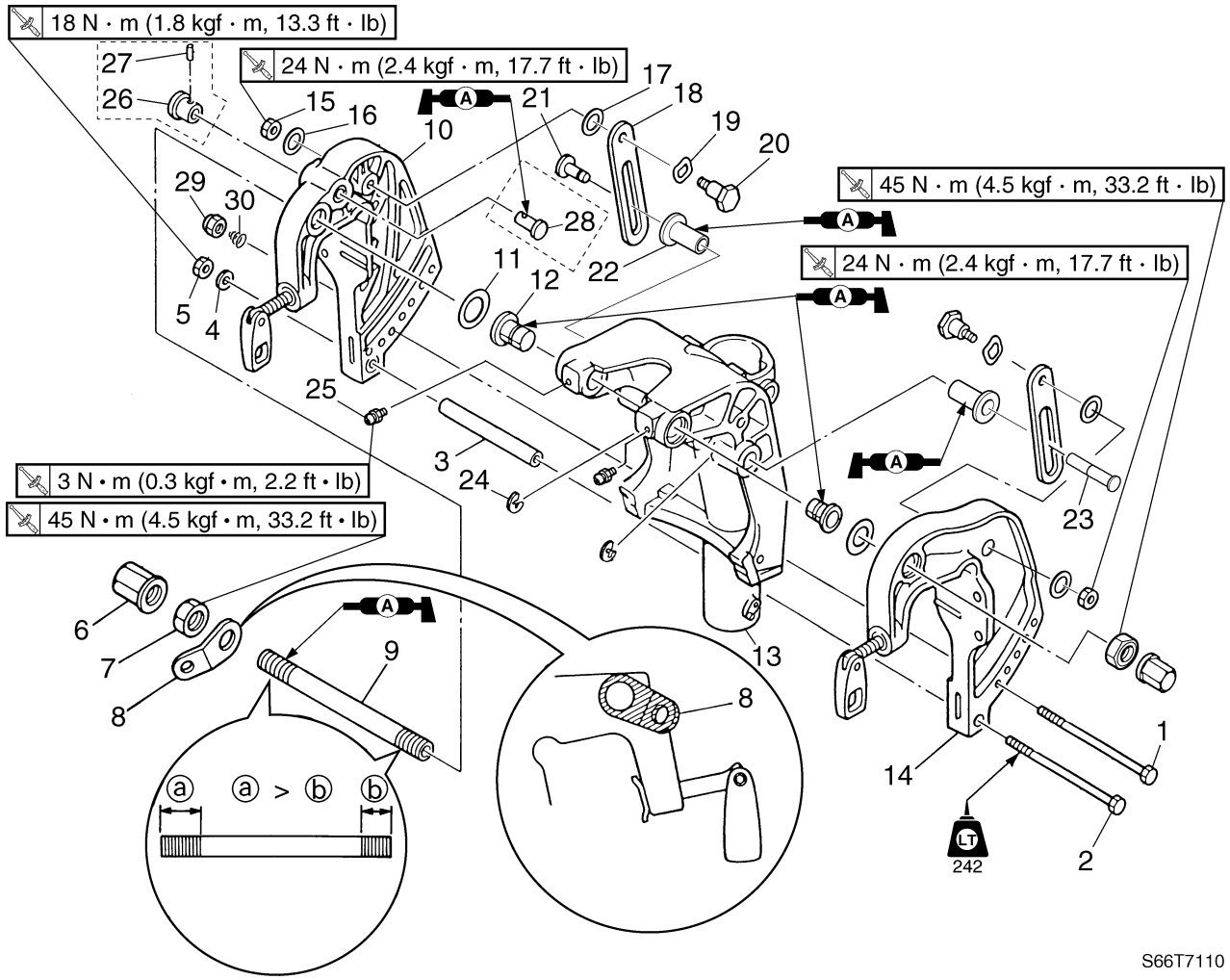
Removing the steering arm

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

Clamp brackets, swivel bracket

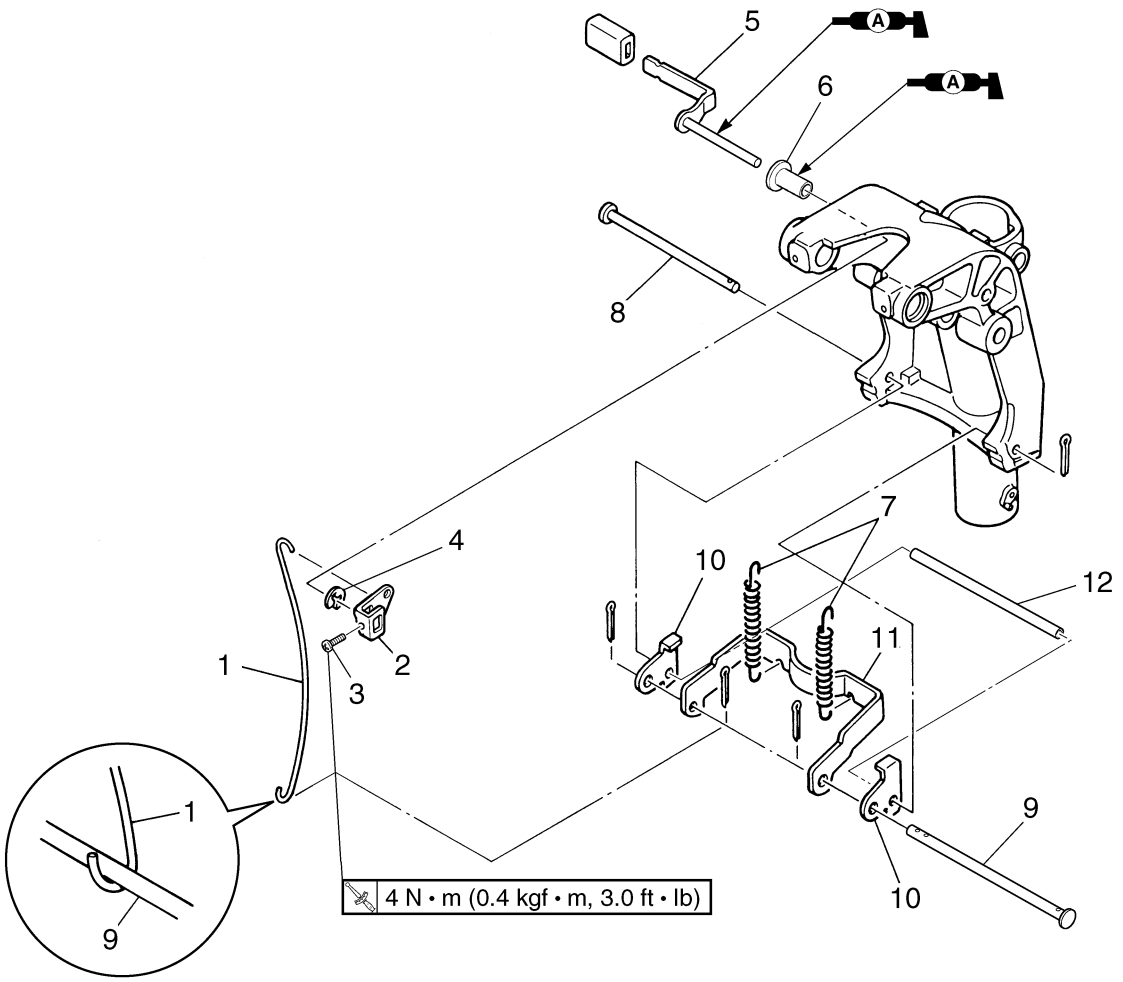


No.	Part name	Q'ty	Remarks
1	Tilt pin	1	
2	Bolt	1	M8 × 255 mm
3	Collar	1	
4	Washer	1	
5	Nut	1	
6	Cap nut	2	
7	Self-locking nut	2	
8	Plate	1	
9	Through tube	1	
10	Clamp bracket	1	
11	Washer	2	
12	Bushing	2	
13	Swivel bracket	1	
14	Clamp bracket	1	
15	Nut	2	
16	Washer	2	
17	Plastic washer	2	



No.	Part name	Q'ty	Remarks
18	Tilt stopper plate	2	
19	Wave washer	2	
20	Bolt	2	
21	Pin	1	
22	Bushing	2	
23	Pin	1	
24	Circlip	2	
25	Grease nipple	2	
26	Knob	1	With shallow water running device
27	Pin	1	With shallow water running device
28	Tilt stop pin	1	With shallow water running device
29	Nut	1	
30	Spring	1	

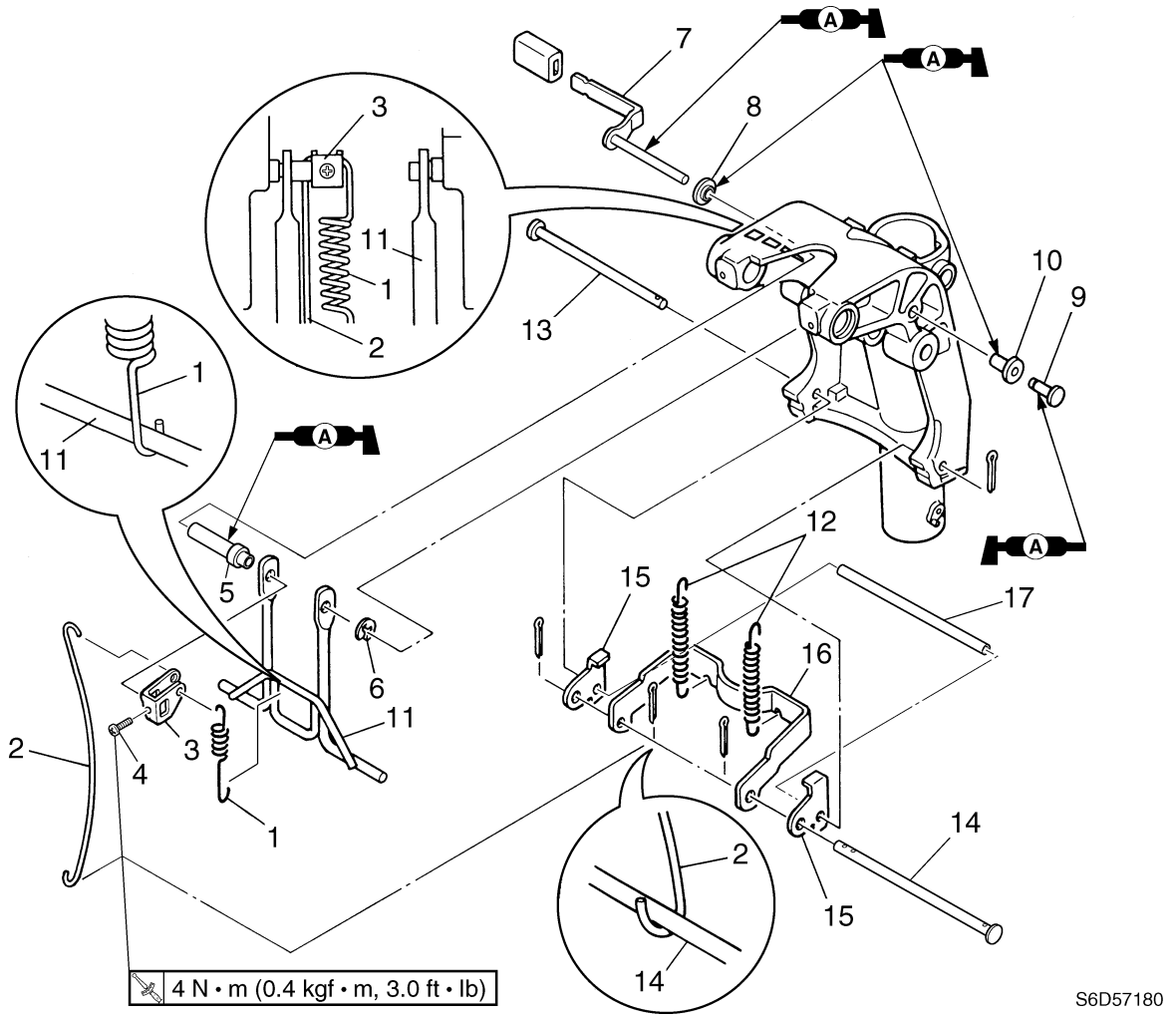
(without shallow water running device)



S66T7120

No.	Part name	Q'ty	Remarks
1	Tilt lock rod	1	
2	Tilt lever	1	
3	Screw	1	ø5 × 5 mm
4	Circlip	1	
5	Tilt lock lever	1	
6	Bushing	1	
7	Spring	2	
8	Pin 1	1	
9	Pin 2	1	
10	Tilt lock plate	2	
11	Tilt lock arm	1	
12	Collar	1	

(with shallow water running device)



No.	Part name	Q'ty	Remarks
1	Spring	1	
2	Tilt lock rod	1	
3	Tilt lever	1	
4	Screw	1	ø5 × 5 mm
5	Collar	1	
6	Circlip	1	
7	Tilt lock lever	1	
8	Bushing	1	
9	Pin	1	
10	Bushing	1	
11	Tilt support bar	1	
12	Spring	2	
13	Pin 1	1	
14	Pin 2	1	
15	Tilt lock plate	2	
16	Tilt lock arm	1	
17	Collar	1	

Removing the clamp brackets

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

Disassembling the swivel bracket (without shallow water running device)

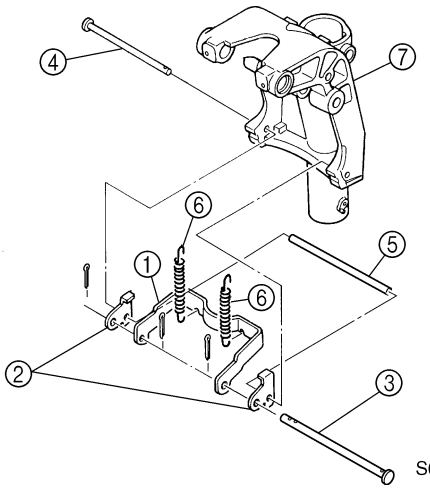
1. Remove the tilt lock lever and tilt lock rod.
2. Remove the bushings and collar.
3. Remove the pin1, pin 2, collar, tilt lock plates, tilt lock arm, and springs.

Disassembling the swivel bracket (with shallow water running device)

1. Remove the tilt lock lever, tilt lever spring, tilt lock rod, pin, and tilt support bar.
2. Remove the bushings and collar.
3. Remove the pin 1, pin 2, collar, tilt lock plates, tilt lock arm, and springs.

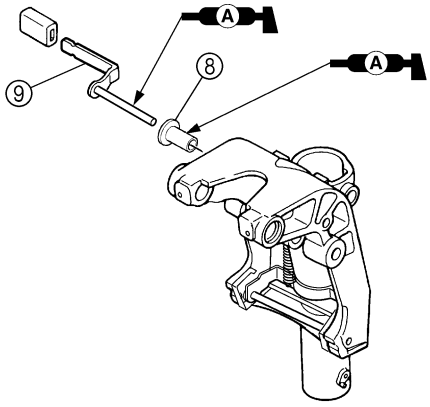
Assembling the swivel bracket (without shallow water running device)

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



S6D57190

2. Install the bushing ⑧, and then install the tilt lock lever ⑨ partially into the swivel bracket.



S66T7130

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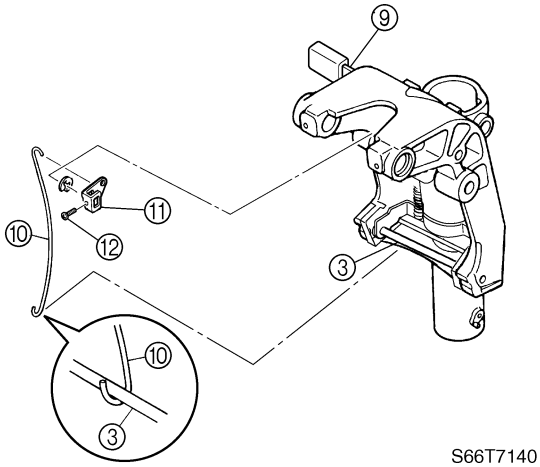
3. Hook the tilt lock rod ⑩ onto the tilt lever ⑪ and the pin 2 ③, and then insert the tilt lock lever ⑨ into the tilt lever ⑪ completely.

4. Install the screw ⑫ to the tilt lever ⑪.



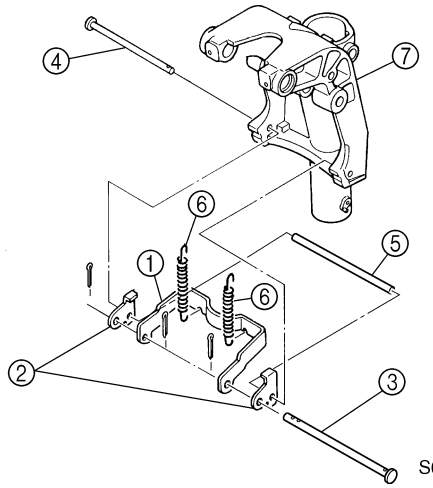
S66T7140

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

Tilt lever screw ⑫:
4 N·m (0.4 kgf·m, 3.0 ft·lb)

Assembling the swivel bracket (with shallow water running device)

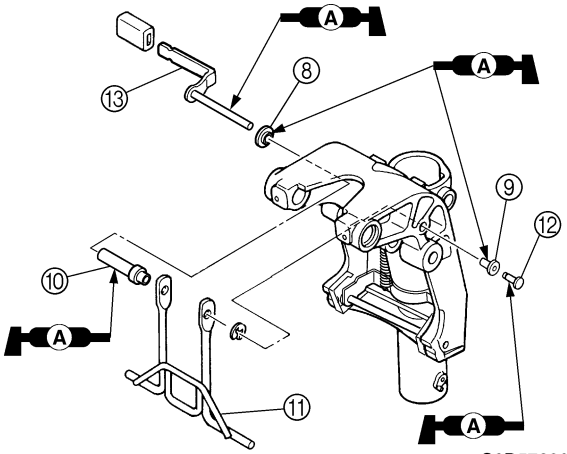
1. Install the tilt lock arm ①, tilt lock plates ②, pin 2 ③, pin 1 ④, collar ⑤, springs ⑥ to the swivel bracket ⑦.



S6D57190

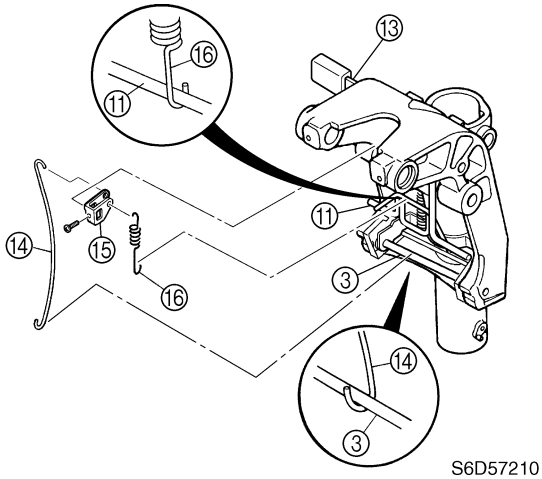
2. Install the bushings ⑧ and ⑨ and collar ⑩ to the swivel bracket.

3. Install the tilt support bar ⑪ and pin ⑫, and then insert the tilt lock lever ⑬ partially into the swivel bracket.



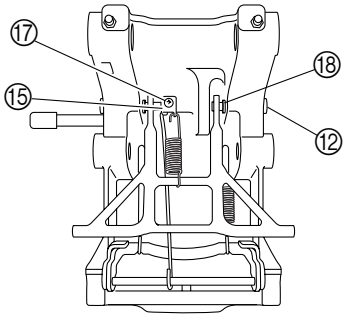
S6D57200

4. Hook the tilt lock rod ⑭ onto the tilt lever ⑮ and the pin 2 ③, hook the spring ⑯ onto the tilt lever ⑮ and the tilt support bar ⑪, and then insert the tilt lock lever ⑬ into the tilt lever ⑮ completely.



S6D57210

5. Install the screw ⑰ to the tilt lever ⑮, and then install the circlip ⑱ to the pin ⑫.



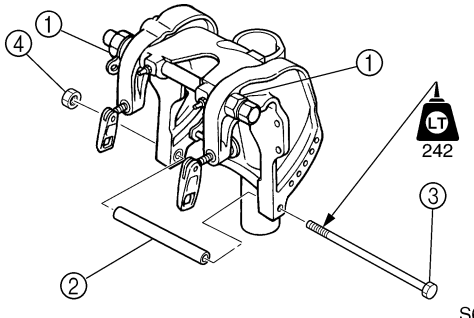
S6D57220

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

Tilt lever screw:
4 N·m (0.4 kgf·m, 3.0 ft·lb)

Installing the clamp brackets

1. Install the bushings, tilt stopper plates, and pins to the swivel bracket assembly.
2. Assemble the clamp brackets, washers, and swivel bracket, and then install the through tube.
3. Install the plate, tighten the self-locking nuts ① to the specified torque, and then tighten the cap nuts.
4. Install the tilt stopper plate bolts and tilt stopper plate nuts, and then tighten the nuts to the specified torque.
5. Install the collar ②, and clamp bracket bolt ③, and then tighten the clamp bracket nut ④ to the specified torque.

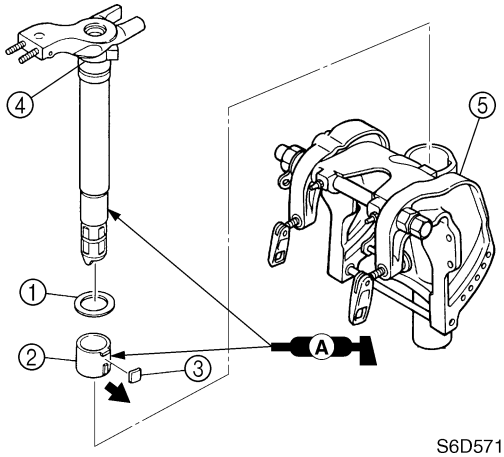


S66T7150

Self-locking nut ①:
45 N·m (4.5 kgf·m, 33.2 ft·lb)
Clamp bracket nut ④:
18 N·m (1.8 kgf·m, 13.3 ft·lb)

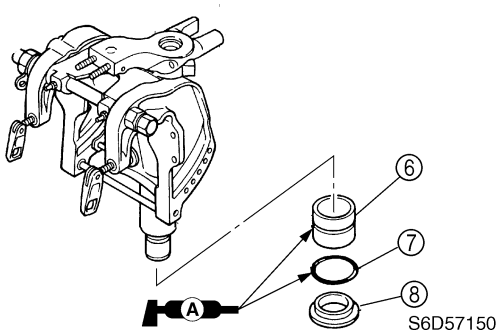
Installing the steering arm

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



S6D57140

3. Install the bushing ⑥, a new O-ring ⑦, and the bushing ⑧ onto the swivel bracket.



S6D57150

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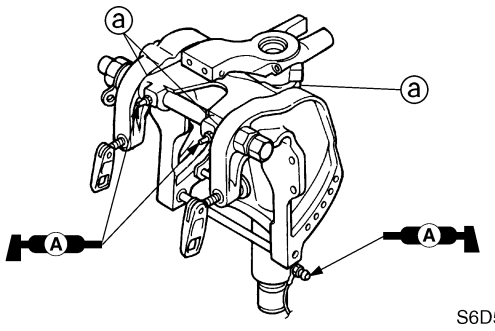
4. Apply water resistant grease to the grease nipples.



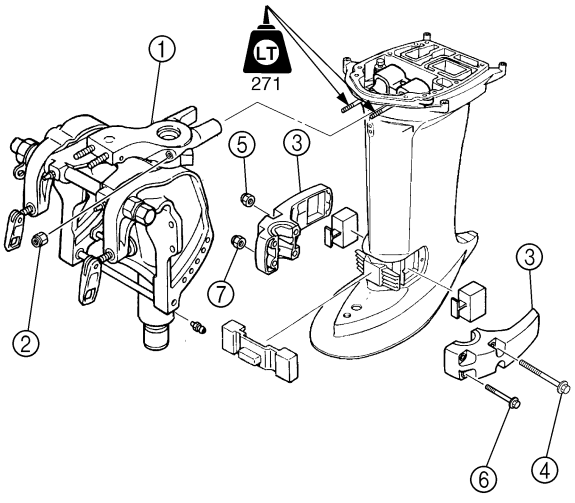
S6D57240

NOTE:
Apply the grease until it comes out of the bushings ⓐ.

Installing the upper case

1. Install the upper mounting bolts into the swivel bracket ①.
2. Install the upper mounting nuts ②.
3. Install the lower mount housing ③, lower mounting bolts ④, lower mounting nuts ⑤, lower mounting bolts ⑥, and lower mounting nuts ⑦, and then tighten the nuts finger tight.
4. Tighten the lower mounting nuts ⑤ to the specified torque, then tighten the lower mounting nuts ⑦ to the specified torque.

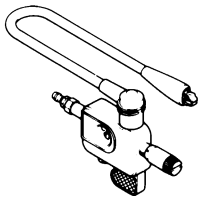
	Lower mounting nut ⑤, ⑦: 54 N·m (5.4 kgf·m, 39.8 ft·lb)



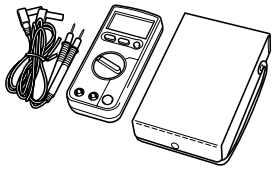
S66T7100

Electrical systems

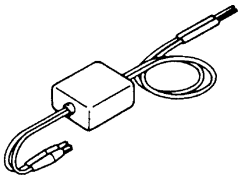
Special service tools



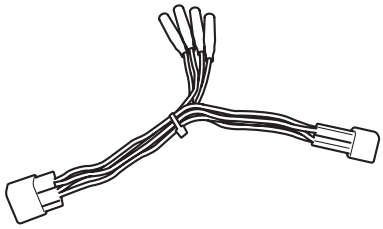
Ignition tester
90890-06754



Digital circuit tester
90890-03174



Peak voltage adapter B
90890-03172



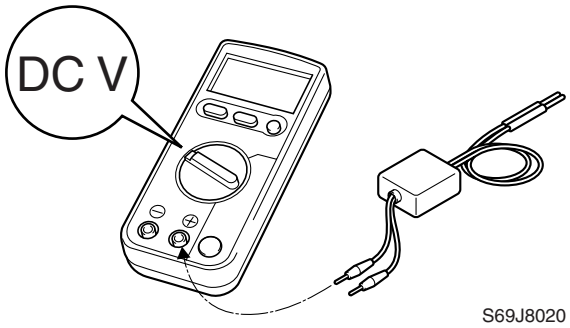
Test harness (4 pins)
New: 90890-06871
Current: 90890-06771

Checking the electrical components

Measuring the peak voltage

NOTE:
Before troubleshooting the peak voltage, check that all electrical connections are tight and free from corrosion, and that the battery is fully charged to 12 V.

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



⚠ WARNING

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

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

Measuring the lower resistance

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

NOTE:
To obtain the internal resistance of the digital circuit tester, connect both of its probes and check the display.

Correct value =
displayed measurement – internal resistance

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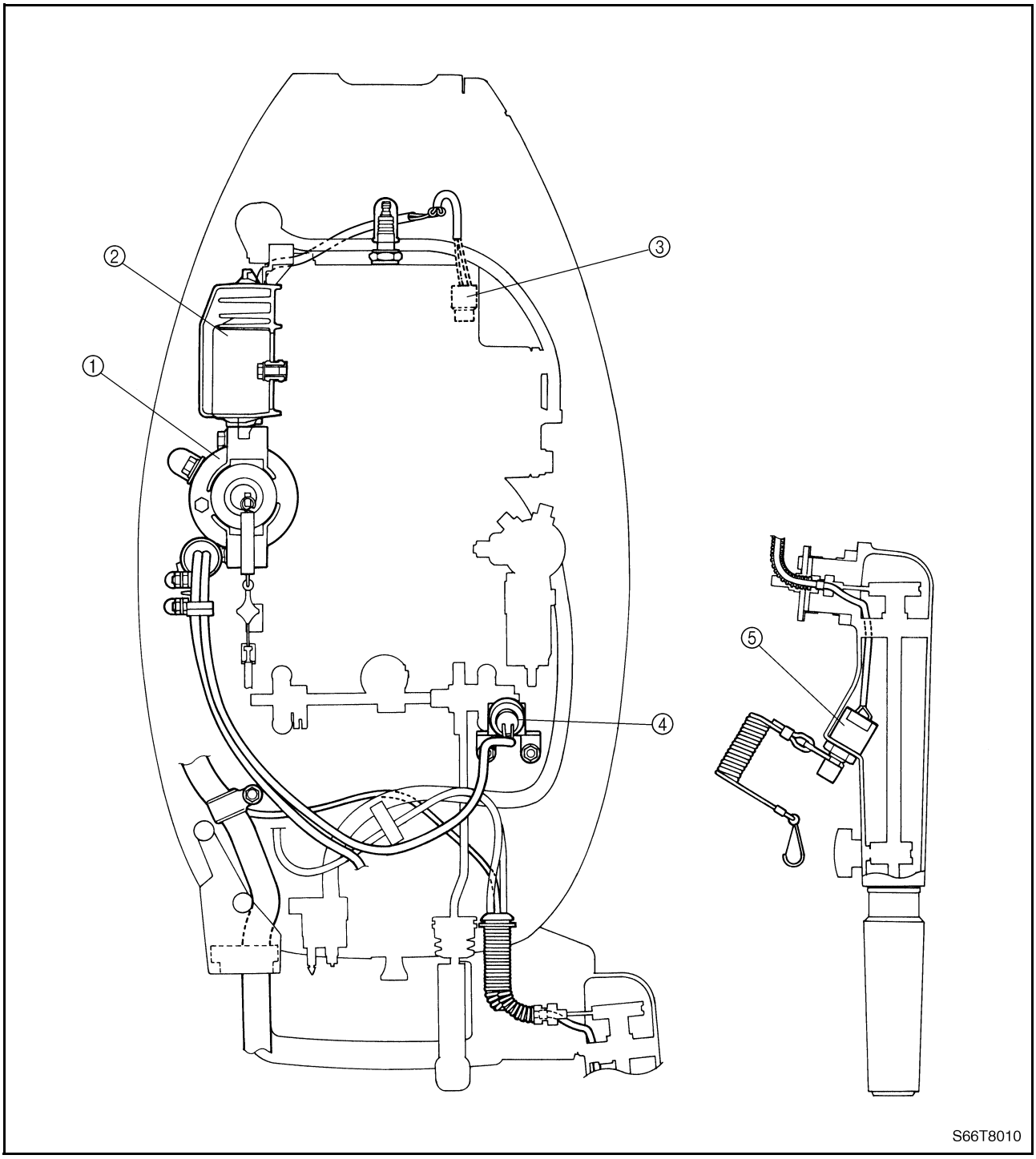
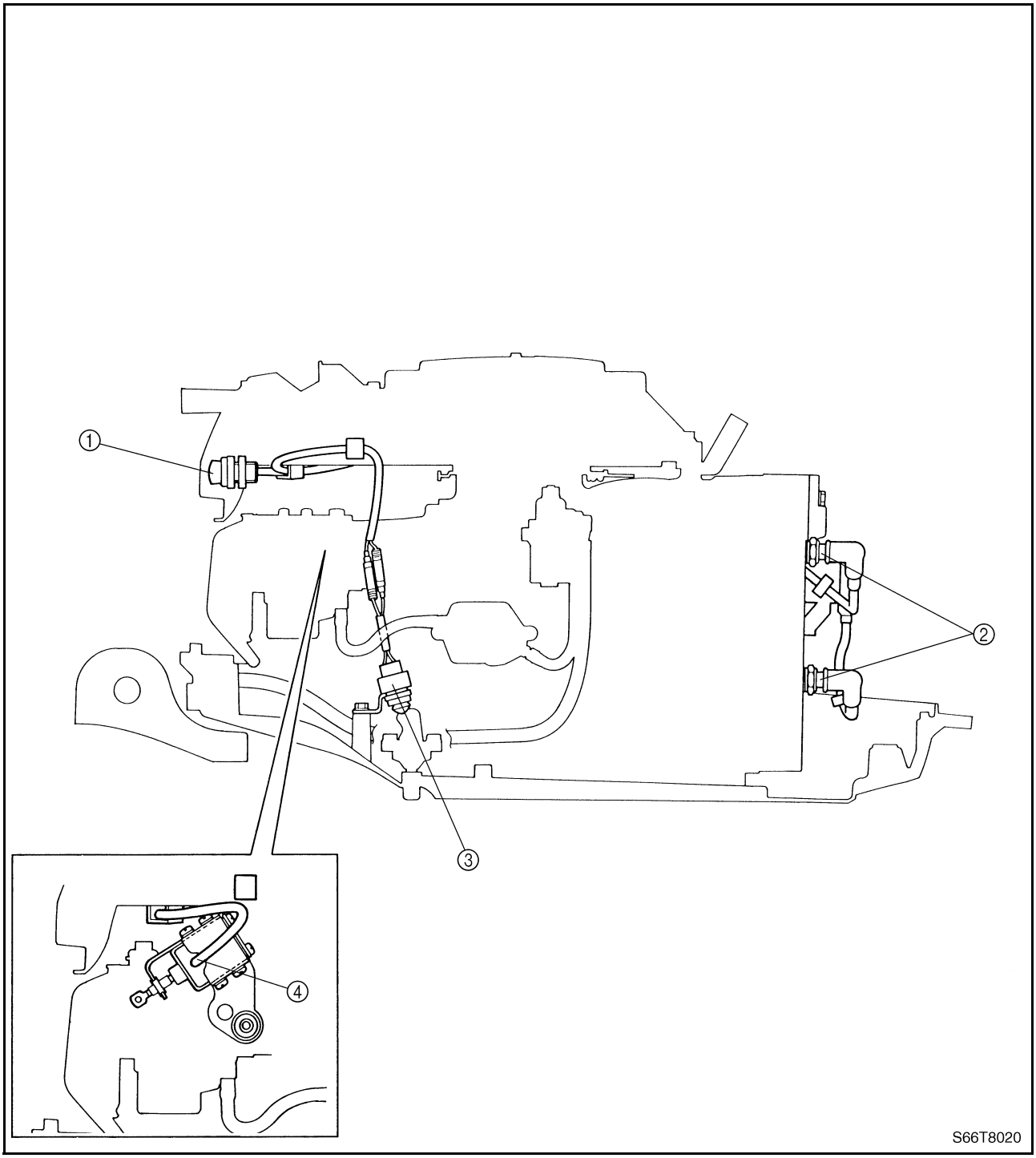
Electrical components

Top view



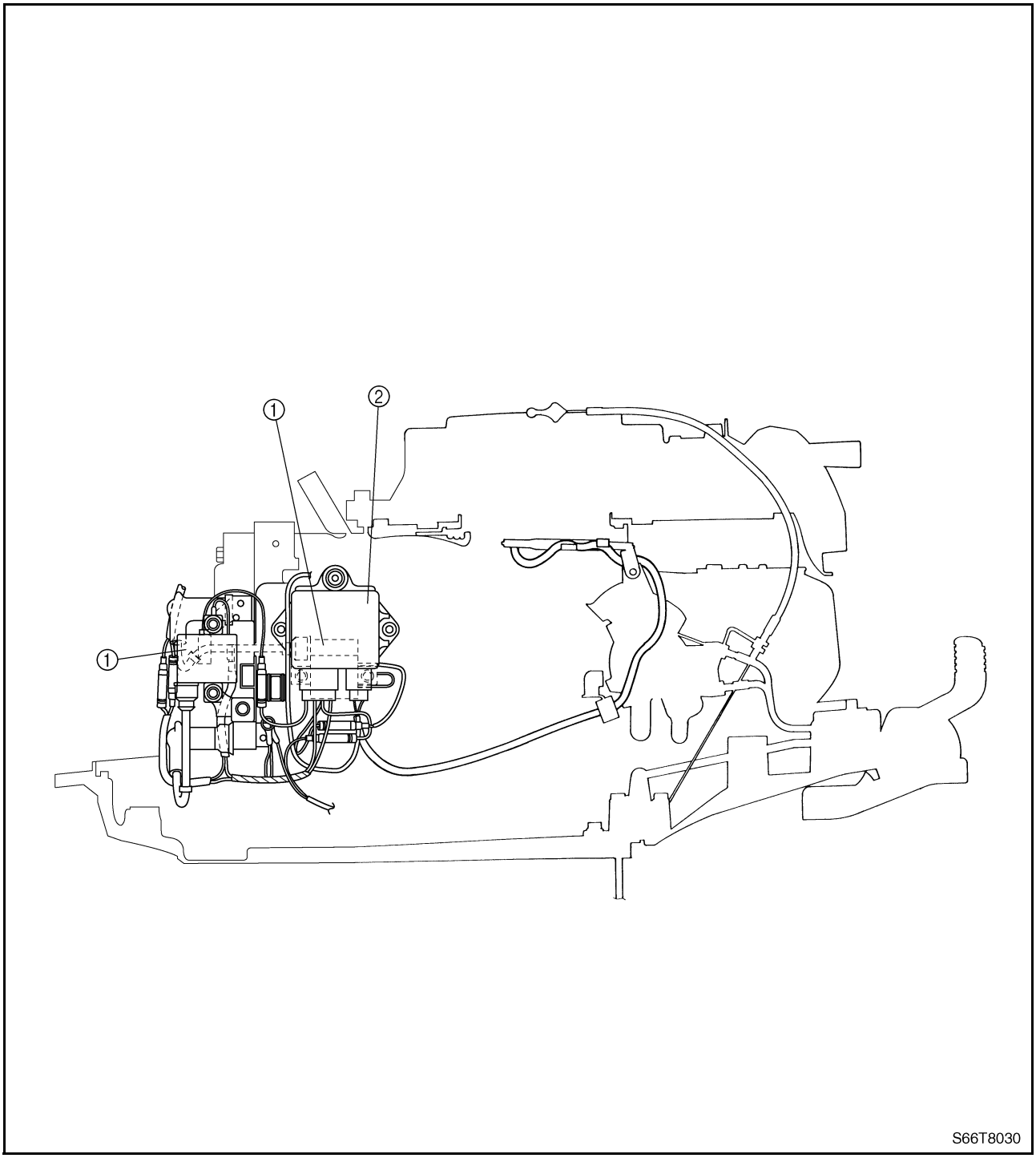
① Starter motor (WH, W)
② CDI unit
③ Thermoswitch
④ Neutral switch (WH), (W: if equipped)
⑤ Engine stop lanyard switch (MH, WH)

Port view



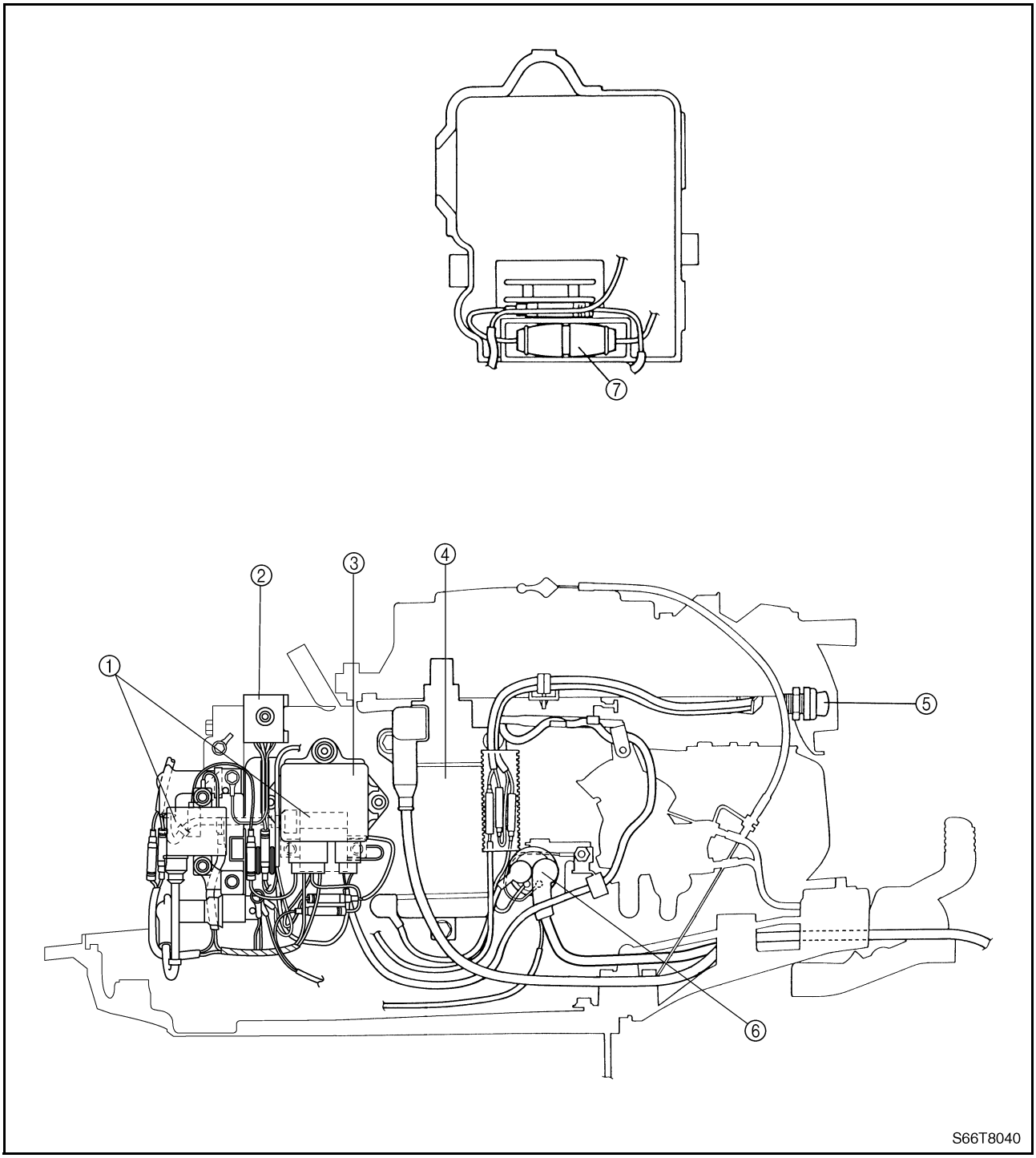
① Engine start button (WH)
② Spark plug
③ Neutral switch (WH), (W: if equipped)
④ Choke solenoid (W)

Starboard view (MH)



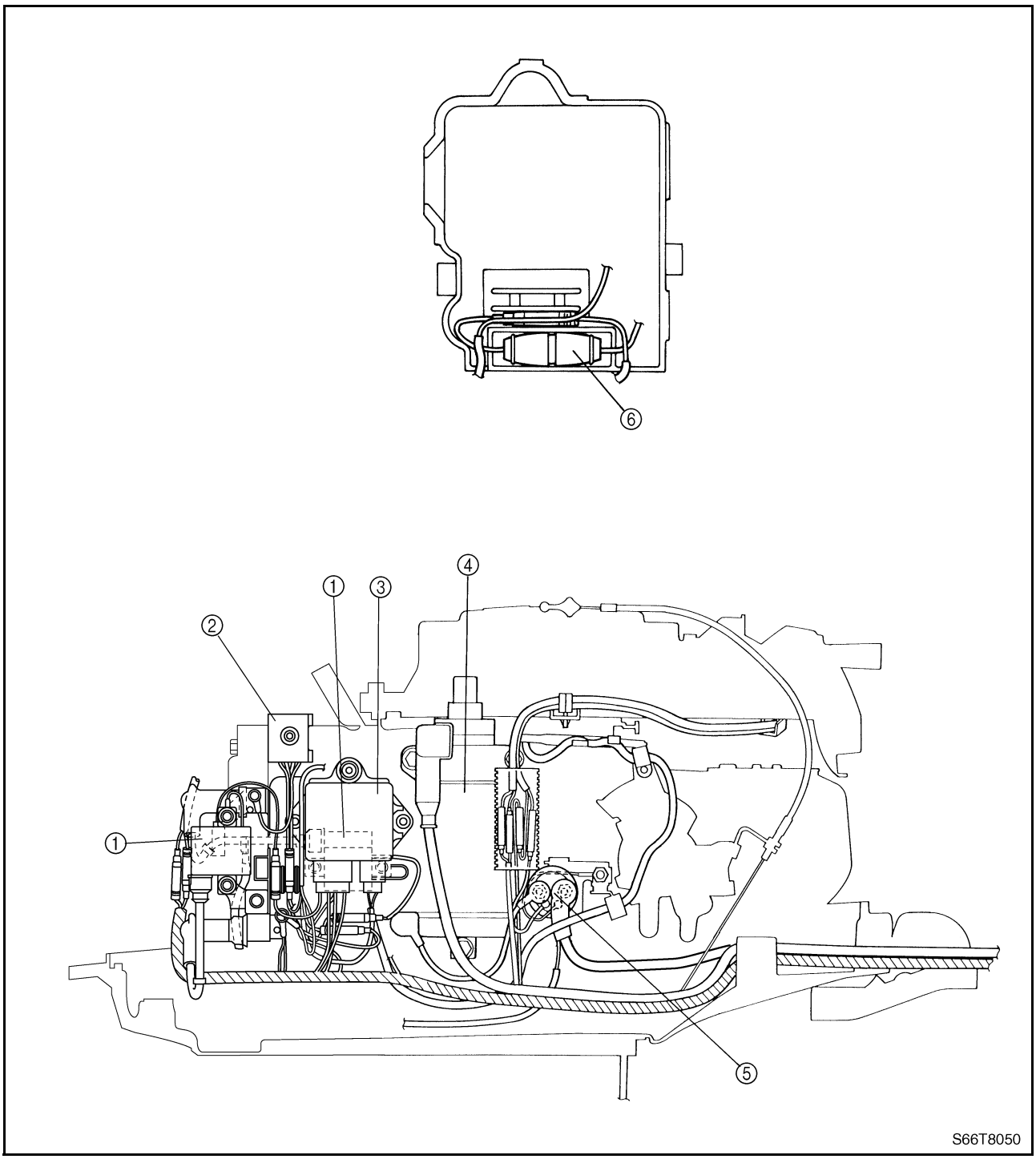
① Ignition coil
② CDI unit

Starboard view (WH)



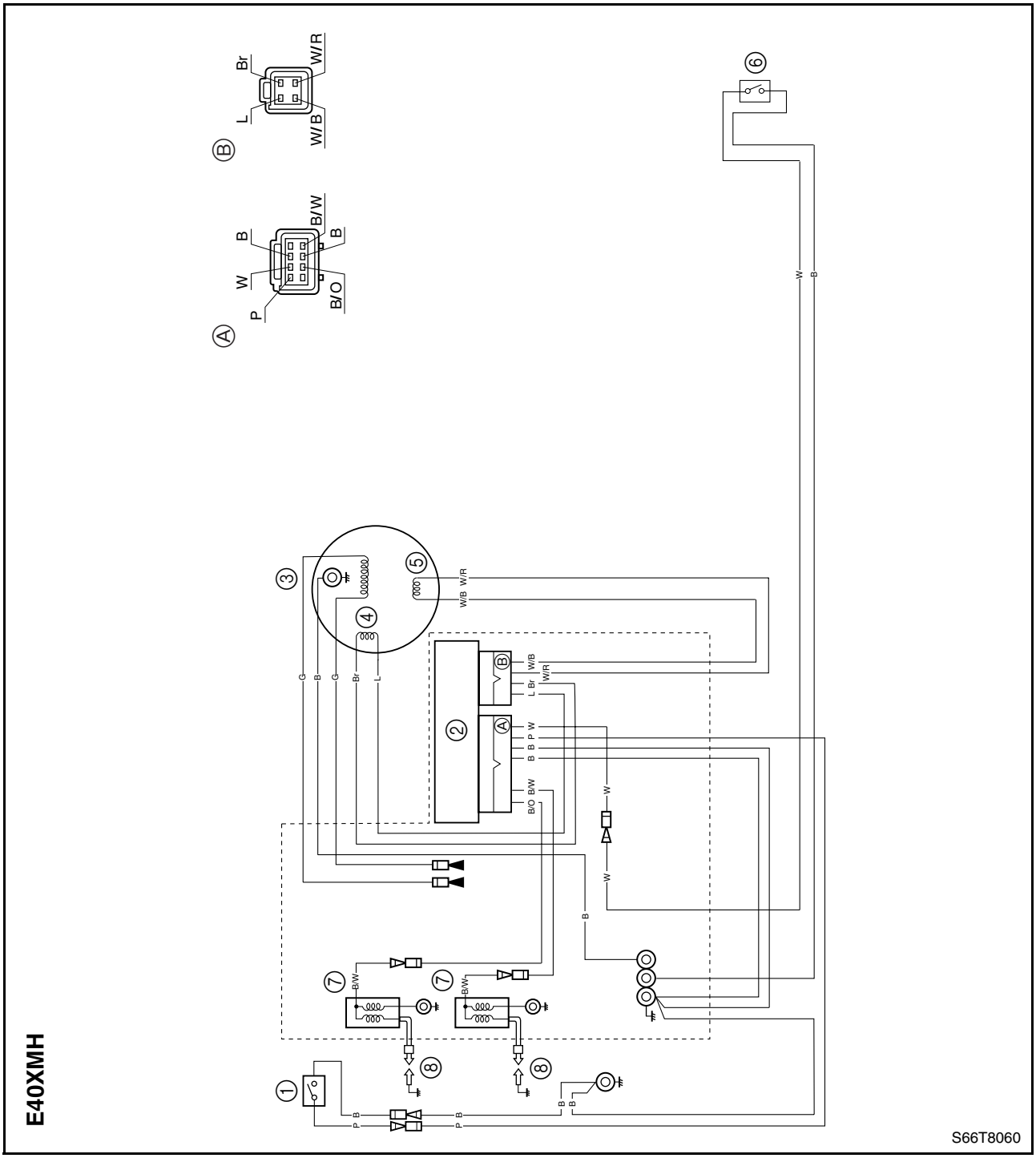
① Ignition coil
② Rectifier
③ CDI unit
④ Starter motor
⑤ Engine start button
⑥ Starter relay
⑦ Fuse

Starboard view (W)



① Ignition coil
② Rectifier
③ CDI unit
④ Starter motor
⑤ Starter relay
⑥ Fuse

Wiring diagram (MH)



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

B : Black
Br : Brown
G : Green
L : Blue
P : Pink
W : White
B/O : Black/orange
B/W : Black/white
W/B : White/black
W/R : White/red

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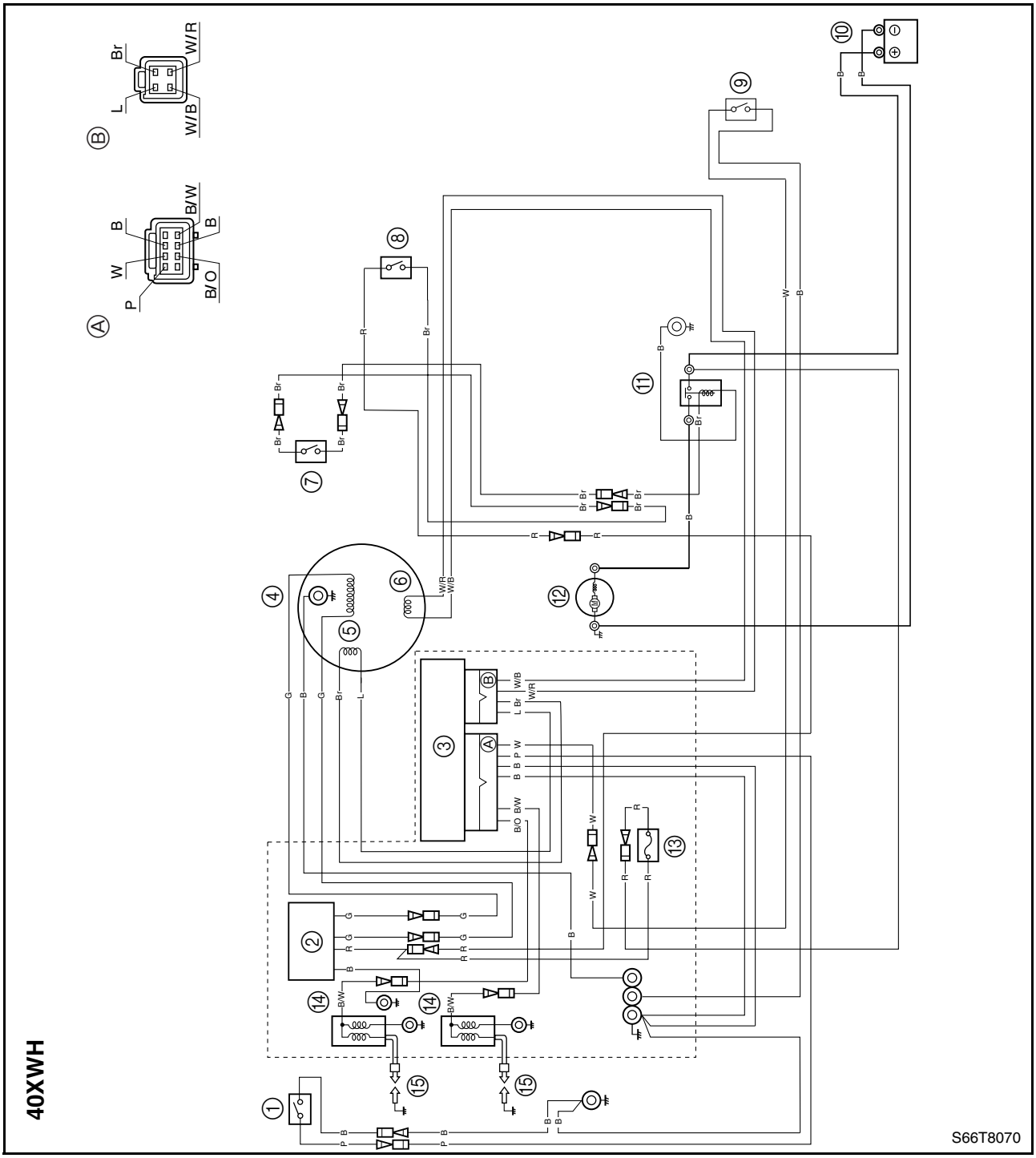
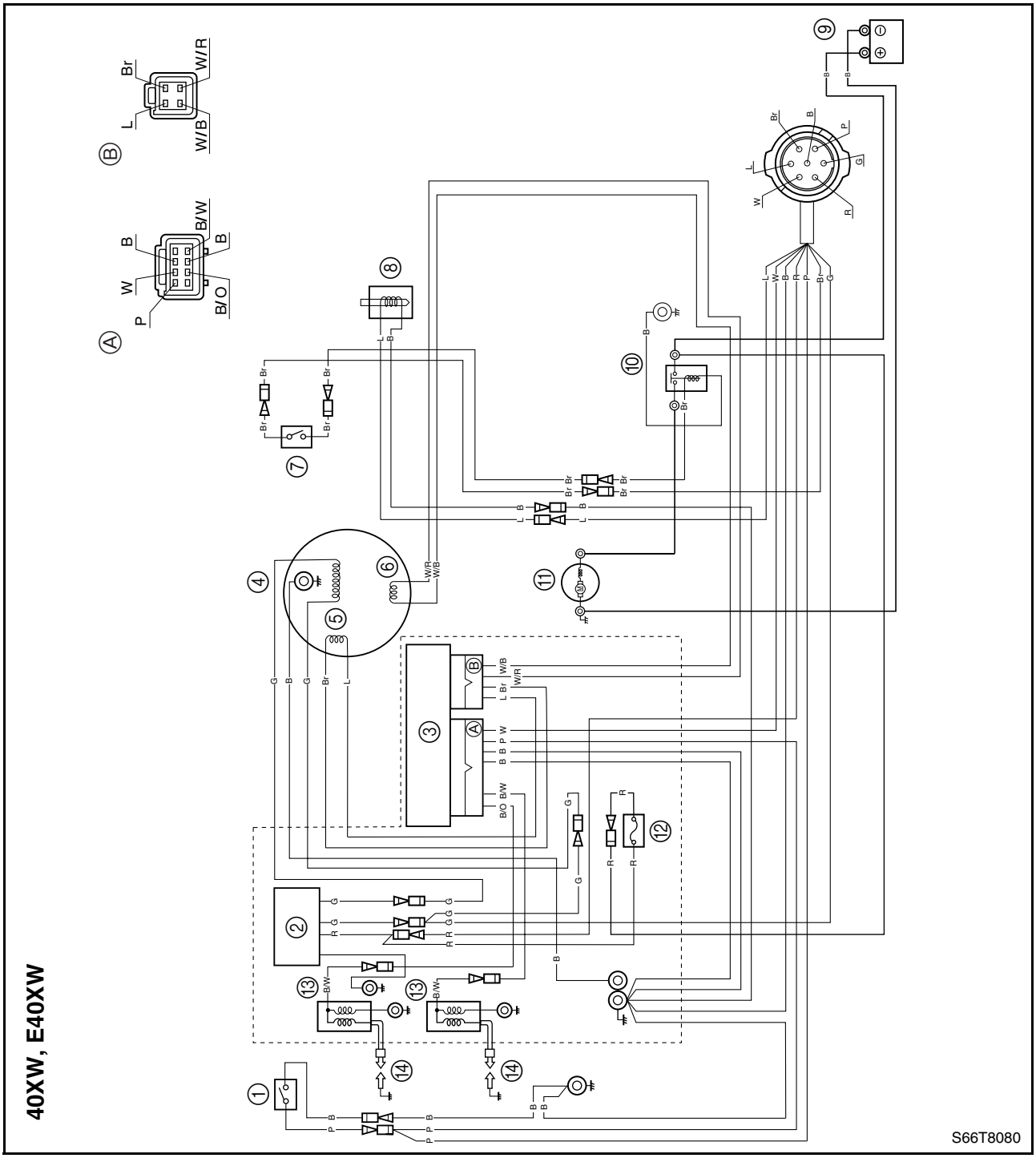
Wiring diagram (WH)



① Thermoswitch
② Rectifier
③ CDI unit
④ Lighting coil
⑤ Charge coil
⑥ Pulser coil
⑦ Neutral switch
⑧ Engine start button
⑨ Engine stop lanyard switch
⑩ Battery
⑪ Starter relay
⑫ Starter motor
⑬ Fuse
⑭ Ignition coil
⑮ Spark plug

B : Black
Br : Brown
G : Green
L : Blue
P : Pink
R : Red
W : White
B/O : Black/orange
B/W : Black/white
W/B : White/black
W/R : White/red

Wiring diagram (W)



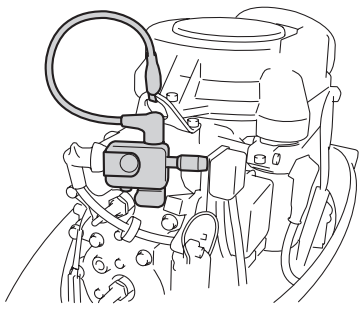
① Thermoswitch
② Rectifier
③ CDI unit
④ Lighting coil
⑤ Charge coil
⑥ Pulser coil
⑦ Neutral switch (if equipped)
⑧ Choke solenoid
⑨ Battery
⑩ Starter relay
⑪ Starter motor
⑫ Fuse
⑬ Ignition coil
⑭ Spark plug

B : Black
Br : Brown
G : Green
L : Blue
P : Pink
R : Red
W : White
B/O : Black/orange
B/W : Black/white
W/B : White/black
W/R : White/red

Ignition and ignition control system

Checking the ignition spark gap

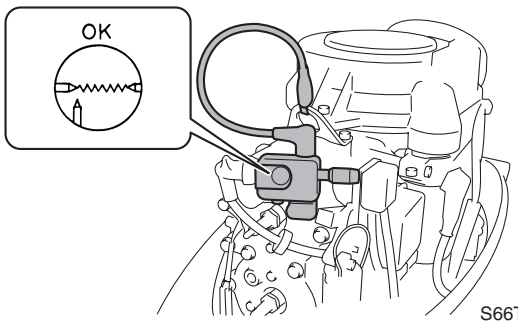
1. Disconnect the spark plug caps from the spark plugs.
2. Connect a spark plug cap to the special service tool.



S66T8130

Ignition tester: 90890-06754

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



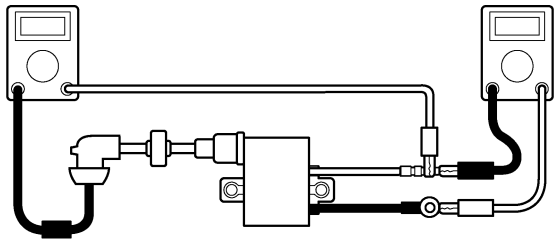
S66T8140

⚠ WARNING

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

Checking the ignition coils

1. Disconnect the spark plug cap from the spark plug.
2. Disconnect the ignition coil connector.
3. Measure the ignition coil resistance. Replace if out of specification.

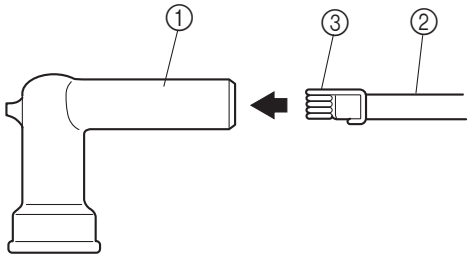


S66T8150

Ignition coil resistance:
Primary coil:
Black/white (B/W) – Black (B)
0.32–0.44 Ω at 20 °C (68 °F)
Secondary coil:
Black/white (B/W) –
spark plug wire
5.4–7.4 kΩ at 20 °C (68 °F)

Checking the spark plug caps (standard type)

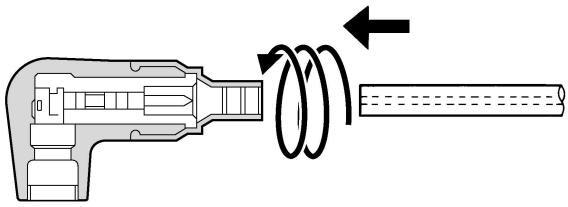
1. Check the spark plug caps for cracks or damage. Replace if necessary.
2. Remove the spark plug cap ① from the spark plug wire ②.
3. Check the spark plug wire for damage or cracks and the spark plug cap spring ③ for damage or corrosion. Replace if necessary.



S66T8380

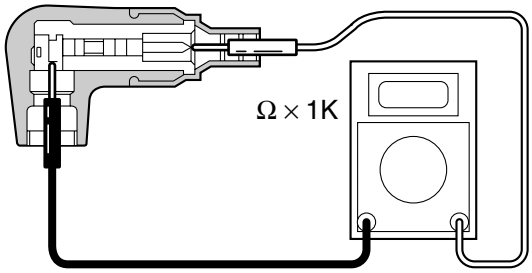
Checking the spark plug cap (with resister type)

1. Remove the spark plug cap from the spark plug wire by turning the cap counterclockwise.



S69M8070

2. Measure the spark plug cap resistance. Replace if out of specification.

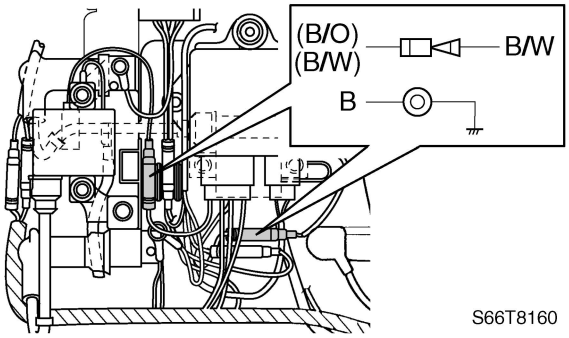


S69M8080

Spark plug cap resistance:
4.0–6.0 kΩ

Checking the CDI unit

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



S66T8160

Digital circuit tester: 90890-03174
Peak voltage adapter B:
90890-03172

CDI unit output peak voltage:
Black/orange (B/O) – Black (B)
Black/white (B/W) – Black (B)

r/min	Loaded		
	Cranking	1,500	3,500
DC V	180	180	170

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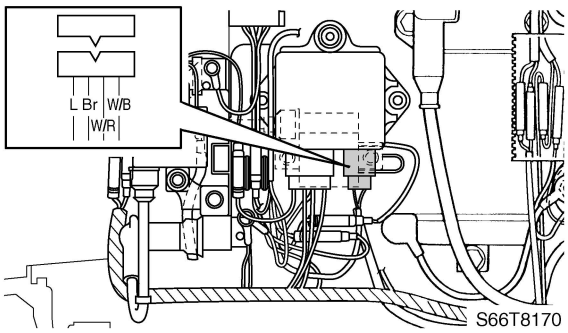
Checking the pulser coil

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



Digital circuit tester: 90890-03174
Peak voltage adapter B: 90890-03172
Test harness (4 pins):
New: 90890-06871
Current: 90890-06771

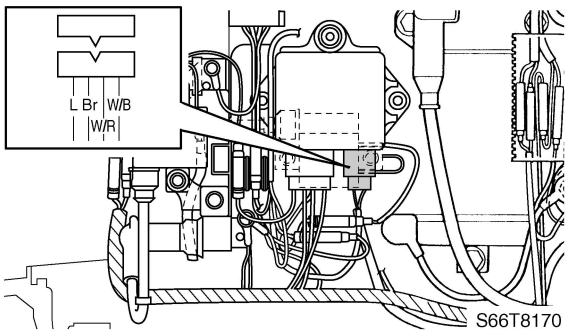
Pulser coil output peak voltage:
White/red (W/R) – White/black (W/B)

r/min	Unloaded	Loaded		
	Cranking		1,500	3,500
DC V	7.0	4.0	10.0	17.0

Pulser coil resistance (reference data):
White/red (W/R) – White/black (W/B)
311.4–380.6 Ω at 20 °C (68 °F)

Checking the charge coil

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



Digital circuit tester: 90890-03174
Peak voltage adapter B: 90890-03172
Test harness (4 pins):
New: 90890-06871
Current: 90890-06771

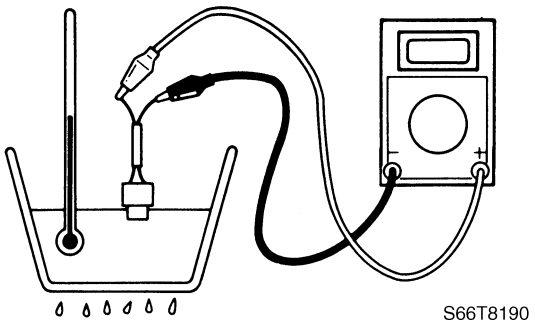
Charge coil output peak voltage:
Positive side: Brown (Br) –
Negative side: Blue (L)

r/min	Unloaded	Loaded		
	Cranking		1,500	3,500
DC V	330	190	190	190

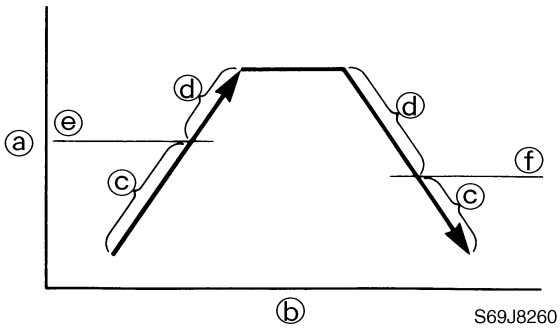
Charge coil resistance (reference data):
Brown (Br) – Blue (L)
684–836 Ω at 20 °C (68 °F)

Checking the thermoswitch

1. Place the thermoswitch in a container of water and slowly heat the water.



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

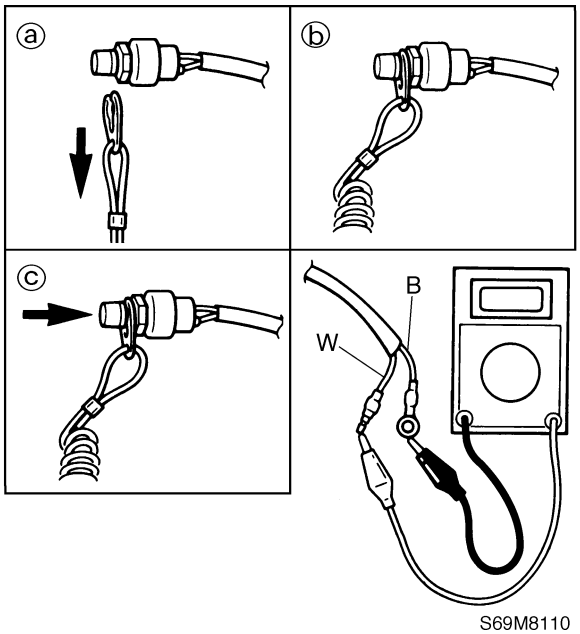


ⓐ Temperature
ⓑ Time
ⓒ No continuity
ⓓ Continuity

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

Checking the engine stop lanyard switch (MH, WH)

1. Check the engine stop lanyard switch for continuity. Replace if out of specification.



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

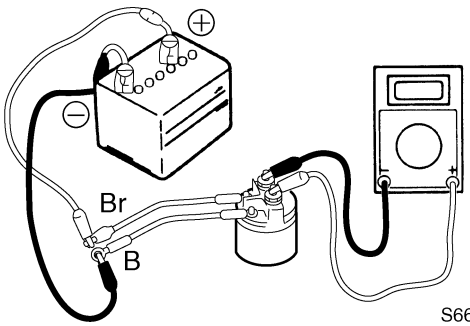
Starting system

Checking the fuse

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

Checking the starter relay

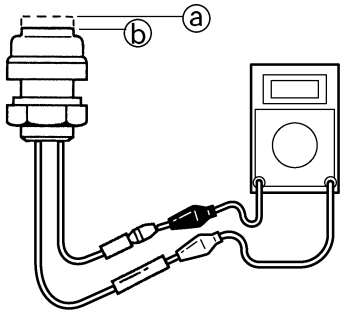
1. Connect the digital circuit tester leads to the starter relay terminals.
2. Connect the positive battery terminal to the brown (Br) lead.
3. Connect the negative battery terminal to the black (B) lead.
4. Check for continuity between the starter relay terminals. Replace if there is no continuity.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



8

Checking the engine start button (WH)

1. Check the engine start button for continuity. Replace if there is no continuity.

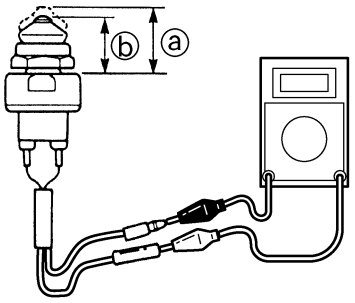


S66T8240

Button position	Lead color	
	Red (R)	Brown (Br)
Free ⓐ		
Push ⓑ	○	○

Checking the neutral switch (WH), (W: if equipped)

1. Check the neutral switch for continuity. Replace if there is no continuity.

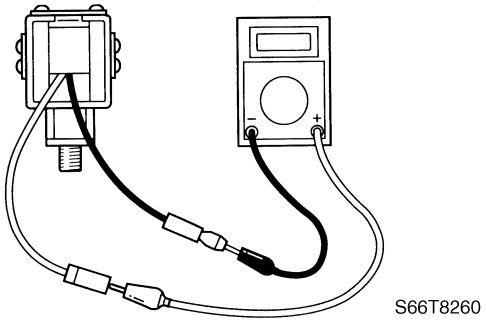


S66T8250

Switch position	Lead color	
	Brown (Br)	Brown (Br)
Free ⓐ		
Push ⓑ	○	○

Checking the choke solenoid (W)

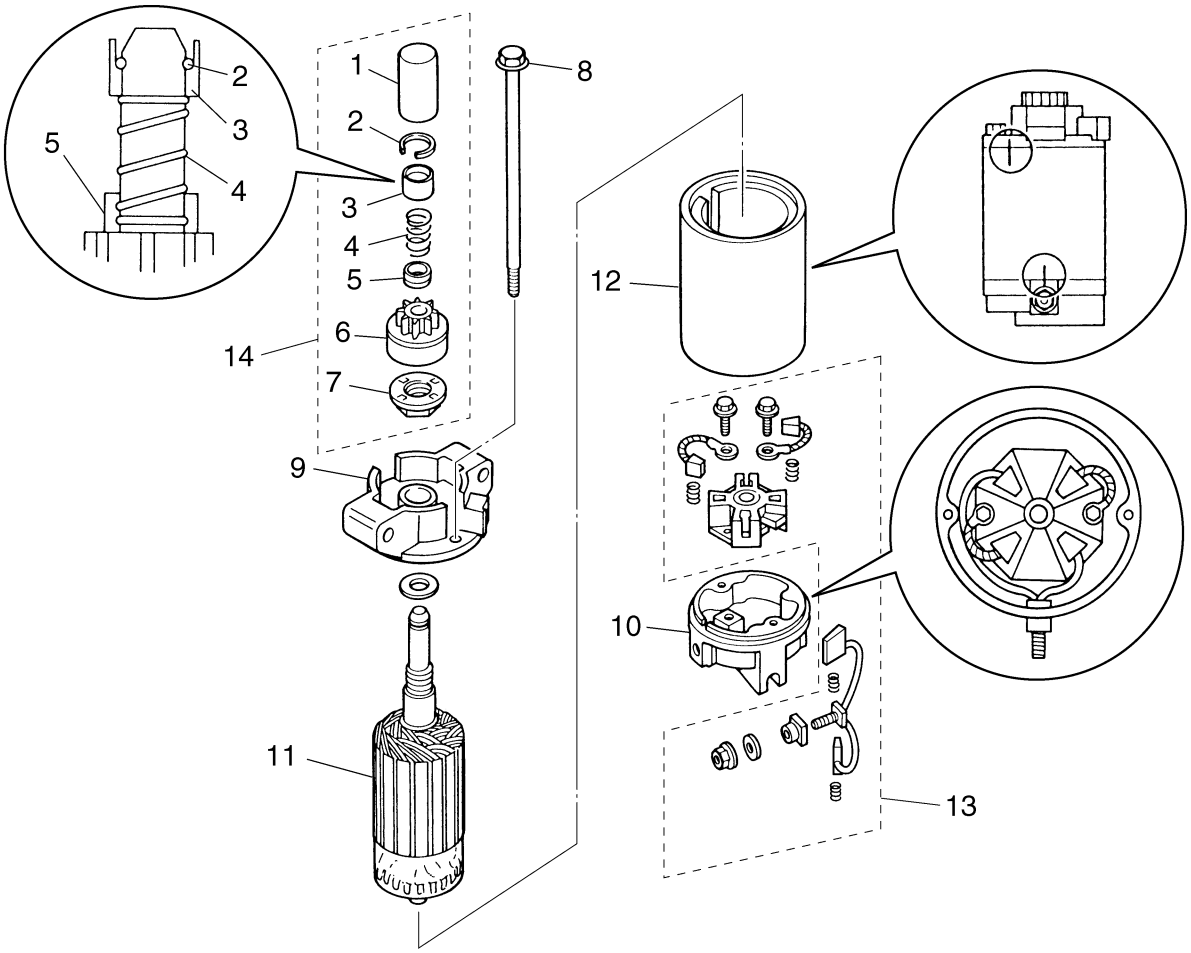
1. Measure the resistance of the choke solenoid.



S66T8260

Choke solenoid resistance (reference data):
Blue (L) – Black (B)
3.6–4.4 Ω at 20 °C (68 °F)

Starter motor (WH, W)



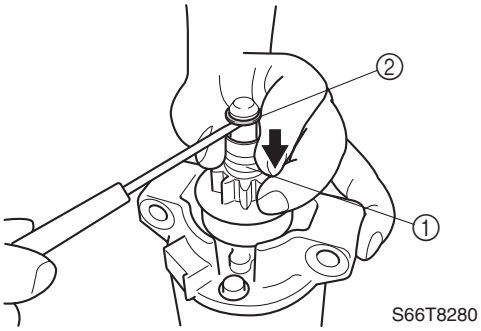
S66T8270

No.	Part name	Q'ty	Remarks
1	Cap	1	
2	Clip	1	
3	Pinion stopper	1	
4	Spring	1	
5	Spacer	1	
6	Pinion	1	
7	Spacer	1	
8	Bolt	2	
9	Housing	1	
10	Bracket	1	
11	Armature	1	
12	Stator	1	
13	Brush holder assembly	1	
14	Pinion stopper set	1	

8

Removing the starter motor pinion

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

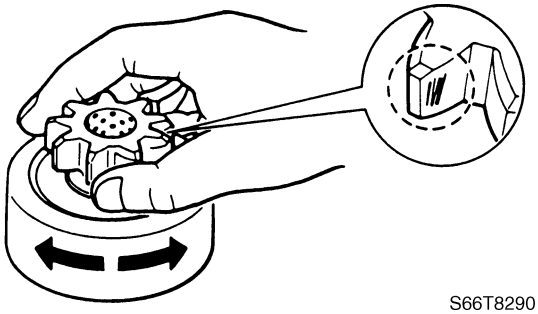


NOTE:
Remove the clip with a thin screwdriver.

Checking the starter motor pinion

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

2. Check for smooth operation. Replace if necessary.

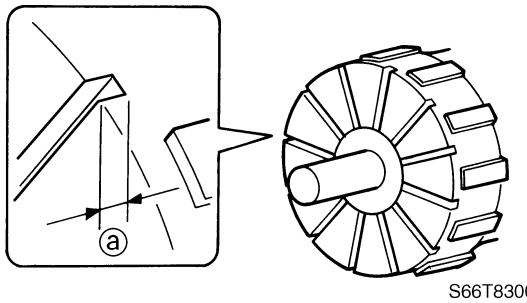


NOTE:
Turn the pinion counterclockwise to check that it operates smoothly and turn it clockwise to check that it locks in place.

Checking the armature

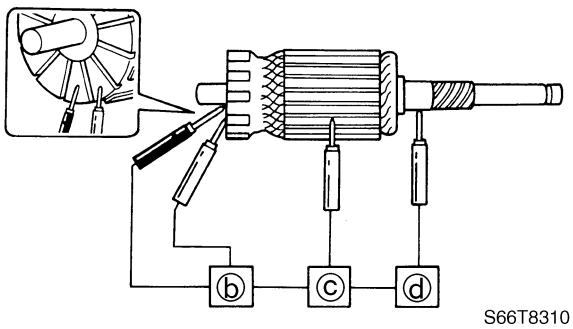
1. Check the commutator for dirt. Clean with 600–grit sandpaper and compressed air if necessary.

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



Commutator undercut limit:
0.8 mm (0.03 in)

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

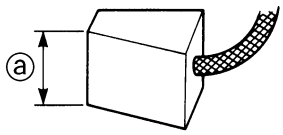


Armature continuity

Commutator segments ⓑ	Continuity
Segment – Armature core ⓒ	No continuity
Segment – Armature shaft ⓓ	No continuity

Checking the brushes

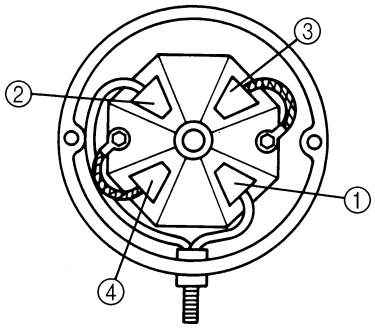
1. Measure the brush length ⓐ. Replace the brush assembly if below specification.



S66T8320

	Brush length limit: 6.4 mm (0.25 in)

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



S66T8330

Brush continuity	
Brush ① – Brush ②	Continuity
Brush ③ – Brush ④	Continuity
Brush ①, ② – Brush ③, ④	No continuity

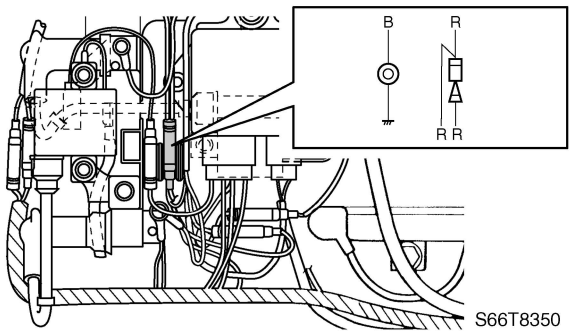
Checking the starter motor operation

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

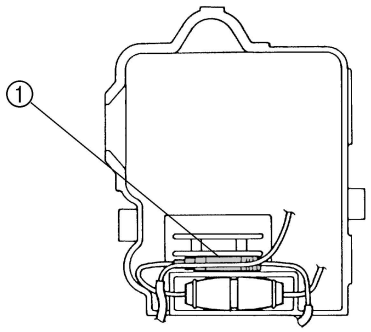
Charging system

Checking the rectifier (WH, W)

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



S66T8350



S66T8360

NOTE:

After starting the engine, disconnect the output lead (red lead) ① of the rectifier when measuring the output peak voltage.

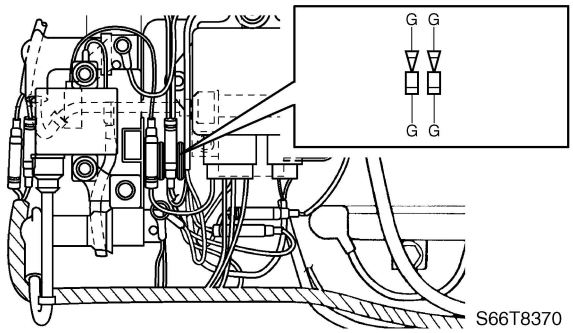
	Digital circuit tester: 90890-03174 Peak voltage adapter B: 90890-03172

Rectifier output peak voltage: Red (R) – Black (B)		
r/min	Unloaded	
	1,500	3,500
DC V	14.0	32.0

8

Checking the lighting coil (WH, W)

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



Digital circuit tester: 90890-03174
Peak voltage adapter B:
90890-03172

Lighting coil output peak voltage:
Green (G) – Green (G)

r/min	Unloaded		
	Cranking	1,500	3,500
DC V	6.0	16.0	33.0

Lighting coil resistance
(reference data):
Green (G) – Green (G)
0.31–0.37 Ω at 20 °C (68 °F)

TRBL SHTG ?

Troubleshooting

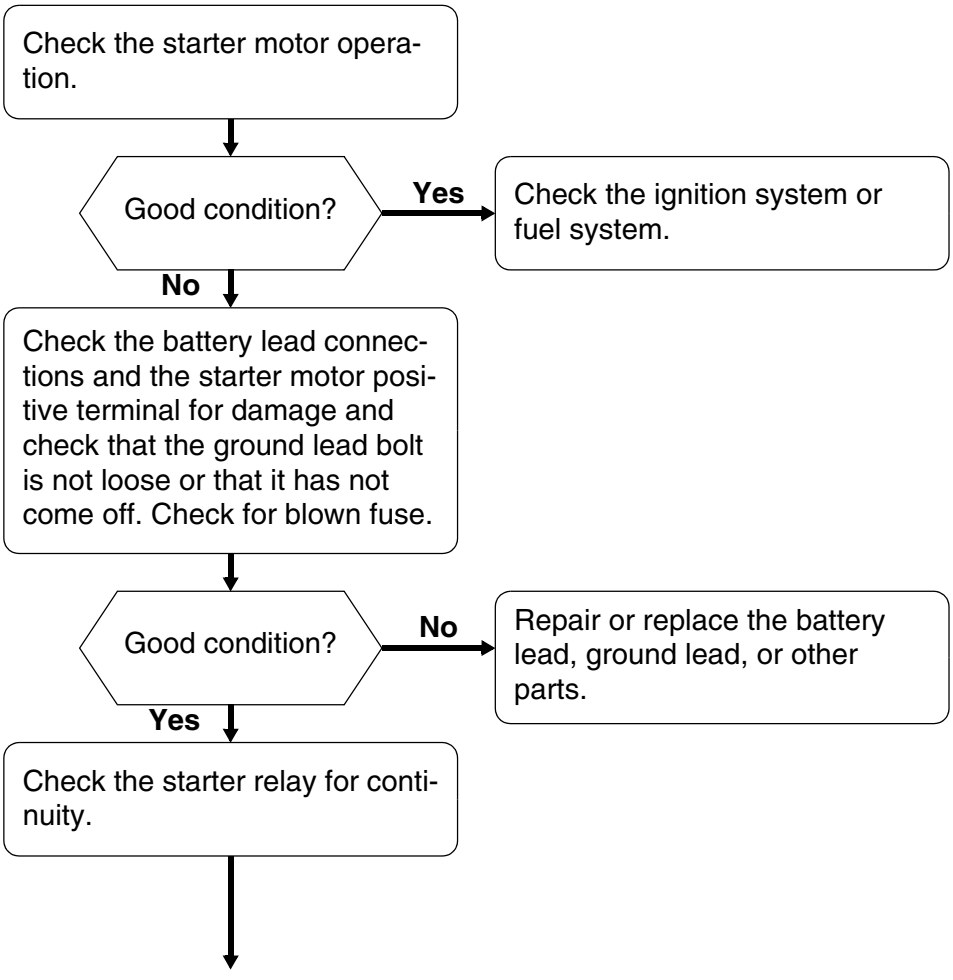
9

NOTE:
- Before troubleshooting the outboard motor, check the compression pressure, the mounting and rigging of the outboard motor, and the operation of the manual starter and engine start switch/button. Also, make sure that specified fuel has been used and that the battery is fully charged.
- Check that all electrical connections are tight and free from corrosion.
- To diagnose a mechanical malfunction, use the troubleshooting charts for each trouble located in this chapter. Also, when checking and maintaining the outboard motor, see Chapters 3–8 for safe maintenance procedures.

Power unit

Symptom 1: Engine does not start, or starting the engine is difficult.
- Manual starter is operating normally.
- Engine start switch/button is operating normally.
- Air vent screw on the fuel tank is open.

Starting system (WH, W)



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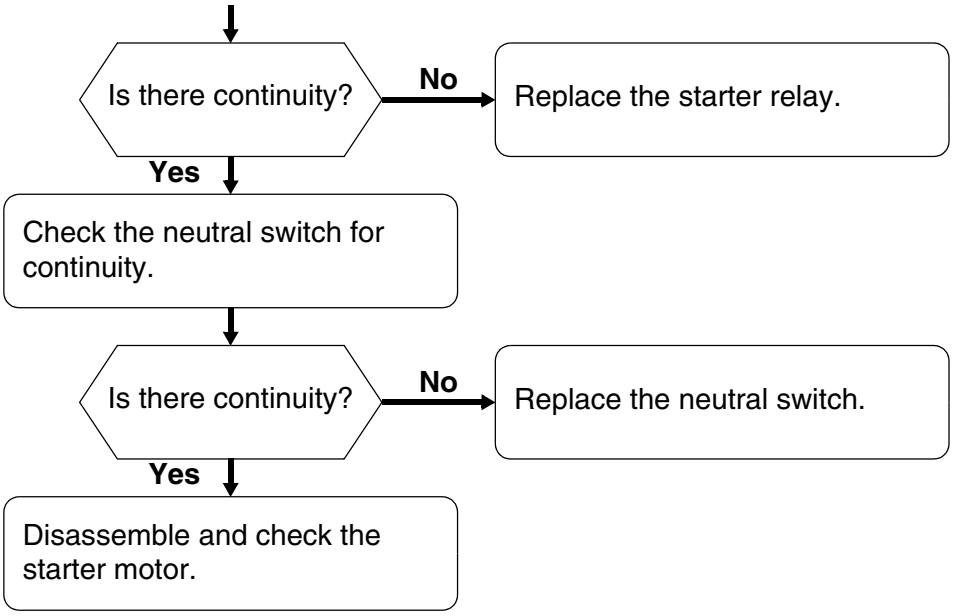
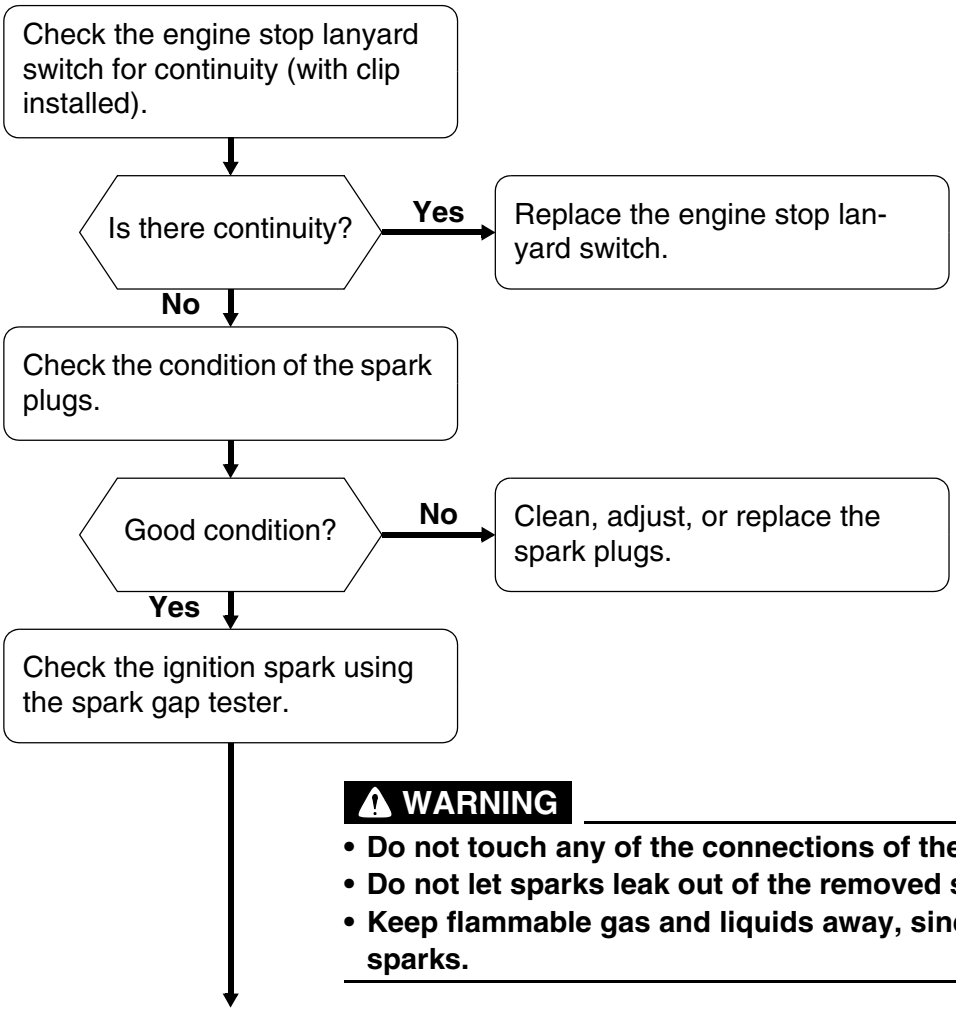


Ignition system



⚠ WARNING

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

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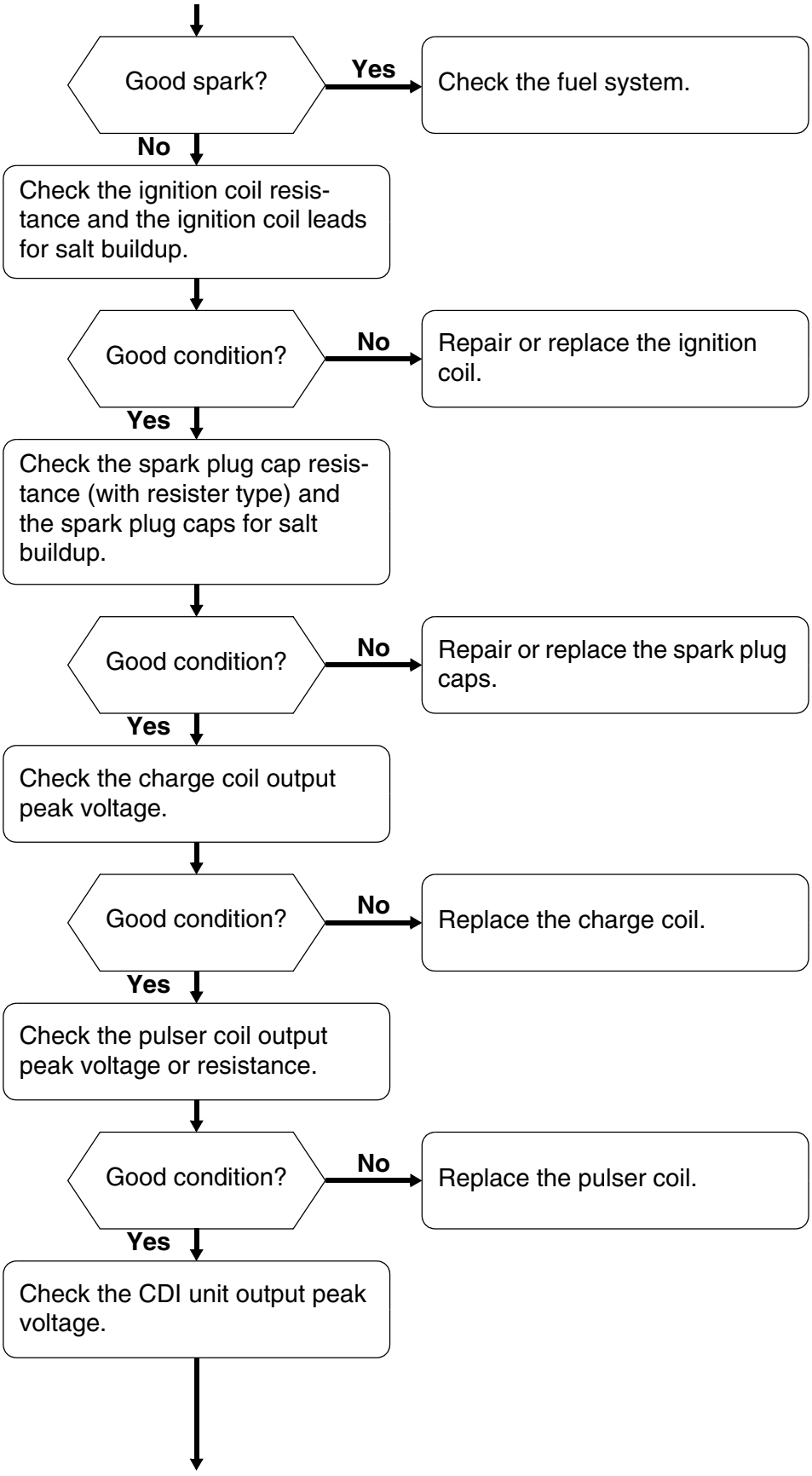

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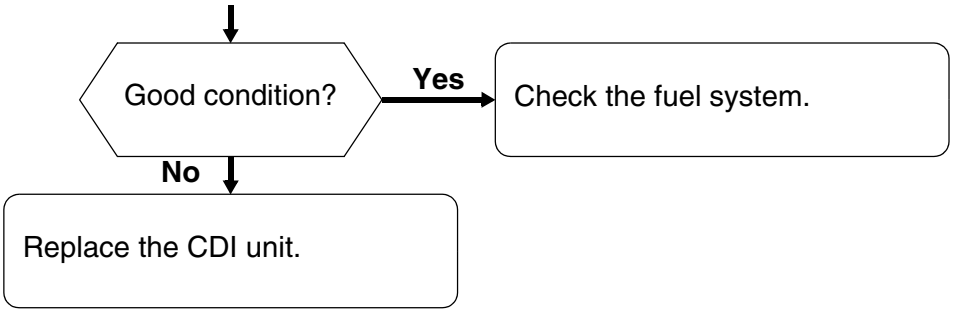
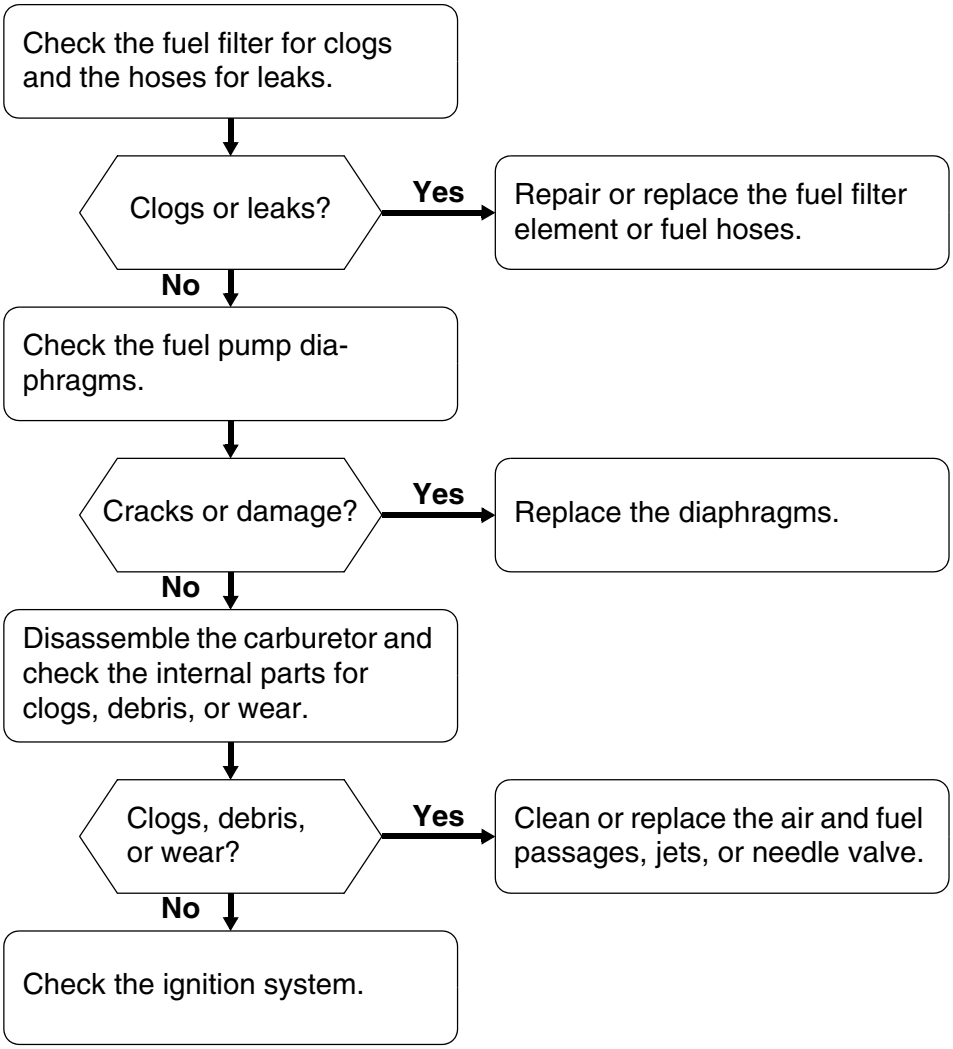

Good condition?
Yes
Check the fuel system.
No
Replace the CDI unit.

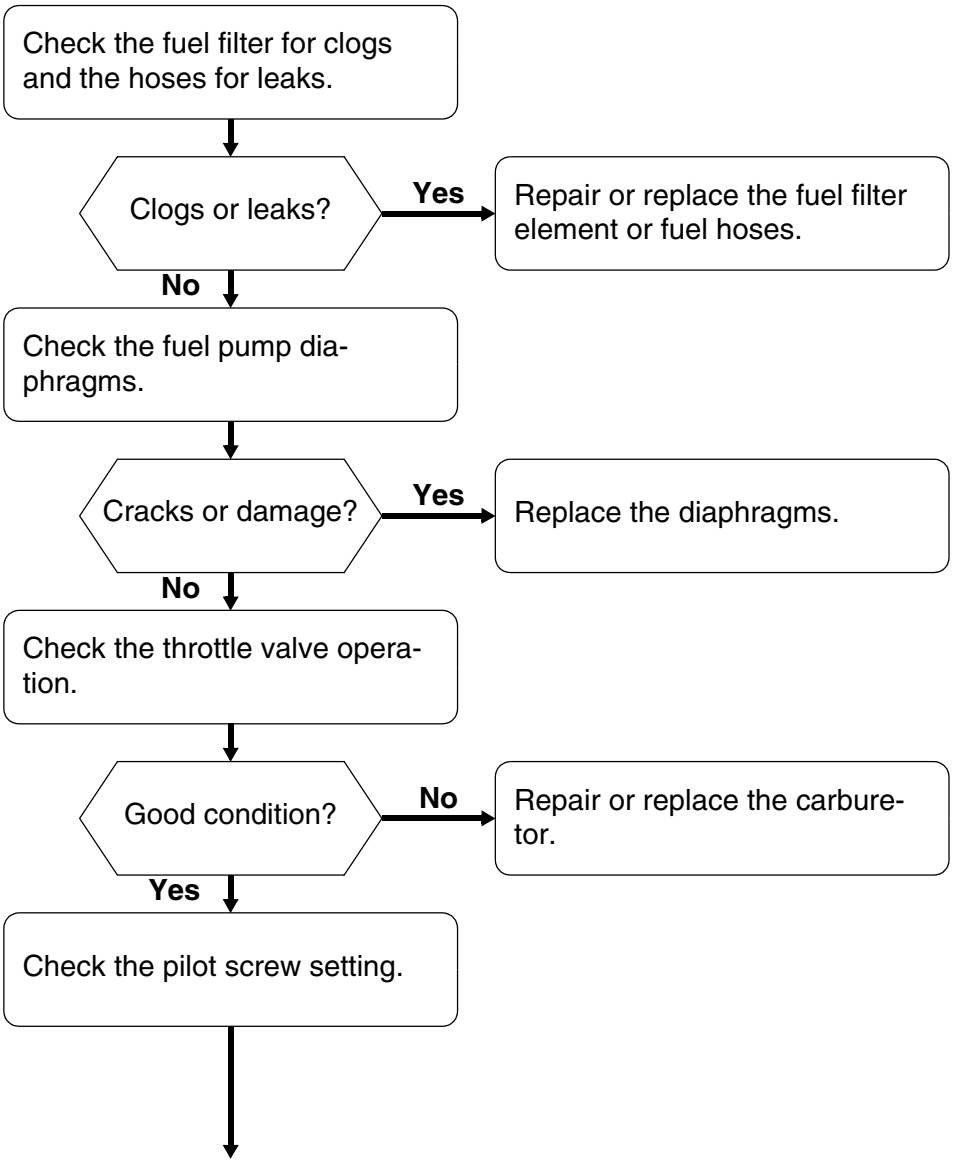
Fuel system


Check the fuel filter for clogs and the hoses for leaks.
Clogs or leaks?
Yes
Repair or replace the fuel filter element or fuel hoses.
No
Check the fuel pump diaphragms.
Cracks or damage?
Yes
Replace the diaphragms.
No
Disassemble the carburetor and check the internal parts for clogs, debris, or wear.
Clogs, debris, or wear?
Yes
Clean or replace the air and fuel passages, jets, or needle valve.
No
Check the ignition system.

Symptom 2: Engine speed at wide open throttle is low, engine speed decreases, or engine stalls (poor acceleration or poor deceleration).
Symptom 3: Engine speed not stable at low speeds.

- Air vent screw on the fuel tank is open.
- Check the throttle cable and link operation.
- Check the ignition system and the thermoswitch.

Fuel system



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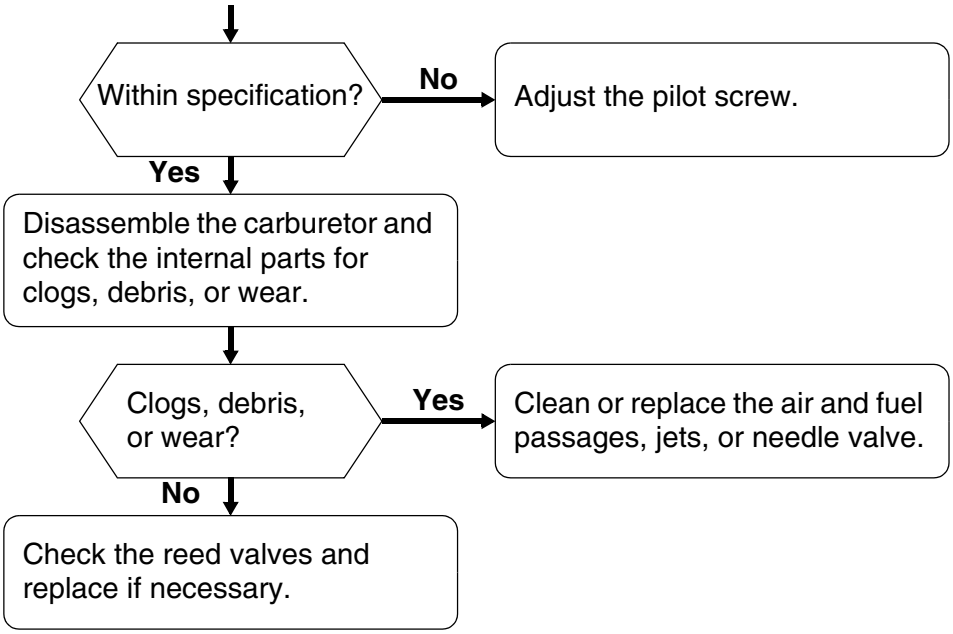
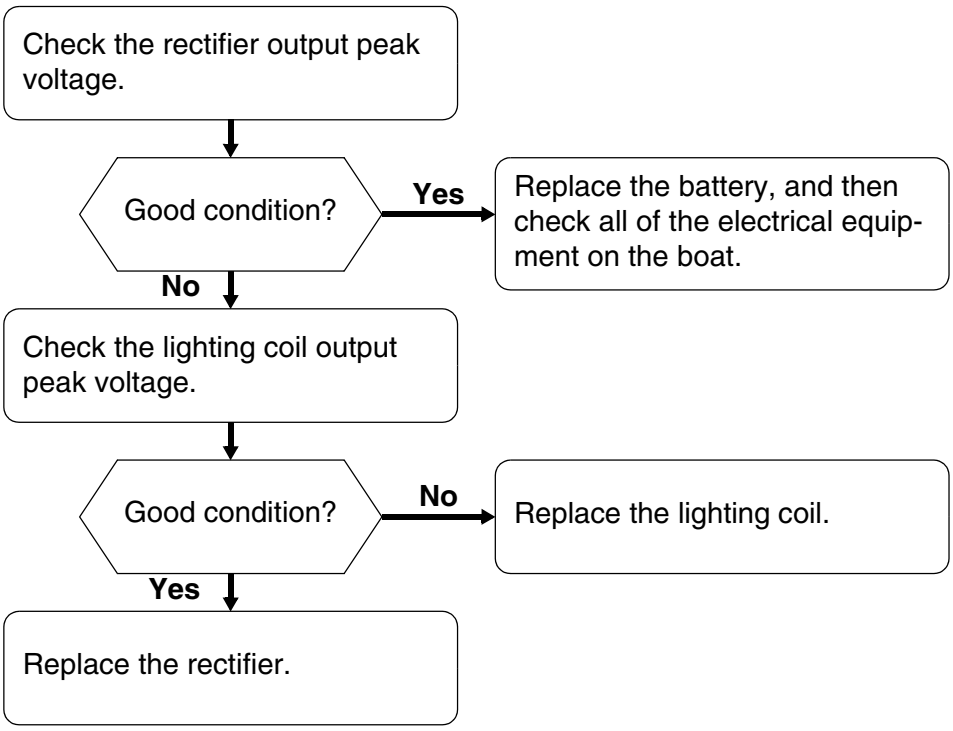


Symptom 4: Battery loses power quickly.

- Check the electrolyte level and specific gravity.
- Check the fuse.

Charging system (WH, W)



A.

B.

C.

D.

E.

F.

G.

H.

I.

L.

M.

P.

R.

S.

T.

U.

V.

W.

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